Klamath County

Multijurisdictional Natural Hazards Mitigation Plan
Klamath County and the City of Klamath Falls

Photos Gary Halvorson, Oregon State Archives
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Acknowledgements
Klamath County performed this 2017 natural hazard mitigation plan update by contracting with a retired Emergency Manager, as well as thoroughly reviewing and making changes in-house. It was previously updated in 2011 through a regional partnership funded by the Federal Emergency Management Agency’s Pre-Disaster Mitigation Competitive Grant Program (PDMC-FT-10- OR-2009-001; Award Number EMS-2009-PC-0001). This current plan update builds on previous planning efforts.

Update Project Steering Committee:
Morgan Lindsay, Klamath County Emergency Manager (Project Manager)
John Spradley, Klamath County Fire District #1
George Buckingham, Klamath County Emergency Management
Stan Strickland, Klamath County Public Works
Ramona Quinn, Klamath County Public Health
Nathan Cherpeski, Klamath Falls City Manager
Mark Willrett, Klamath Falls Public Works

Plan Adoption:
Promulgated herewith is the Natural Hazards Mitigation Plan for Klamath County, Oregon, and the City of Klamath Falls.

This plan has been approved by the Klamath County Board of Commissioners and City of Klamath Falls City Council. It will be revised and updated as required. All stakeholders are requested to advise the County Emergency Manager of any changes that might result in its improvement or increase its usefulness.

For the County: [Signature]
Derrick DeGroot, Chair

Donnie Boyd, Vice Chair

Kelley Minty Morris, Commissioner

For the City: [Signature]
Carol Westfall, Mayor

September 2017 Klamath Natural Hazards Mitigation Plan
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Volume I: Natural Hazard Mitigation Plan

Section 1: Introduction

What is Natural Hazard Mitigation?

Natural hazard mitigation is defined as permanently reducing or alleviating the losses of life, property and injuries resulting from natural hazards through long and short-term strategies. Example strategies include policy changes, such as updated ordinances; projects, such as seismic retrofits to critical facilities; and education and outreach to targeted audiences, such as Spanish speaking residents, or the elderly. Mitigation is the responsibility of individuals, private businesses and industries, state and local governments, and the federal government.

Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

Why Develop a Mitigation Plan?

Klamath County and the City of Klamath Falls developed this Natural Hazards Mitigation Plan in an effort to reduce future loss of life and damage to property resulting from natural hazards. It is impossible to predict exactly when hazard events will occur, or the extent to which they will affect the County. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from natural hazards. The figure below is utilized throughout the plan to illustrate the concepts of risk reduction.

[Diagram: Understanding Risk]

Figure 1.1: Understanding Risk
This plan focuses on the primary natural hazards that could affect Klamath County, Oregon, and its incorporated cities to include the City of Klamath Falls, which include drought, earthquake, flood, landslide, volcano, wildfire, and winter storms. The dramatic increase in the costs associated with natural disasters over the past decades has fostered interest in identifying and implementing effective means of reducing vulnerability. A report submitted to Congress by the National Institute of Building Science’s Multi-hazard Mitigation Council (MMC) highlights that for every dollar spent on mitigation, society can expect an average savings of $4. This Natural Hazards Mitigation Plan is intended to assist all participating jurisdictions in reducing its risk from natural hazards by identifying resources, information, and strategies for risk reduction.

The plan is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the County; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other County plans and programs including Comprehensive Land Use Plans, Emergency Response and Recovery Plans, Capital Improvement Plans, Community Wildfire Protection Plans and the State of Oregon Natural Hazards Mitigation Plan.

The plan provides a set of actions to prepare for and reduce the risks posed by natural hazards through education and outreach programs, the development of partnerships, and the implementation of preventative activities such as land use or watershed management programs. The actions described in the plan are intended to be implemented through existing plans and programs within the County.

**What is the County’s Overall Risk to Hazards?**

Oregon currently uses a county by county methodology to assess the probability of and vulnerability to natural hazard events. The hazard annexes in Volume II present probability and vulnerability scores for each hazard within Klamath County. Table I.1. below summarizes the hazard probability and vulnerability scores for Klamath County. The City of Klamath Falls performed its own hazard assessment using the same methodology as the County, and the results of the assessment are reflected in Table I.1.1.
See Table I.1.2 also. This Hazard Analysis was performed in July 2016 by the Klamath County Natural Hazards Mitigation Steering Committee and a group of agency and public representatives. This resulting table of hazards has been modified to exclude non-Natural hazards.

Table I.1.: OEM Hazard Analysis Worksheet

<table>
<thead>
<tr>
<th>Hazard</th>
<th>History</th>
<th>Vulnerability</th>
<th>Maximum Threat</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Severity</td>
<td>Weight Factor</td>
<td>Subtotal</td>
<td>Severity</td>
</tr>
<tr>
<td>Drought</td>
<td>10</td>
<td>2</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Wildfire (WUI)</td>
<td>10</td>
<td>2</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>Winter Storm</td>
<td>10</td>
<td>2</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Fire - Large Scale Urban</td>
<td>8</td>
<td>2</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>Conflagration</td>
<td>2</td>
<td>1</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Earthquake - Cascadia (3-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Earthquake - Cascadia (3-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Volcano</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Dust Storm</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Flood - Riverine</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Landslide/Debris Flow</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>3</td>
</tr>
</tbody>
</table>

See Table I.1.2 also. This Hazard Analysis was performed in June 2017 by the City of Klamath Falls Natural Hazards Mitigation Steering Committee.

Table I.1.1.: OEM Hazard Analysis Worksheet

<table>
<thead>
<tr>
<th>Hazard</th>
<th>History</th>
<th>Vulnerability</th>
<th>Maximum Threat</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Severity</td>
<td>Weight Factor</td>
<td>Subtotal</td>
<td>Severity</td>
</tr>
<tr>
<td>Winter Storm</td>
<td>10</td>
<td>2</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Drought</td>
<td>10</td>
<td>2</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Earthquake - Crystal (1 min)</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Wildfire (WUI)</td>
<td>10</td>
<td>2</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Winter Storm</td>
<td>10</td>
<td>2</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Dam Failure</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Volcano</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Landslide/Debris Flow</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Pre - Large Scale Urban</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Conflagration</td>
<td>4</td>
<td>2</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Extreme Heat Event</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Flood - Riverine</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Table I.1.2: Klamath County and City of Klamath Falls Risk Analysis Summary

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Probability</th>
<th>Vulnerability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Earthquake</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Flood</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Landslide</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>Volcano</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Wildfire</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Winter Storm</td>
<td>High</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

Table I.1.2 reduces the hazards shown in Table I.1 to a simpler list for use in developing Action Items (see Appendix A). Both the County and the City determined the same hazards to be used.

**Policy Framework for Natural Hazards in Oregon**

Planning for natural hazards is an integral element of Oregon’s statewide land use planning program, which began in 1973. All Oregon cities and counties have comprehensive plans and implementing ordinances that are required to comply with the statewide planning goals. The challenge faced by state and local governments is to keep this network of local plans coordinated in response to the changing conditions and needs of Oregon communities.

Statewide land use planning Goal 7: Areas Subject to Natural Hazards calls for local plans to include inventories, policies and ordinances to guide development in or away from hazard areas. Goal 7, along with other land use planning goals, has helped to reduce losses from natural hazards. Through risk identification and the recommendation of risk-reduction actions, this plan aligns with the goals of the jurisdiction’s Comprehensive Plan, and helps each jurisdiction meet the requirements of statewide land use planning Goal 7.

The primary responsibility for the development and implementation of risk reduction strategies and policies lies with local jurisdictions. However, resources exist at the state and federal levels. Some of the key agencies in this area include Oregon Emergency Management (OEM), Oregon Building Codes Division (BCD), Oregon Department of Forestry (ODF), Oregon Department of Geology and Mineral Industries (DOGAMI), and the Department of Land Conservation and Development (DLCD).

The Disaster Mitigation Act of 2000 (DMA 2000) is the key federal legislation addressing mitigation planning. It reinforces the importance of mitigation planning and emphasizes planning for natural hazards before they occur. As such, this Act established the Pre-Disaster Mitigation (PDM) grant program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP). Section 322 of the Act specifically addresses mitigation planning at the state and local levels. State and local jurisdictions must have approved
mitigation plans in place in order to qualify to receive post-disaster HMGP funds. Mitigation plans must demonstrate that their proposed mitigation measures are based on a sound planning process that accounts for the risk to the individual and their capabilities.

How was the Plan Developed?

The Klamath County Natural Hazard Mitigation Plan was originally adopted in 2007. In the fall of 2009, the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon’s Community Service Center partnered with Oregon Emergency Management (OEM) to develop a Pre-Disaster Mitigation Planning Grant proposal. Klamath County joined this effort by signing a Memorandum of Understanding. FEMA awarded a grant to support the development of the plan for the County.

The planning process and associated resources used to create the Klamath Natural Hazards Mitigation Plan were developed by OPDR. The planning process was designed to: (1) result in a plan that is DMA 2000 compliant; (2) coordinate with the State’s plan and activities of OPDR; and (3) build a network of jurisdictions and organizations that can play an active role in plan implementation.

The City of Klamath Falls became interested and signed onto the project during the spring of 2010. As such, this 2017 update of the Klamath Natural Hazard Mitigation Plan continued to use the multijurisdictional approach as it applied to both Klamath County and the City of Klamath Falls.

Development of the 2017 Klamath Natural Hazards Mitigation Plan Update

In June of 2016 a multi-agency organization was formed by Klamath County Emergency Management and was named the Emergency Management Council (EMC). The EMC is a group of key Klamath community leaders and decision-makers who are involved in disaster response and recovery efforts. The various individuals represent all communities and disaster response functions in the County. They meet quarterly to discuss Klamath disaster preparedness, planning, mitigation, response, and recovery items, to include the Natural Hazard Mitigation Plan. The EMC has facilitated and overseen the 2017 plan update process, as is documented through meeting agendas and rosters in this plan. Members of the EMC were chosen during their initial meeting, based on expertise and position, to further manage the update process as part of the Update Project Steering Committee.

Plan Work Sessions

As a first step in the NHMP updating process, the EMC met in June of 2016 and updated the Klamath County Hazards Assessment. This was used as the basis to update the NHMP.

In September of 2016, the Update Project Steering Committee met and determined the next step in the updating process would involve reviewing the existing plan and making
recommendations for updating the plan and identifying tasks for the EMC to address in January of 2017.

In January 2017, the EMC and Update Project Steering Committee met and reviewed the draft plan (see Appendix B). The Committee agreed to review the Action Items and finalize them at the May of 2017 EMC meeting.

Emergency Management presented the draft plan to the Klamath County Commissioners during a work session on June 21, 2017, and the public was invited to make additional comments. No comments were received. Copies of the draft plan were shared with adjoining Counties and posted on the Klamath County website after the work session, and also the City of Klamath Falls’s website. Again, no comments were received. The draft plan was then sent to Oregon Emergency Management (OEM) for review on July 5, 2017. OEM suggestions were implemented and OEM forwarded the plan to FEMA for review and approval. Upon FEMA’s pre-approval, the plan will be adopted and approved by the Klamath County Board of Commissioners and the Klamath Falls City Council.

The Klamath NHMP Steering Committee includes representatives from the City of Klamath Falls. The City’s update process and addendum were performed simultaneously to the County’s by the City NHMP Steering Committee, thus making this plan multijurisdictional.

**How is the Plan Organized?**

Each volume of the mitigation plan provides specific information and resources to assist readers in understanding the hazard-specific issues facing Klamath County citizens, businesses, and the environment.

Volume I contains an introduction; community profile; plan mission, goals, and action items; and plan maintenance.

Volume II contains the hazard specific annexes, including:

- Drought
- Earthquake
- Flood
- landslide
- Volcano
- Wildfire
- Winter Storm

Volume III contains resource appendices, including: action item forms; planning process documentation; grant programs; economic analysis process; and the plan review guide.
Section 2: Community Profile

This section describes Klamath County from a number of perspectives in order to help define and understand their sensitivity and resilience to natural hazards. Sensitivity factors can be defined as those community assets and characteristics that may be impacted by natural hazards, (e.g., special populations, economic factors, and historic and cultural resources). Community resilience factors can be defined as the community’s ability to manage risk and adapt to hazard event impacts (e.g., governmental structure, agency missions and directives, and plans, policies, and programs). The information in this section represents a snapshot in time of the current sensitivity and resilience factors in the County when the plan was developed. This information should be used as the local level rationale for the risk reduction actions identified in Section 3 – Mission, Goals, and Action Items.

Geography and Climate

Klamath County is located in south-central Oregon and covers 6,135 square miles. The County is bounded in the west by the Cascade Mountains, to the south by the Oregon-California border and to the north and east by high plateau. The geographic diversity of Klamath County is an important factor to consider in natural hazards mitigation planning.

The information below includes precipitation information for areas around Klamath County with a special focus on Crater Lake National Park and the City of Klamath Falls. Also included is average temperature information for the City of Klamath Falls.

Table I.2.1: Klamath County Precipitation, Monthly and Annual Averages (1981-2010)

<table>
<thead>
<tr>
<th>Month</th>
<th>Chemult</th>
<th>Chiloquin</th>
<th>Crater Lake</th>
<th>Klamath Falls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>4.46</td>
<td>3.06</td>
<td>9.41</td>
<td>1.85</td>
</tr>
<tr>
<td>Feb</td>
<td>3.15</td>
<td>2.36</td>
<td>7.72</td>
<td>1.92</td>
</tr>
<tr>
<td>Mar</td>
<td>2.59</td>
<td>1.89</td>
<td>7.53</td>
<td>1.27</td>
</tr>
<tr>
<td>Apr</td>
<td>1.44</td>
<td>1.35</td>
<td>5.46</td>
<td>1.37</td>
</tr>
<tr>
<td>May</td>
<td>1.21</td>
<td>1.37</td>
<td>3.57</td>
<td>1.38</td>
</tr>
<tr>
<td>Jun</td>
<td>1.11</td>
<td>0.67</td>
<td>2.28</td>
<td>1.04</td>
</tr>
<tr>
<td>Jul</td>
<td>0.51</td>
<td>0.42</td>
<td>1.03</td>
<td>0.48</td>
</tr>
<tr>
<td>Aug</td>
<td>0.59</td>
<td>0.42</td>
<td>1.00</td>
<td>0.43</td>
</tr>
<tr>
<td>Sep</td>
<td>0.60</td>
<td>0.59</td>
<td>1.98</td>
<td>0.53</td>
</tr>
<tr>
<td>Oct</td>
<td>1.47</td>
<td>1.21</td>
<td>4.42</td>
<td>1.05</td>
</tr>
<tr>
<td>Nov</td>
<td>3.56</td>
<td>2.98</td>
<td>10.25</td>
<td>2.19</td>
</tr>
<tr>
<td>Dec</td>
<td>5.10</td>
<td>4.46</td>
<td>11.56</td>
<td>1.45</td>
</tr>
<tr>
<td>Annual</td>
<td>25.79</td>
<td>20.78</td>
<td>66.21</td>
<td>14.96</td>
</tr>
</tbody>
</table>

Source: National Weather Service
The information above shows a climate that is variable across the County. This is unsurprising, given both the geographic size of the County and difference in topography. Elevations in the County can range from nearly 9,000 feet above sea level at the top of the Crater Lake Caldera to roughly 4,100 feet at the City of Klamath Falls.

### Population and Demographics

Disaster impacts (in terms of loss and the ability to recover) vary among population groups following a disaster. To some extent, any individual can be vulnerable to natural hazards, but social-science research has demonstrated that demographic factors like age, race, gender, and socioeconomic status can amplify vulnerability, thereby increasing the potential for losses.

The population of Klamath County was estimated at 66,016 in 2015. This is a 0.5% decrease from the 66,310 residents in 2010. Table 2.3 shows a general trend towards an aging population, with the age category from 65 and over having a larger percentage total of the population in 2015 than in 2010 (+2.7%).
Table I.2.3: Klamath County Population by Age

<table>
<thead>
<tr>
<th>People and Age</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Population estimates, 2015</td>
<td>66,016</td>
</tr>
<tr>
<td>Population estimates, 2010</td>
<td>66,380</td>
</tr>
<tr>
<td>Population, percent change - 2010 to 2015</td>
<td>-0.5%</td>
</tr>
<tr>
<td>Persons under 5 years, 2015</td>
<td>6.1%</td>
</tr>
<tr>
<td>Persons under 5 years, 2010</td>
<td>6%</td>
</tr>
<tr>
<td>Persons under 18 years, 2015</td>
<td>21.6%</td>
</tr>
<tr>
<td>Persons under 18 years, 2010</td>
<td>22.3%</td>
</tr>
<tr>
<td>Persons 65 years and over, 2015</td>
<td>19.8%</td>
</tr>
<tr>
<td>Persons 65 years and over, 2010</td>
<td>17.1%</td>
</tr>
<tr>
<td>Female persons, percent, 2015</td>
<td>50.1%</td>
</tr>
<tr>
<td>Female persons, percent, 2010</td>
<td>50.2%</td>
</tr>
</tbody>
</table>

Source: US Census QuickFacts data

Due to their immaturity and size, younger populations often require direction and assistance in evacuations. Children are also prone to developing post-traumatic stress disorders, depression, anxieties, and behavioral disorders. As shown in Table I.2.3 above, 21.6 percent of Klamath County’s population is estimated to be between the ages of 0 and 18. Between 2010 and 2015 this population has declined somewhat in number. Older populations may also have special needs during and/or after a natural disaster. Research suggests that older populations may require assistance in evacuation due to potential mobility and health issues or reluctance to evacuate. Additionally, older populations may require special medical equipment at shelters, and are more apt to lack the social and economic resources needed for post-disaster recovery. As shown above, 19.8 percent of Klamath County’s population is 65 years or older. The 65 and older population percentages have increased over the last 5 years.

Additionally, race and ethnicity can influence individual sensitivities and vulnerabilities, and studies have shown that households of racial and ethnic minorities tend to be more vulnerable to extreme natural events. This is not necessarily reflective of individual characteristics; instead, historic patterns of racial and ethnic inequalities may have resulted in minority communities that are more likely to have inferior building stock, infrastructure, and access to public services. Table I.2.4 provides a population analysis by race.

Minorities that primarily speak a language other than the English can also be vulnerable to natural disasters. In Klamath County, 8.9% of the population primarily speaks something other than English at home, with most likely language being Spanish.
Table I.2.4: Klamath County Population by Race

<table>
<thead>
<tr>
<th>Race and Hispanic Origin</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>White 2015</td>
<td>89.1%</td>
</tr>
<tr>
<td>White 2010</td>
<td>85.9%</td>
</tr>
<tr>
<td>Black or African American 2015</td>
<td>0.9%</td>
</tr>
<tr>
<td>Black or African American 2010</td>
<td>0.7%</td>
</tr>
<tr>
<td>American Indian and Alaska Native 2015</td>
<td>4.7%</td>
</tr>
<tr>
<td>American Indian and Alaska Native 2010</td>
<td>4.1%</td>
</tr>
<tr>
<td>Asian 2015</td>
<td>1%</td>
</tr>
<tr>
<td>Asian 2010</td>
<td>0.9%</td>
</tr>
<tr>
<td>Native Hawaiian and Other Pacific Islander 2015</td>
<td>0.2%</td>
</tr>
<tr>
<td>Native Hawaiian and Other Pacific Islander 2010</td>
<td>0.1%</td>
</tr>
<tr>
<td>Two or More Races, 2015</td>
<td>4%</td>
</tr>
<tr>
<td>Two or More Races, 2010</td>
<td>4.1%</td>
</tr>
<tr>
<td>Hispanic or Latino, 2015</td>
<td>12.2%</td>
</tr>
<tr>
<td>Hispanic or Latino, 2010</td>
<td>10.4%</td>
</tr>
<tr>
<td>Language other than English spoken at home age 5+, 2010-2014</td>
<td>8.9%</td>
</tr>
</tbody>
</table>

Source: US Census QuickFacts data

Employment and Economics

Economic resilience to natural disasters is particularly important for the major employment sectors in the region. If the region is negatively impacted by a natural hazard, such that employment numbers are reduced, the economic impact will be felt throughout the region.

Table I.2.5: Klamath County Economic Data

<table>
<thead>
<tr>
<th>Economy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>In civilian labor force age 16 years+, 2010-2014</td>
<td>56.5%</td>
</tr>
<tr>
<td>In civilian labor force, female, age 16 years+, 2010-2014</td>
<td>51.2%</td>
</tr>
<tr>
<td>Total accommodation and food services sales, 2012</td>
<td>$110,662,000</td>
</tr>
<tr>
<td>Total health care and social assistance receipts/revenue, 2012</td>
<td>$323,540,000</td>
</tr>
<tr>
<td>Total manufacturer shipments, 2012</td>
<td>$449,873,000</td>
</tr>
<tr>
<td>Total merchant wholesaler sales, 2012</td>
<td>$210,886,000</td>
</tr>
<tr>
<td>Total retail sales, 2012 ($1,000)</td>
<td>$757,458,000</td>
</tr>
<tr>
<td>Total retail sales per capita, 2012</td>
<td>$11,492</td>
</tr>
</tbody>
</table>

Transportation

Mean travel time to work, workers age 16 years+, 2010-2014 17.4 minutes

Income and Poverty

Median household income (in 2014 dollars), 2010-2014 $39,534
Per capita income in past 12 months (in 2014 dollars), 2010-2014 $21,740
Persons in poverty, percent 21.9%

Businesses

Total employer establishments, 2014 1,504
Total employment, 2014 16,696
Total non-employer establishments, 2014 3,354
All firms, 2012 4,137
Median income can be used as an indicator of the strength of the region’s economic stability. In 2010-2014, the median household income in Klamath County was $39,534. This was about 26 percent below the 2010-2014 national median household income of $53,482. Although median household income can be used to compare areas as a whole, this number does not reflect how income is divided among area residents.

**Housing**

Housing type and age are important factors in hazard mitigation planning. Certain housing types tend to be less disaster resistant and warrant special attention: mobile homes, for example, are generally more prone to wind and water damage than standard wood-frame construction. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. In Oregon, for example, the building code was only recently (1993) upgraded to include earthquake loading in the building design. As shown in Table I.2.6 below, over 75% of Klamath County’s housing structures were built before 1990.

**Table I.2.6: Klamath County Housing Age**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005 or later</td>
<td>877</td>
<td>2.8%</td>
</tr>
<tr>
<td>2000-2004</td>
<td>2,183</td>
<td>7.0%</td>
</tr>
<tr>
<td>1990-1999</td>
<td>3,976</td>
<td>12.8%</td>
</tr>
<tr>
<td>1980-1989</td>
<td>2,933</td>
<td>9.4%</td>
</tr>
<tr>
<td>1970-1979</td>
<td>7,484</td>
<td>24.0%</td>
</tr>
<tr>
<td>1960-1969</td>
<td>3,130</td>
<td>10.0%</td>
</tr>
<tr>
<td>1950-1959</td>
<td>2,922</td>
<td>9.4%</td>
</tr>
<tr>
<td>1940-1949</td>
<td>2,885</td>
<td>9.3%</td>
</tr>
<tr>
<td>1939 or earlier</td>
<td>4,794</td>
<td>15.4%</td>
</tr>
<tr>
<td>Total</td>
<td>31,184</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: U.S. Census, 2008 American Community Survey

**Table I.2.7: Klamath County Units and Costs**

<table>
<thead>
<tr>
<th>Housing</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing units, 2015</td>
<td>32,815</td>
</tr>
<tr>
<td>Housing units, 2010</td>
<td>32,774</td>
</tr>
<tr>
<td>Owner-occupied housing unit rate, 2010-2014</td>
<td>65.8%</td>
</tr>
<tr>
<td>Median value of owner-occupied housing units, 2010-2014</td>
<td>$154,600</td>
</tr>
<tr>
<td>Median selected monthly owner costs - with mortgage, 2010-2014</td>
<td>$1,197</td>
</tr>
<tr>
<td>Median selected monthly owner costs - without mortgage, 2010-2014</td>
<td>$345</td>
</tr>
<tr>
<td>Median gross rent, 2010-2014</td>
<td>$738</td>
</tr>
</tbody>
</table>

Source: US Census QuickFacts data
Land Use and Development

Klamath County was founded on October 17, 1882. The County was created from the western portion of Lake County and named after the Klamath (also spelled Clammite) Tribe. When created, the county seat was called Linkville. In 1893, Linkville changed its name to Klamath Falls.

Klamath County consists of five incorporated cities, which include Bonanza, Chiloquin, Klamath Falls, Malin and Merrill. About 24,170 people reside within the incorporated cities of Klamath County. The principal population area is the City of Klamath Falls with a population of 21,495. The Klamath Falls Urban Growth Boundary covers roughly twice the area of the City, and puts the population just over 41,000.

In July 1947, the school that would eventually become the Oregon Institute of Technology (OIT) began holding its first classes at its campus on the North end of Klamath Falls. Including faculty, OIT employs roughly 500 staff and engages over 4,700 students from across the country and globe annually.

Klamath Community College was founded in 1995 and services approximately 5,000 students annually, most of whom are from Klamath and Lake Counties. Its campus resides on the East side of the Klamath Falls Suburbs.

Klamath County is home to the 173d Fighter Wing Air National Guard Base, which makes its home at the Crater Lake- Klamath Regional Airport on the South side of the City of Klamath Falls. It employs roughly 1,000 military members.

Klamath County’s economy has historically been based on timber and agriculture. This has impacted the land use and development patterns in the County. Three-fourths of the county is forested, but over one half of that is publicly owned.

Critical Infrastructure and Facilities

Transportation networks, systems for power transmission, and critical facilities such as hospitals and police stations are all vital to the functioning of the region. Due to the fundamental role that infrastructure plays both pre-and post-disaster, it deserves special attention in the context of creating more resilient communities. The information documented in this section of the profile can provide the basis for informed decisions about how to reduce the vulnerability of Klamath County’s infrastructure to natural hazards.

The two major transportation routes in Klamath County are U.S. Highway 97 (US 97) and Oregon Highway 140. US 97 runs north-south through the entire County. Oregon Highway 140 runs east-west, connecting Klamath Falls with Medford to the west and Lakeview to the east. Other important transportation routes include Oregon Highways 39, 58, 62, 66, 70, and 138. Possible transportation options other than those involving a personal vehicle include the
Basin Transportation Service, Amtrak passenger rail, and Crater Lake-Klamath Regional Airport commercial airline service.

Critical facilities are those facilities that are essential to government response and recovery activities. These facilities include local police and fire stations, public works facilities, sewer and water facilities, hospitals, and shelters. Table I.2.8 provides a list of some of Klamath County’s critical facilities and structures.

Table I.2.8: Critical Facilities in Klamath County

<table>
<thead>
<tr>
<th>Facility</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital (beds)</td>
<td>1 (176*)</td>
</tr>
<tr>
<td>Police Stations</td>
<td>6</td>
</tr>
<tr>
<td>Fire &amp; Rescue</td>
<td>32</td>
</tr>
<tr>
<td>Power Plants</td>
<td>2</td>
</tr>
<tr>
<td>Dams</td>
<td>4</td>
</tr>
<tr>
<td>Bridges</td>
<td>332</td>
</tr>
</tbody>
</table>

Source: Oregon State Fire Marshal, *Sky Lakes Medical Center

Historical and Cultural Resources

Historic and cultural resources such as historic structures and landmarks can help to define a community and may also be sources of tourism dollars. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important.

The following structures and/or places within Klamath County are listed on the National Register of Historic Places:

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ashland</td>
<td>Honeymoon Creek Snow--Survey Cabin</td>
</tr>
<tr>
<td>Bly</td>
<td>Bly Ranger Station</td>
</tr>
<tr>
<td>Crater Lake National Park</td>
<td>Munson Valley Historic District</td>
</tr>
<tr>
<td>Crater Lake National Park</td>
<td>Watchman Lookout Station No. 68</td>
</tr>
<tr>
<td>Crater Lake National Park</td>
<td>Comfort Station No. 68</td>
</tr>
<tr>
<td>Crater Lake National Park</td>
<td>Comfort Station No. 72</td>
</tr>
<tr>
<td>Crater Lake National Park</td>
<td>Munson Valley Historic District (Boundary Decrease)</td>
</tr>
<tr>
<td>Crater Lake National Park</td>
<td>Rim Village Historic District</td>
</tr>
<tr>
<td>Crater Lake National Park</td>
<td>Rim Drive Historic District</td>
</tr>
<tr>
<td>Crater Lake National Park</td>
<td>Crater Lake Superintendent's Residence</td>
</tr>
<tr>
<td>Fort Klamath</td>
<td>Fort Klamath Site</td>
</tr>
<tr>
<td>Fort Klamath</td>
<td>Sinnott Memorial Building No. 67</td>
</tr>
<tr>
<td>Klamath Falls</td>
<td>Crater Lake Lodge</td>
</tr>
<tr>
<td>Klamath Falls</td>
<td>Lake of the Woods Ranger Station--Work Center</td>
</tr>
<tr>
<td>Klamath Falls</td>
<td>Benson, Judge Henry L., House</td>
</tr>
<tr>
<td>Klamath Falls</td>
<td>Baldwin Hotel</td>
</tr>
<tr>
<td>Klamath Falls</td>
<td>Oregon Bank Building</td>
</tr>
<tr>
<td>Klamath Falls</td>
<td>Richardson--Ulrich House</td>
</tr>
</tbody>
</table>
Klamath Falls | Valley Hospital
---|---
Klamath Falls | Klamath Falls City Library, Old
Klamath Falls | Klamath Falls City Hall
Klamath Falls | Mills, Warren, House
Klamath Falls | Point Comfort Lodge
Klamath Falls | Blackburn Sanitarium
Klamath Falls | Goeller, Fred, House
Klamath Falls | Bisbee Hotel
Klamath Falls | Klamath County Armory & Auditorium
Klamath Falls | Linkville Pioneer Cemetery

Source: National Park Service, National Register of Historic Places NPGallery Database, current through September 2015

Klamath County is home to many tribal members of the Klamath, Yahooskin, and Modoc peoples, collectively the Klamath Tribes. The Klamath Tribes perform their own hazard assessment and also have their own Natural Hazard Mitigation Plan. Klamath County and the Tribes have coordinated some planning processes to increase accuracy and efficiency.

**Government Structure**

Klamath County has three elected County Commissioners, as well as an elected Sheriff, District Attorney, Treasurer, Clerk, and Surveyor. The Board of Commissioners oversees all county activities and departments with the exception of the Sheriff and the District Attorney (but do oversee their appropriations).

The City of Klamath Falls has an elected Mayor that presides over a council of five elected members, who in turn appoint a City Manager.

**Existing Plan & Policies**

Klamath County has existing plans and policies that guide and influence land use, land development, and population growth. Plans and policies already in existence have support from local residents, businesses and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can adapt easily to changing conditions and needs.

The Klamath NHMP includes a range of recommended action items that, when implemented, will reduce vulnerability to natural hazards. Many of these recommendations are consistent with the goals and objectives of existing plans and policies. Implementing the NHMP’s action items through existing plans and policies increases their likelihood of being supported and getting updated, and maximizes resources.

Klamath’s current plans and policies include the following:
**Klamath County Comprehensive Plan**
Date of Last Revision (Audit): 2010
Author/Owner: Klamath County
Description: The Comprehensive Plan is the official policy guide for decisions about growth, development, and conservation of natural resources in Klamath County.
Relationship to Natural Hazard Mitigation Planning: The Goal 7 Policies within Klamath County’s Comprehensive Plan provide the framework for evaluating land uses for their exposure to harm from natural hazards. The policies guide identification of areas subject to natural hazards, regulation of development, and protection of citizens, property and the environment from natural hazards. The protection methods prescribed include prevention and preparedness, land use regulation, public education, and collaboration with other organizations. These policies guide development of this natural hazards mitigation plan.

**Klamath County Transportation Systems Plan**
Date of Last Revision: 2009 (Adopted 2010)
Author/Owner: Klamath County
Description: The Transportation System Plan (TSP) is required to provide a transportation system that accommodates the expected 20-year growth in population and employment resulting from implementation of the currently adopted Klamath County comprehensive plan.
Relation to Natural Hazard Mitigation Planning: Transportation systems are important in evacuating and responding to natural disasters. Mitigation actions that focus on strengthening the transportation system can be incorporated into the Transportation Systems Plan.

**Klamath County Community Wildfire Protection Plan 2016 Update**
Date of Last Revision: December 5, 2016
Author/Owner: Klamath County Fire Defense Board
Description: This document is the 2016 update of the 2007 Community Wildfire Protection Plan for Klamath County, Oregon (KCCWPP). The content of the KCCWPP was developed to meet the intent of the National Fire Plan (NFP) and the Healthy Forest Restoration Act (HFRA). It was prepared to support the planning efforts of all agencies and districts that participate in wildland fire management throughout Klamath County. The KCCWPP compiled wildland fire hazards for defined Wildland Urban Interface (WUI) communities in Klamath County.

**Klamath County Land Development Code/Klamath Falls Community Development Ordinances**
Date of Last Revision: 1991/2007
Author/Owner: Klamath County and the City of Klamath Falls
Description: These document implements the Klamath County Comprehensive Plan; they manage growth and promote public health, safety and general citizen welfare in regards to land use development. They regulate land use to encourage orderly development and beneficial land use and assist the public with understanding regulations. Both provide guidance on floodplain management.
Community Organizations and Programs

Social systems can be defined as community organizations and programs that provide social and community-based services, such as health care or housing assistance, to the public. In planning for natural hazard mitigation, it is important to know what social systems exist within the community because of their existing connections to the public. Often, actions identified by the plan involve communicating with the public or specific subgroups within the population (e.g. elderly, children, low income). The County and City can use existing social systems as resources for implementing such communication-relate activities because these service providers already work directly with the public on a number of issues, one of which could be natural hazard preparedness and mitigation.

The following table highlights organizations that are active within the community and may be potential partners for implementing mitigation actions. The table includes information on each organization or program’s service area, types of services offered, and populations served. Each organization can assist with:

- Education and outreach – organization could partner with the community to educate the public or provide outreach assistance on natural hazard preparedness and mitigation.

- Information dissemination – organization could partner with the community to provide hazard-related information to target audiences.

- Plan/project implementation – organization may have plans and/or policies that may be used to implement mitigation activities or the organization could serve as the coordinating or partner organization to implement mitigation actions.
<table>
<thead>
<tr>
<th>Name and Contact Information</th>
<th>Description</th>
<th>Service Area</th>
<th>Populations Served</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sky Lakes Medical Center</strong>&lt;br&gt;2865 Daggett Ave, Klamath Falls&lt;br&gt;(541) 882-6311</td>
<td>Sky Lakes Medical Center Health Center is a place where children, families and other adults in the community can come for medical care.</td>
<td>Klamath County</td>
<td>x x x x x</td>
</tr>
<tr>
<td><strong>Klamath County Fire District No. 1</strong>&lt;br&gt;541-885-2056</td>
<td>Provides quick, effective and professional assistance to deal with fire and emergency related calls.</td>
<td>Portions of Klamath County</td>
<td>x x x x x x</td>
</tr>
<tr>
<td><strong>Bly RFPD</strong>&lt;br&gt;60800 OR 140&lt;br&gt;Bly, OR 97622&lt;br&gt;(541) 353-2713</td>
<td>Provide fire and emergency related services to the Bly Rural Fire Protection District.</td>
<td>Portions of Klamath County</td>
<td>x x x x x x</td>
</tr>
<tr>
<td><strong>Chiloquin-Agency Lake Fire District</strong>&lt;br&gt;127 S. First St.&lt;br&gt;Chiloquin&lt;br&gt;(541) 752-3354</td>
<td>Protect life, property, and environment to the best of their ability having provided for safety first.</td>
<td>Portions of Klamath County</td>
<td>x x x x x x</td>
</tr>
<tr>
<td><strong>Klamath County Fire District 4</strong>&lt;br&gt;4041 Balsam Drive Klamath Falls&lt;br&gt;(541) 884-1670</td>
<td>To save lives and property from damage and destruction by fire, providing medical care, and to promote fire prevention.</td>
<td>Portions of Klamath County</td>
<td>x</td>
</tr>
<tr>
<td><strong>Keno Rural Fire Protection District</strong>&lt;br&gt;14800 Puckett Road&lt;br&gt;Keno, OR&lt;br&gt;(541) 883-3062</td>
<td>To save lives, suppress and control fires, and provide other services such as rescue, wildland urban interface fuels reduction, public fire education and other activities</td>
<td>Portions of Klamath County</td>
<td>x x x x x x</td>
</tr>
<tr>
<td><strong>Klamath Water Users Association</strong>&lt;br&gt;735 Commercial St.&lt;br&gt;Klamath Falls&lt;br&gt;(541) 883-8893</td>
<td>To preserve, protect and defend the water and power rights of the landowners in the Klamath Basin while promoting wise management of ecosystem resources.</td>
<td>Klamath County</td>
<td>x x</td>
</tr>
<tr>
<td><strong>Klamath Tribes</strong>&lt;br&gt;501 Chiloquin Blvd.&lt;br&gt;Chiloquin&lt;br&gt;(800) 524-9787</td>
<td>Protect, preserve, and enhance the spiritual, cultural, and physical values and resources of the Klamath, Modoc, and Yahooskin Peoples, by maintaining the customs and heritage of their ancestors.</td>
<td>Klamath County</td>
<td>x x x x x x</td>
</tr>
</tbody>
</table>
Section 3: Mission, Goals, and Action Items

This section describes the components that guide implementation of the identified mitigation strategies and is based on strategic planning principles. This section provides information on the process used to develop a mission, goals and action items. It also includes an explanation of how Klamath County intends to incorporate the mitigation strategies outlined in the plan into existing planning mechanisms and programs such as the comprehensive land use planning process, capital improvement planning process, and building codes enforcement and implementation.

Mitigation Plan Mission

The mission of the Klamath NHMP is intended to be adaptable with any future updates to the plan. The OPDR and the Klamath Steering Committee developed the following mission statement for the plan, and the 2017 Update Steering Committee saw no reason to change it:

To strive to create a self-sustaining, independent community.

Mitigation Plan Goals

The plan goals help guide the direction of future activities aimed at reducing risk and preventing loss from natural hazards. The goals listed here serve as checkpoints as agencies and organizations begin implementing mitigation action items. The goals of the Klamath NHMP are to:

1. Protect life and reduce injuries resulting from natural hazards
2. Minimize public and private property damages and the disruption of essential infrastructure and services from natural hazards
3. Increase the resilience of the local economy
4. Minimize the impact of natural hazards while protecting and restoring the environment
5. Enhance and maintain the local capability to implement a comprehensive hazard loss reduction strategy
6. Document and evaluate local progress in achieving hazard mitigation

Mitigation Plan Action Items

Short and long-term action items identified through the planning process are an important part of the mitigation plan. Action items are detailed recommendations for activities that local departments, citizens and others could engage in to reduce risk. They address both multi-hazard and hazard-specific issues. Action items can be developed through a number of sources. A description of how the plan’s mitigation actions were developed is provided below.

Each action item has a corresponding action item worksheet describing the activity, identifying the rationale for the project, identifying potential ideas for implementation, and assigning
coordinating and partner organizations. The action item worksheets can assist the community in pre-packaging potential projects for grant funding. The worksheet components are described below. These action item worksheets are located in Appendix A.

The Steering Committee developed the action items presented in this plan based upon local vulnerability information, stakeholder interviews, and an analysis of local plans and reports. The action items also include deferred actions from the 2007 and 2011 mitigation plan. During the update process, the Update Steering Committee identified which actions from the 2011 plan had been completed or not completed, and which should be rolled over into the 2017 update.

Rationale or Key Issues Addressed

Action items should be fact-based and tied directly to issues or needs identified throughout the planning process. Action items can be developed at any time during the planning process and can come from a number of sources, including participants in the planning process, noted deficiencies in local capability, or issues identified through the risk assessment. The rationale for proposed action items is based on the information documented in Section 2 and the Hazard Annexes.

Ideas for Implementation

The ideas for implementation offer a transition from theory to practice and serve as a starting point for this plan. This component of the action item is dynamic, since some ideas may prove to not be feasible, and new ideas may be added during the plan maintenance process. Ideas for implementation include such things as collaboration with relevant organizations, grant programs, tax incentives, human resources, education and outreach, research, and physical manipulation of buildings and infrastructure.

Implementation through Existing Programs

The Klamath NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in Klamath County. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. Klamath County currently addresses statewide planning goals and legislative requirements through its comprehensive land use plan, capital improvements plan, mandated standards and building codes. To the extent possible, Klamath County will work to incorporate the recommended mitigation action items into existing programs and procedures.

Coordinating Organization

The coordinating organization is the public agency with the regulatory responsibility to address natural hazards, or that is willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring and evaluation.
**Internal and External Partners**

The internal and external partner organizations listed in the Action Item Worksheets are potential partners recommended by the project Steering Committee but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and/or resources toward completion of the action items.

Internal partner organizations are departments within the County or other participating jurisdictions that may be able to assist in the implementation of action items by providing relevant resources to the coordinating organization.

External partner organizations can assist the coordinating organization in implementing the action items in various functions and may include local, regional, state, or federal agencies, as well as local and regional public and private sector organizations.

**Plan Goals Addressed**

The plan goals addressed by each action item are identified as a means for monitoring and evaluating how well the mitigation plan is achieving its goals, following implementation.

**Timeline**

Action items include both short and long-term activities. Each action item includes an estimate of the timeline for implementation. *Short-term action items* (ST) are activities that may be implemented with existing resources and authorities in one to two years. *Long-term action items* (LT) may require new or additional resources and/or authorities, and may take from one to five years to implement.

**Section 4: Plan Implementation and Maintenance**

Klamath County has submitted the 2017 NHMP update to the State Hazard Mitigation Officer at Oregon Emergency Management. Oregon Emergency Management submits the plan to the Federal Emergency Management Agency (FEMA--Region X) for review. This review addresses the federal criteria outlined in the FEMA Interim Final Rule 44 CFR Part 201. Upon pre-approval by FEMA, Klamath County and the City of Klamath Falls will adopt the plan via resolution. At that point the County and City will gain eligibility for the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program funds, and Flood Mitigation Assistance program funds.
Implementing the Plan

Convener

The Chair of the Klamath County EMC serves as the convener for this plan, which is the Klamath County Emergency Manager. The convener’s responsibilities include:

- Coordinating steering committee meetings, dates, times, locations, agendas, and member notification;
- Documenting the discussions and outcomes of committee meetings;
- Serving as a communication conduit between the steering committee and the public stakeholders;
- Identifying emergency management-related funding sources for natural hazards mitigation projects;
- Coordinating plan update processes (to include review of the risk assessment, goals, action items, and plan implementation and maintenance strategies);
- Submitting future plan updates to Oregon Emergency Management for review; and
- Coordinating the local adoption process.

Coordinating Body

The coordinating body for this plan is the EMC Update Steering Committee, which included Klamath County Emergency Management, Public Health, Planning, and Public Works; Klamath County Fire District 1; and the City of Klamath Falls. Roles and responsibilities of the coordinating body include:

- Serving as the local evaluation committee for funding programs such as the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program funds, and Flood Mitigation Assistance program funds;
- Prioritizing and recommending funding for natural hazard risk reduction projects;
- Documenting successes and lessons learned;
- Evaluating and updating the Natural Hazards Mitigation Plan following a disaster;
- Evaluating and updating the Natural Hazards Mitigation Plan in accordance with the prescribed maintenance schedule; and
- Developing and coordinating ad hoc and/or standing subcommittees as needed.

Members

The following organizations were represented on the EMC during the development of this update to the Klamath NHMP:

- Klamath County Emergency Management
- Klamath County Planning Department
- Klamath County Public Health
- Klamath County Fire District #1
To make the coordination and review of Klamath NHMP as broad and useful as possible, the coordinating body will engage additional stakeholders.

**Plan Maintenance**

The EMC and Steering Committee are responsible for implementing this process, in addition to maintaining and updating the plan through a series of meetings outlined in the maintenance schedule below.

**Bi-Annual Meetings**

The EMC NHMP Steering Committee will meet at least semi-annually to complete the following tasks:

- Review existing action items to determine appropriateness for funding;
- Educate and train new members on the plan and mitigation in general;
- Identify issues that may not have been identified when the plan was developed; and
- Prioritize potential mitigation projects using the methodology described below.
- Review existing and new risk assessment data;
- Discuss methods for continued public involvement; and
- Document successes and lessons learned during the year.

The convener will be responsible for documenting the outcome of meetings in Appendix B.
The plan’s format allows the County and participating jurisdictions to review and update sections when new data becomes available. New data can be easily incorporated, resulting in a natural hazards mitigation plan that remains current and relevant to the participating jurisdictions.

**Project Prioritization Process**

The Disaster Mitigation Act of 2000 requires that jurisdictions identify a process for prioritizing potential actions. Potential mitigation activities often come from a variety of sources; therefore the project prioritization process needs to be flexible. Projects may be identified by committee members, local government staff, other planning documents, or the risk assessment.

Figure 4.1 illustrates the project development and prioritization process.

**Figure 4.1: Project Prioritization Process**

*Action Item and Project Review Process*

![Flowchart](image)

Source: Community Service Center’s Partnership for Disaster Resilience at the University of Oregon, 2008.

**Step 1: Examine funding requirements**

The first step in prioritizing the plan’s action items is to determine which funding sources are open for application. Several funding sources may be appropriate for the county’s proposed mitigation projects. Examples of mitigation funding sources include but are not limited to: FEMA’s Pre-Disaster Mitigation competitive grant program (PDM), Flood Mitigation Assistance (FMA) program, Hazard Mitigation Grant Program (HMGP), National Fire Plan (NFP),
Community Development Block Grants (CDBG), local general funds, and private foundations, among others. Please see Appendix C Grant Programs for a more comprehensive list of potential grant programs.

Because grant programs open and close on differing schedules, the coordinating body will examine upcoming funding streams’ requirements to determine which mitigation activities would be eligible. The coordinating body may consult with the funding entity, Oregon Emergency Management, or other appropriate state or regional organizations about project eligibility requirements. This examination of funding sources and requirements will happen during the coordinating body’s semi-annual plan maintenance meetings.

**Step 2: Complete risk assessment evaluation**

The second step in prioritizing the plan’s action items is to examine which hazards the selected actions are associated with and where these hazards rank in terms of community risk. The coordinating body will determine whether or not the plan’s risk assessment supports the implementation of eligible mitigation activities. This determination will be based on the location of the potential activities, their proximity to known hazard areas, and whether community assets are at risk. The coordinating body will additionally consider whether the selected actions mitigate hazards that are likely to occur in the future, or are likely to result in severe / catastrophic damages.

**Step 3: Committee Recommendation**

Based on the steps above, the coordinating body will recommend which mitigation activities should be moved forward. If the coordinating body decides to move forward with an action, the coordinating organization designated on the action item form will be responsible for taking further action and, if applicable, documenting success upon project completion. The coordinating body will convene a meeting to review the issues surrounding grant applications and to share knowledge and/or resources. This process will afford greater coordination and less competition for limited funds.

**Step 4: Complete quantitative and qualitative assessment, and economic analysis**

The fourth step is to identify the costs and benefits associated with the selected natural hazard mitigation strategies, measures or projects. Two categories of analysis that are used in this step are: (1) benefit/cost analysis, and (2) cost-effectiveness analysis.

Conducting benefit/cost analysis for a mitigation activity assists in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating natural hazards provides decision makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects. Figure 4.2 shows decision criteria for selecting the appropriate method of analysis.
If the activity requires federal funding for a structural project, the Committee will use a Federal Emergency Management Agency-approved cost-benefit analysis tool to evaluate the appropriateness of the activity. A project must have a benefit/cost ratio of greater than one in order to be eligible for FEMA grant funding.

For non-federally funded or nonstructural projects, a qualitative assessment will be completed to determine the project’s cost effectiveness. The committee will use a multivariable assessment technique called STAPLE/E to prioritize these actions.

STAPLE/E stands for Social, Technical, Administrative, Political, Legal, Economic, and Environmental. Assessing projects based upon these seven variables can help define a project’s qualitative cost effectiveness. The STAPLE/E technique has been tailored for use in natural hazard action item prioritization by the Partnership for Disaster Resilience at the University of Oregon’s Community Service Center. See Appendix D for a description of the STAPLE/E evaluation methodology.

Continued Public Involvement & Participation

The participating jurisdictions are dedicated to involving the public directly in the continual reshaping and updating of the Klamath NHMP. Although members of the Steering Committee represent the public to some extent, the public has also been invited to comment on the plan and will be encouraged to participate during the implementation process.
To ensure that these opportunities will continue, Klamath County will post the plan on its website, allowing the public to have easy online access to the plan. The public will also be informed when meetings discussing the plan are held.

On an annual basis the Steering Committee will utilize the “Local Plan Review Guide” to verify the continued relevance of the plan. See Volume III, Appendix E.

**Five-Year Review of Plan**

This plan will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. The Klamath County Natural Hazards Mitigation Plan is due to be updated on or before September of 2022. The convener will be responsible for organizing the coordinating body to address plan update needs. The coordinating body will be responsible for updating any deficiencies found in the plan, and for ultimately meeting the Disaster Mitigation Act of 2000’s plan update requirements.

The following ‘toolkit’, as well as the “Local Plan Review Guide” found in Volume III, Appendix E, can assist the convener in determining which plan update activities can be discussed during regularly-scheduled plan maintenance meetings, and which activities require additional meeting time and/or the formation of sub-committees.
<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Plan Update Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the planning process description still relevant?</td>
<td>X</td>
<td></td>
<td>Modify this section to include a description of the plan update process. Document how the planning team reviewed and analyzed each section of the plan, and whether each section was revised as part of the update process. (This toolkit will help you do that).</td>
</tr>
<tr>
<td>Do you have a public involvement strategy for the plan update process?</td>
<td>X</td>
<td></td>
<td>Decide how the public will be involved in the plan update process. Allow the public an opportunity to comment on the plan process and prior to plan approval.</td>
</tr>
<tr>
<td>Have public involvement activities taken place since the plan was adopted?</td>
<td>X</td>
<td></td>
<td>Document activities in the &quot;planning process&quot; section of the plan update.</td>
</tr>
<tr>
<td>Are there new hazards that should be addressed?</td>
<td>X</td>
<td></td>
<td>Add new hazards to the risk assessment section.</td>
</tr>
<tr>
<td>Have there been hazard events in the community since the plan was adopted?</td>
<td>X</td>
<td></td>
<td>Document hazard history in the risk assessment section.</td>
</tr>
<tr>
<td>Have new studies or previous events identified changes in any hazard's location or extent?</td>
<td>X</td>
<td></td>
<td>Document changes in location and extent in the risk assessment section.</td>
</tr>
<tr>
<td>Has vulnerability to any hazard changed?</td>
<td>X</td>
<td></td>
<td>Document changes in vulnerability in the risk assessment section.</td>
</tr>
<tr>
<td>Have development patterns changed? Is there more development in hazard prone areas?</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do future annexations include hazard prone areas?</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there new high risk populations?</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there completed mitigation actions that have decreased overall vulnerability?</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Yes</td>
<td>No</td>
<td>Plan Update Action</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-----</td>
<td>------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Did the plan document and/or address National Flood Insurance Program repetitive flood loss properties?</td>
<td></td>
<td>x</td>
<td>There are no repetitive losses.</td>
</tr>
<tr>
<td>Did the plan identify the number and type of existing and future buildings, infrastructure, and critical facilities in hazards areas?</td>
<td></td>
<td>x</td>
<td>1) Update existing data in risk assessment section or 2) determine whether adequate data exists. If so, add information to plan. If not, describe why this could not be done at the time of the plan update</td>
</tr>
<tr>
<td>Did the plan identify data limitations?</td>
<td></td>
<td>x</td>
<td>If yes, the plan update must address them: either state how deficiencies were overcome or why they couldn't be addressed</td>
</tr>
<tr>
<td>Did the plan identify potential dollar losses for vulnerable structures?</td>
<td></td>
<td>x</td>
<td>1) Update existing data in risk assessment section or 2) determine whether adequate data exists. If so, add information to plan. If not, describe why this could not be done at the time of the plan update</td>
</tr>
<tr>
<td>Are the plan goals still relevant?</td>
<td></td>
<td>x</td>
<td>Document any updates in the plan goal section</td>
</tr>
<tr>
<td>What is the status of each mitigation action?</td>
<td></td>
<td>x</td>
<td>Document whether each action is completed or pending. For those that remain pending explain why. For completed actions, provide a 'success' story.</td>
</tr>
<tr>
<td>Are there new actions that should be added?</td>
<td></td>
<td>x</td>
<td>Add new actions to the plan. Make sure that the mitigation plan includes actions that reduce the effects of hazards on both new and existing buildings.</td>
</tr>
<tr>
<td>Is there an action dealing with continued compliance with the National Flood Insurance Program?</td>
<td></td>
<td>x</td>
<td>If not, add this action to meet minimum NFIP planning requirements</td>
</tr>
<tr>
<td>Are changes to the action item prioritization, implementation, and/or administration processes needed?</td>
<td></td>
<td>x</td>
<td>Document these changes in the plan implementation and maintenance section</td>
</tr>
<tr>
<td>Do you need to make any changes to the plan maintenance schedule?</td>
<td></td>
<td>x</td>
<td>Document these changes in the plan implementation and maintenance section</td>
</tr>
<tr>
<td>Is mitigation being implemented through existing planning mechanisms (such as comprehensive plans, or capital improvement plans)?</td>
<td></td>
<td>x</td>
<td>If the community has not made progress on process of implementing mitigation into existing mechanisms, further refine the process and document in the plan.</td>
</tr>
</tbody>
</table>
Volume II: Hazard Annexes
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**Introduction**

The foundation of the Klamath NHMP is the risk assessment. Risk assessments provide information about the areas where the hazards may occur, the value of existing land and property in those areas, and an analysis of the potential risk to life, property, and the environment that may result from natural hazard events.

This section identifies and profiles the location, extent, previous occurrences, and future probability of natural hazards that can impact the participating jurisdictions, as highlighted in Figure II.1.1 below. The information in this section was paired with the information in Section 2 – Community Profile during the planning process in order to identify issues and develop actions aimed at reducing overall risk, or the area of overlap in the figure below.

**Figure II.1.1: Understanding Risk**

This section drills down to local level information and results in an understanding of the risks the communities face. In addition to local data, the information here relies upon the Regional Risk Assessment in the State Natural Hazard Mitigation.

**What is a Risk Assessment?**

A risk assessment consists of three phases: hazard identification, vulnerability assessment, and risk analysis, as illustrated in the following graphic.
Figure II.1.2: The Three Phases of a Risk Assessment

<image>


The first phase, hazard identification, involves the identification of the geographic extent of a hazard, its intensity, and its probability of occurrence. This level of assessment typically involves producing a map. The outputs from this phase can also be used for land use planning, management, and regulation; public awareness; defining areas for further study; and identifying properties or structures appropriate for acquisition or relocation.\(^1\)

The second phase, vulnerability assessment, combines the information from the hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard, and attempts to predict how different types of property and population groups will be affected by the hazard. This step can also assist in justifying changes to building codes or development regulations, property acquisition programs, policies concerning critical and public facilities, taxation strategies for mitigating risk, and informational programs for members of the public who are at risk.\(^2\)

The third phase, risk analysis, involves estimating the damage, injuries, and costs likely to be incurred in a geographic area over a period of time. Risk has two measurable components: (1) the magnitude of the harm that may result, defined through the vulnerability assessment, and (2) the likelihood or probability of the harm occurring. An example of a product that can assist communities in completing the risk analysis phase is HAZUS, a risk assessment software program for analyzing potential losses from floods, hurricane winds and earthquakes. In HAZUS-MH current scientific and engineering knowledge is coupled with the latest geographic information systems (GIS) technology to produce estimates of hazard-related damage before, or after a disaster occurs.

This three-phase approach to developing a risk assessment should be conducted sequentially because each phase builds upon data from prior phases. However, gathering data for a risk assessment need not occur sequentially.

**Probability and Vulnerability Assessments**

The hazard annexes in Volume II describe each hazard’s probability of future occurrence within Klamath County as well as the county’s overall vulnerability to each hazard. To facilitate connections with the State of Oregon’s Natural Hazards Mitigation Plan, this plan uses the same rating scales as provided within Oregon Emergency Management’s Hazard Analysis
Methodology template, and are listed below. Probability estimates are based on the frequency of previous events, and vulnerability estimates are based on potential impacts of the hazard to Klamath County.

**Probability** scores address the likelihood of a future major emergency or disaster within a specific period of time as follows:

*High* = One incident likely within a 10-35 year period  
*Moderate* = One incident likely within a 35-75 year period  
*Low* = One incident likely within a 75-100 year period

**Vulnerability** scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

*High* = More than 10% affected  
*Moderate* = 1-10% affected  
*Low* = Less than 1% affected

The probability and vulnerability scores in each hazard annex are taken from the 2016 Klamath County Hazard Analysis. Scores were reviewed by the Klamath Steering Committee members during the plan update process.

Hazard scores listed in this plan are based upon an analysis of risk conducted by the Klamath County Emergency Manager. Table I.1.2 below summarizes the hazard probability and vulnerability scores for Klamath County.

**Table I.1.2: Risk Assessment Summary**

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Probability</th>
<th>Vulnerability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Earthquake</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Flood</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Landslide</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>Volcano</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Wildfire</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Winter Storm</td>
<td>High</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

Source: Klamath NHMP Risk Assessment
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Drought
Causes and Characteristics of the Hazard

Drought can be defined in several ways. The American Heritage Dictionary defines drought as "a long period with no rain, especially during a planting season." The National Drought Mitigation Center and the National Center for Atmospheric Research further define the hazard by categorizing it according the “type of drought.” These types include the following:

Meteorological or Climatological Droughts
Meteorological droughts are defined in terms of the departure from a normal precipitation pattern and the duration of the event. These droughts are a slow-onset phenomenon that can take at least three months to develop and may last for several seasons or years.

Agricultural Droughts
Agricultural droughts link the various characteristics of meteorological drought to agricultural impacts. The focus is on precipitation shortages and soil-water deficits. Agricultural drought is largely the result of a deficit of soil moisture. A plant's demand for water is dependent on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil.

Hydrological Droughts
Hydrological droughts refer to deficiencies in surface water and sub-surface water supplies. It is measured as stream flow, and as lake, reservoir, and ground water levels. Hydrological measurements are not the earliest indicators of drought. When precipitation is reduced or deficient over an extended period of time, the shortage will be reflected in declining surface and sub-surface water levels.

Socioeconomic Droughts
Socioeconomic droughts occur when physical water shortage begins to affect people, individually and collectively. Most socioeconomic definitions of drought associate it with supply, demand, and economic good. One could argue that a physical water shortage with no socio-economic impacts is a policy success.

Drought is typically measured in terms of water availability in a defined geographical area. It is common to express drought with a numerical index that ranks severity. The Palmer Drought Severity Index is the most commonly used drought measurement in the state because it incorporates both local conditions and mountain snow pack. The Palmer Drought Severity Index categorizes droughts as mild, moderate, severe, and extreme.
History of the Hazard in Klamath County

Drought is a fairly common occurrence in Klamath County. In 1903, the Reclamation Service (now the Bureau of Reclamation, a branch of the U.S. Department of the Interior) started the Klamath Project. The Klamath Project investigated the possibility of converting rangeland, wetlands, and natural lakes into irrigated farmland. Construction began in 1906, the first water deliveries were made in 1907. The project was completed in 1924. The Bureau of Reclamation supplies water to the farmers at the cost of delivery, without charging for the water. Fodder, barley, oats, potatoes, and wheat are the principal crops on the 225,000 acres of irrigated land. In addition, the irrigation dams control floodwaters.

Droughts are not just a summer-time phenomenon; winter droughts can have a profound impact on the state’s agricultural sector, particularly east of the Cascade Mountains. Below-average snowfall in Oregon’s higher elevations has a far-reaching effect on the entire state, especially in terms of hydroelectric power generation, irrigation, recreation, and industrial uses. Oregon is continuously confronted with drought and water scarcity issues, despite its rainy reputation. These events generally affect areas east of the Cascades and some specific locales across the state. Severe or prolonged drought can impact Oregon’s public health, infrastructure, facilities, economy, and environment.

Drought produces conditions of climatic dryness severe enough to reduce soil moisture and water below the minimum necessary to sustain plant, animal and human life systems. The major effects from drought are: culinary water shortages, increased potential for wild land fires, damage or total loss of crops, civil unrest and economic consequences to all sectors of
historically, Klamath County has declared more disasters for drought than any other Oregon county.

Specific dates of droughts that have impacted Klamath County include:

1904-1905 - A statewide drought period of about 18 months

1917-1931 - A very dry period throughout Oregon, punctuated by brief wet spells in 1920-21 and 1927

1939-1941 - A three-year intense drought in Oregon

1959-1964 - Primarily affected eastern Oregon


2000-2010 - Klamath drought intensifies with legal battles over water rights beginning in 2001. In 2001, the City of Bonanza’s water supply (provided entirely by wells) was contaminated with pesticides, fertilizer, and manure. The water quality was so bad that it was not even safe to bathe in, much less drink. The problem stemmed from a very low water table caused directly by the drought, and indirectly from the increased irrigation from underground aquifers to compensate for the lack of water from Upper Klamath Lake.

2010 - Low snow pack has created low lake levels causing farmers to rely on wells for irrigation lowering ground water levels. The impacts of the lowered ground water levels were felt most acutely in the City of Merrill, which lost water for four days in July 2010 and had to lower the city well pump.

2013 - The state of Oregon adjudicates water rights in Klamath County. The Klamath Tribes rights are established as ‘time immemorial’ giving them considerable influence in water distribution. The State begins enforcing water rights. The town of Malin experiences a cessation of water deliveries in 2013 due to a drop in their well’s water level. The pump was lowered.

2010-2015 - During this period, the Klamath County Commissioners declared a Drought Emergency each year. This opened the door to provide relief to much of the agricultural community.

Risk Assessment

How are Hazard Areas Identified?

Droughts usually occur county-wide. In severe droughts, environmental and economic consequences can be significant, especially for the county’s agriculture sector. The extent of the drought hazard depends on the length of time of the hazard and the local climatic conditions.
Probability of Future Occurrence

The Klamath Steering Committee rated the probability of a drought occurring for the Klamath County as **high**, meaning one incident is likely within a 10-35 year period. The high ranking is consistent with the 2016 Klamath County Hazard Analysis.

Vulnerability Assessment

The effects of drought typically extend across the county. There are a number of community sectors that are vulnerable to drought, and those are further explained in the Community Hazard Issues section below. The Klamath Steering Committee rated the County’s vulnerability to drought as **high** meaning that 10% of the community’s assets or population is likely to be affected by a drought. The high ranking is consistent with the 2016 Klamath County Hazard Analysis.

Risk Analysis

A risk analysis estimating the potential loss of life and property for the drought hazard in Klamath County has not been completed at this time.

Community Hazard Issues

Drought is frequently an "incremental" hazard, meaning the onset and end is often difficult to determine. Also, its effects may accumulate slowly over a considerable period of time and may linger for years after the termination of the event.

Drought can have significant impacts on the county’s agricultural sector which depends on water for irrigation. Over the past 100 years, Klamath County has experienced numerous droughts, greatly impacting both agricultural and rural populations.

Rural populations that depend on well water can also be impacted by droughts. The water table decreases during the months of August to October and is more severe during a dry year. As a result, some rural wells may run dry. Droughts do not typically affect the population centers of the county or their wells, including the City of Klamath Falls, though severe and prolonged droughts may. The economic impacts of a severe drought result in millions of dollars of lost agricultural revenue across the county, which also affects other local businesses.

In addition, drought and water scarcity add another dimension of stress to species listed pursuant to the Endangered Species Act (ESA) of 1973. An example of the tension created by drought and ESA requirements occurred in 2001. After a winter with below-average snowpack and low rainfall, the ensuring extreme drought caused a U.S. District Court to order water deliveries originating from Upper Klamath Lake stopped to protect two endangered species. Klamath County farmers, many of them entirely dependent on irrigation, protested the court’s decision. On July 24, the Department of the Interior approved the release of some irrigation
water from Upper Klamath Lake, but the flow lasted only until August 23. Some fields were saved, but some crops were unsalvageable.

**Existing Hazard Mitigation Activities**

Many rural residents in Klamath County rely on groundwater wells for their water needs. In some years these rural wells have run dry in the late summer months due to low rainfall. The State of Oregon also has a water master that works with residents to coordinate water usage and conservation efforts. Real estate agents may inform new residents about the drought hazard in Klamath County.

The USDA Farm Service currently works with local farmers to develop continuity of operations plans in the event of drought conditions in the county.

**Hazard Mitigation Action Items**

**Drought Action Item #1**: Conduct public outreach campaigns to raise awareness about drought hazards and mitigation actions residents can take to reduce the impact of drought on the county.

**Drought Action Item #2**: Make information regarding droughts available to the public in either electronic or radio formats.

**Drought Action Item #3**: Support local agencies’ training on water conservation measures for farmers and ranchers.
Earthquake
Causes and Characteristics of the Hazard

Seismic events were once thought to pose little or no threat to Oregon communities. However, recent earthquakes and scientific evidence indicate that the risk to people and property is much greater than previously thought. Oregon and the Pacific Northwest in general are susceptible to earthquakes from three sources: 1) the off-shore Cascadia Subduction Zone; 2) deep intra-plate events within the subducting Juan de Fuca Plate; and 3) shallow crustal events within the North American Plate.

While all three types of quakes possess the potential to cause major damage, subduction zone earthquakes pose the greatest danger. The source for such events lies off the Oregon Coast and is known as the Cascadia Subduction Zone (CSZ). A major CSZ event could generate an earthquake with a magnitude of 9.0 or greater resulting in devastating damage and loss of life. The specific hazards associated with an earthquake include the following:

Ground Shaking
Ground shaking is defined as the motion or seismic waves felt on the Earth’s surface caused by an earthquake. Ground shaking is the primary cause of earthquake damage.

Ground Shaking Amplification
Ground shaking amplification refers to the soils and soft sedimentary rocks near the surface that can modify ground shaking from an earthquake. Such factors can increase or decrease the amplification (i.e., strength) as well as the frequency of the shaking.

Surface Faulting
Surface faulting are planes or surfaces in Earth materials along which failure occurs. Such faults can be found deep within the earth or on the surface. Earthquakes occurring from deep lying faults usually create only ground shaking.

Earthquake-Induced Landslides
These landslides are secondary hazards that occur from ground shaking.

Liquefaction
Liquefaction takes place when ground shaking causes granular soils to turn from a solid into a liquid state. This in turn causes soils to lose their strength and their ability to support weight.

Tsunamis
Tsunamis are another secondary earthquake hazard created by events occurring under the ocean. A tsunami, often incorrectly referred to a “tidal wave,” is a series of gravity-induced waves that can travel great distances from the earthquake’s origin and can cause serious flooding and damage to coastal communities. As Klamath County is not near the Pacific Ocean’s coast, this plan will not discuss tsunamis in any more detail.
The severity of an earthquake is dependent upon a number of factors including: 1) the distance from the quake’s source (or epicenter); 2) the ability of the soil and rock to conduct the quake’s seismic energy; 3) the degree (i.e. angle) of slope materials; 4) the composition of slope materials; 5) the magnitude of the earthquake; and 6) the type of earthquake.

History of the Hazard in Klamath County

On September 20, 1993, the Klamath Basin sustained a 6.0 earthquake with an epicenter near the community of Rocky Point, which took two lives and caused considerable damage (excess of $10 million) in downtown Klamath Falls, including the total loss of the county courthouse. A rock fall occurred next to Klamath Lake on Highway 97, which was responsible for one of the lost lives. This is the highest recorded quake in Oregon history since settlement of the state by non-native Americans. Un-reinforced masonry buildings represent the largest vulnerability to another event such as this.

Geologic studies indicate earthquakes have impacted Klamath County in the past. Significant earthquakes that occurred in Oregon are listed in Table EQ 1 below.

Table EQ 1: Significant Earthquakes in Oregon

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Magnitude (M)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/2008</td>
<td>Newport, OR</td>
<td>5.0-5.4</td>
<td>Swarm of earthquakes occurred off the Central Oregon Coast</td>
</tr>
<tr>
<td>8/2004</td>
<td>Newport, OR</td>
<td>4.7</td>
<td>Small earthquake recorded northeast of Newport, no damages.</td>
</tr>
<tr>
<td>7/2004</td>
<td>Newport, OR</td>
<td>4.9</td>
<td>Earthquake recorded southwest of Newport, no damages</td>
</tr>
<tr>
<td>9/1993</td>
<td>Klamath Falls</td>
<td>6.0</td>
<td>Two earthquakes causing two deaths and extensive damage. $10 million in damage to homes, commercial, and government buildings. Crustal event (FEMA-1004-DR-OR)</td>
</tr>
<tr>
<td>3/1993</td>
<td>Scotts Mills</td>
<td>5.6</td>
<td>$28 million in damage. Damage to homes, schools, businesses, state buildings (Salem). Crustal Event (FEMA-985-DR-OR)</td>
</tr>
<tr>
<td>11/1962</td>
<td>Portland</td>
<td>5.2 to 5.5</td>
<td>Damage to many homes (chimneys, windows, etc.). Crustal event</td>
</tr>
<tr>
<td>11/1873</td>
<td>Brookings area</td>
<td>7.3</td>
<td>Chimneys fell at Port Orford, Grants Pass, and Jacksonville. No aftershocks. Origin probably Gorda block of the Juan de Fuca plate. Intraplate event</td>
</tr>
<tr>
<td>1/1700</td>
<td>Offshore (CSZ)</td>
<td>9.0</td>
<td>Catastrophic CSZ earthquake with deadly tsunami</td>
</tr>
</tbody>
</table>
Risk Assessment

How are Hazard Areas Identified?

The earthquake hazard and its effects are prevalent over the entire county. The fault map in Figure EQ 1 below shows the prevalence of subduction zone and crustal event earthquake faults and events near Klamath County.

Figure EQ 1: Klamath County Earthquake and Fault Map

Source: Oregon Department of Geology and Mineral Industries (DOGAMI) HazVu

The extent of the earthquake hazard depends on its magnitude and proximity to Klamath County.

The Cascadia Subduction Zone (illustrated in Figure EQ 2 below,) has the potential to produce an earthquake of magnitude 9.0 or higher. A subduction zone earthquake is a significant threat to Oregon’s coastal communities as they will likely be closer to the epicenter, and will therefore
suffer more shaking and collateral damage. Damage isn’t expected to be as severe in Klamath County.

Figure EQ 2: Cascadia Subduction Zone

![Cascadia Subduction Zone Diagram](image)


**Probability of Future Occurrence**

Scientists estimate the chance in the next 50 years of a large subduction zone earthquake is between 10 and 20 percent, assuming that the recurrence is on the order of 400 +/- 200 years.iii The Klamath Steering Committee rated the probability of a future seismic event for Klamath County as **moderate**, meaning that one incident is likely within a 35-75 year period. The moderate ranking is consistent with the 2016 Klamath County Hazard Analysis.

**Vulnerability Assessment**

The Klamath Steering Committee has identified a number of community assets vulnerable to earthquakes in Klamath County. These vulnerable community assets are detailed in the following two sections: “Risk Analysis” and “Community Hazard Issues.” The Klamath Steering Committee rated Klamath County’s vulnerability to an earthquake as **high** meaning that more than 10% of the community’s assets are likely to be affected by a major emergency or disaster. The high ranking is consistent with the 2016 Klamath County Hazard Analysis.
Risk Analysis

In 1999, the Department of Geology and Mineral Industries (DOGAMI) developed two earthquake loss models for Oregon based on the two most likely sources of seismic events: (1) the Cascadia Subduction Zone (CSZ), and (2) combined crustal events (500-year model). Both models are based on HAZUS, a computerized program, currently used by the Federal Emergency Management Agency (FEMA) as a means of determining potential losses from earthquakes. The CSZ event is based on a potential 8.5 earthquake generated off the Oregon Coast. The 500-Year crustal model does not look at a single earthquake (as in the CSZ model); it encompasses many faults, each with a 10% chance of producing an earthquake in the next 50 years. The model assumes that each fault will produce a single “average” earthquake during this time. Neither model takes unreinforced masonry buildings into consideration.

DOGAMI investigators caution that the models contain a high degree of uncertainty and should be used only for general planning purposes. Despite their limitations, the models do provide some approximate estimates of damage. Results are found in Table EQ 2 below.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$3,134,000</td>
<td>$41,000</td>
<td>$939,000</td>
</tr>
</tbody>
</table>


1...there are numerous un-reinforced masonry structures (URMs) in Oregon, the currently available default building data does not include any URMs. Thus, the reported damage and loss estimates may seriously under-represent the actual threat” (page 126 – 1998, DOGAMI)
Community Hazard Issues

What is susceptible to damage during a hazard event?

In 2007, DOGAMI completed a rapid visual screening (RVS) of educational and emergency facilities in communities across Oregon, as directed by the Oregon Legislature in Senate Bill 2 (2005). RVS is a technique used by the Federal Emergency Management Agency (FEMA), known as FEMA 154, to identify, inventory, and rank buildings that are potentially vulnerable to seismic events. DOGAMI ranked each building surveyed with a ‘low,’ ‘moderate,’ ‘high,’ or ‘very high’ potential of collapse in the event of an earthquake. A ‘very high’ ranked building is has a 100% risk of collapse, a ‘high’ ranked building has a greater than 10% chance, a ‘moderate’ ranked building has a greater than 1% chance of collapse and a ‘low’ ranked building has a 1% chance or less of collapse.

It is important to note that these rankings represent a probability of collapse based on limited observed and analytical data and are therefore approximate rankings. To fully assess a building’s potential of collapse, a more detailed engineering study completed by a qualified professional is required, but the RVS study can help to prioritize which buildings to survey.

DOGAMI surveyed 79 distinct buildings in Klamath County. Some of those structures are part of a larger structure; for example an elementary school and junior high school might be connected into one structure, but are treated in the RVS as two distinct buildings.

The results are summarized below, and ratings for specific buildings can be found in the RVS study on DOGAMI’s website (http://www.oregongeology.org/sub/default.htm). Some buildings identified on DOGAMI’s site are not represented below because they have received earthquake mitigation grant funds to seismically retrofit their facilities, or they have built new facilities between 2011 and present, to include Klamath 911, Klamath Falls Police Department, and Klamath County Fire District 1 Administration Building, or they have been closed. Others are in the process of seismic retrofits, and are indicated as such.

The assessed buildings in Klamath County but outside of the City of Klamath Falls that have a ‘very high’ ranking are:

- Chiloquin Agency Lake Fire District (applying for seismic retrofit grant, 2018)
- Chiloquin High School
- Chiloquin Elementary School

Those Klamath County buildings with a ‘high’ ranking are:

- Bonanza Elementary School
- Bonanza Junior/Senior High School
- Lost River High School
- Gilchrist Elementary School
• Gilchrist Junior/Senior High School
• Malin Elementary School
• Merrill Elementary School
• Harriman RFPD (now Rocky Point Fire and Rescue)

The results for the City of Klamath Falls are summarized below. Again, the ratings for specific buildings can be found in the RVS study on DOGAMI’s website (www.oregongeology.org).

The assessed buildings in the City of Klamath Falls that have a ‘very high’ ranking are:

- Klamath County FD #1 (2342 Gettle St.) (applying for seismic retrofit grant, 2018)
- Roosevelt Elementary School
- Portions of Klamath Union High School (completing seismic retrofit, 2017/2018)
- Mills Elementary School (completed seismic retrofit of gym, 2016)
- Portions of Fairview Elementary School
- Portions of Joseph Conger Elementary School.

Those with a ‘high’ ranking in the City of Klamath Falls are:

- Klamath County FD #1 (1661 Mitchell St.)
- Ferguson Elementary School
- Peterson Elementary School
- Shasta Elementary School
- Stearns Elementary School
- Brixner Junior High School
- Henley Middle School
- Henley High School
- Mazama High School
- Ponderosa Junior High School
Infrastructure

Klamath County’s transportation infrastructure is highly vulnerable to the earthquake hazard. The primary north-south transportation route is US Highway 97. Portions of this route lie directly on fault lines (shown in Figure EQ 1). Any damage to this route will have impacts on Klamath County by limiting access to the county’s largest hospital. Earthquakes in Klamath County may also impact the Union Pacific rail line in Klamath County, the major north-south freight line in Oregon.

Aside from the transportation network, earthquakes could also impact the energy infrastructure of Klamath County. Specifically, the north-south trunk lines for the Bonneville Power Authority and TransCanada’s natural gas line may be impacted.

As shown by the DOGAMI RVS scores, schools are also particularly vulnerable to earthquakes given their older construction methods and use of unreinforced masonry materials. The last infrastructure system of Klamath County that could be impacted is the water and wastewater systems. Any sustained ground shaking could either damage the well fields that supply the City of Klamath Falls with water or the distribution systems that transport water and wastewater.

Populations

School aged children are vulnerable to earthquakes as many of the school buildings themselves have been listed as having high or very high probability of collapse.

The elderly populations, beyond any individual infirmities, are not particularly vulnerable according to the Klamath Steering Committee. This is because most of the extended care and retirement homes are of newer construction. The one exception to this is the Plum Ridge-Crystal Terrace facilities. While neither is especially vulnerable to earthquakes, Crystal Terrace’s power line is fed through the Plum Ridge facility. In short, if a power interruption occurred at the Plum Ridge facility, Crystal Terrace would also be without power.

The only area of highly concentrated non-native English speakers in Klamath County is the Hispanic populations of Merrill and Malin. There have been problems in the past communicating hazard information to these populations during winterstorms.

Economic

The major economic impacts that could result from an earthquake event are disruption of transportation systems or disruption of energy systems. Klamath County will experience economic impacts if goods, services and people are unable to travel or if an earthquake disrupts electrical service to employers.
Also, with the City of Klamath Falls, much of the downtown economic area is comprised of unreinforced masonry buildings. Unreinforced masonry buildings are known to be vulnerable to seismic events.

**Existing Hazard Mitigation Activities**

Klamath County has adopted the 2014 Oregon State Structural Code based on the 2012 International Building Code which includes regulations that address seismic hazards. However, while new buildings currently meet seismic codes, buildings built before 1993 when seismic codes began to be addressed are still vulnerable to earthquakes.

The Klamath County Building Department is responsible for administering the Building Code with the City of Klamath Falls. However, the City of Klamath Falls is responsible for administering and permitting uses and activities unrelated to natural hazard mitigation.

**Hazard Mitigation Action Items**

**Earthquake Action Item #1:** Educate homeowners about structural and non-structural retrofitting of vulnerable homes and encourage retrofit.

**Earthquake Action Item #2:** Alert the owners of the buildings whose probability of collapse in DOGAMI’s rapid visual assessment is “high” or “very high” of their building’s status.

**Earthquake Action Item #3:** Assist K-12 schools, child care facilities and private schools to develop mitigation projects and emergency response plans to improve safety.

**Earthquake Action Item #4:** Encourage participation in the Local Emergency Preparedness Committee for special hazard private facilities such as bulk fuel storage and hazmat facilities.

**Earthquake Action Item #5:** Encourage the purchase of earthquake insurance.
Flood
Causes and Characteristics of the Hazard

The principal types of flood that occur in Klamath County include:

Riverine floods
Riverine floods occur when water levels in rivers and streams overflow their banks. Communities in Klamath County that are located along such water bodies have the potential to experience this type of flooding after spring rains, heavy thunderstorms or rapid runoff from snow melt. Riverine floods can be slow or fast-rising, but usually develop over a period of days.

The danger of riverine flooding occurs mainly during the winter months, with the onset of persistent, heavy rainfall, and during the spring, with melting of snow in the Cascade Range.

Shallow area floods
These floods are a special type of riverine flooding. FEMA defines a shallow area flood hazard as an area that is inundated by a 100-year flood with a flood depth between one to three feet. Such areas are generally flooded by low velocity sheet flows of water.

Urban floods
Urban flooding occurs where land has been converted from fields or woodlands to developed areas consisting of homes, parking lots, and commercial, industrial and public buildings and structures. In such areas the previous ability of water to filter into the ground is often prevented by the extensive impervious surfaces associated with urban development. This in turn results in more water quickly running off into watercourses which causes water levels to rise above pre-development levels. During periods of urban flooding streets can rapidly become swift moving rivers and basements and backyards can quickly fill with water. Storm drains often may back up with yard waste or other flood debris leading to further localized flooding. Another source of urban flooding is grading associated with development. In some cases, such grading can alter changes in drainage direction of water from one property to another.

History of the Hazard in Your Community

December 1964: Severe flooding in Central Oregon, including Klamath County.


December 1996, January 1997: The Sprague River experienced near record levels and flooded over 30 structures between the communities of Beatty, Sprague River, and Chiloquin. FEMA provided mitigation funds to raise many of the structures in the floodplain.

December 2005: Extensive flooding causes $500,000 in damages in Klamath and Lake Counties.
June 2006: A dike on Upper Klamath Lake failed, inundating agricultural fields, the Running Y Resort and portions of State Highway 140.

2009: A dike on Upper Klamath Lake along Lakeshore Drive started leaking and flooding fields, caused by burrowing animals. Klamath County spent $40,000 to strengthen the dike.

February 2017: The Sprague River was forecast to reach above flood stage (8.5 feet) and crested at 9.6 feet, one of the highest levels on record. Some small structures such as greenhouses and animal shelters were inundated, but no homes were affected.

Risk Assessment

How are Hazard Areas Identified?

Flooding sources in Klamath County include the Sprague River, Williamson River, Klamath River, Lost River, Four Mile Creek, Varney Creek, and Upper Klamath Lake. Klamath County’s Flood Insurance Rate Maps are current as of December 12, 1984 and June 5, 1985. Table FL-1 shows that as of December 2016, there were 155 National Flood Insurance Program (NFIP) policies in force with a total value of nearly $30 million. Between 1978 and 2016, the NFIP paid $193,345 in claims. All eight of the claims are closed; one claim in unincorporated Klamath County closed without payment. As of September 2017, Klamath County has zero repetitive flood loss properties. At the time of this NHMP update, Klamath County is undergoing a NFIP rate map update, which will increase the floodplain in some areas and reduce it in others, if finalized. Both the City and the County are NFIP participants. Klamath County enforces floodplain management requirements through Article 59 of its Land Development Code; Klamath Falls similarly uses its Community Development Ordinances, Chapters 12 and 14. Both are audited on a 5 year cycle by the Oregon Dept. of Land Conservation.

Table FL-1: Klamath County NFIP Policy/Claim Summary

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<tr>
<th>Jurisdiction</th>
<th># of Policies</th>
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<th>Claim amount paid</th>
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<td>$1,196,700</td>
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<tr>
<td>Bonanza</td>
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<td>$-</td>
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<td>County Total</td>
<td>119</td>
<td>$22,656,900</td>
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</tbody>
</table>

Source: State NFIP Coordinator 2016

Probability of Future Occurrence

The Klamath Steering Committee rated the probability of a future flood event for Klamath County as moderate, meaning that one incident is likely within a 35-75 year period. Klamath County’s moderate ranking is consistent with the 2016 Klamath County Hazard Analysis.
Vulnerability Assessment

The Klamath Steering Committee rated the vulnerability of a future flood event for Klamath County as **moderate**, meaning that in a flooding event 1-10 percent of the population would be impacted. This is consistent with the **moderate** ranking 2016 Klamath County Hazard Analysis.

Risk Analysis

A risk analysis estimating the potential loss of life and property for the flood hazard in Klamath County has not been completed at this time.

Community Hazard Issues

The watersheds associated with FEMA’s 100 year floodplain that pose risks to some roads and residences include the Williamson, Sprague, Lost, and Klamath Rivers, and Varney/Fourmile Creeks. There are no critical facilities, to include law enforcement and fire/rescue, schools, power generation, or hospitals in the floodplain. The majority of lands affected by these watersheds are agricultural-purposed. The Williamson River affects the City of Chiloquin and some portions of Highway 97N. Historically there have been no major issues with this watershed. The Sprague River affects the communities of Bly, Beatty, Sprague River, and the City of Chiloquin, and also portions of Highway 140E and Sprague River, Ivory Pine and Drews Roads. This watershed frequently reaches minor flood stage (twice per decade) but does not often affect residences or roads (several times per century, average). The Klamath River affects the City of Klamath Falls and the community of Keno, as well as some portions of Highway 97S. It does not affect any critical infrastructure in the City of Klamath Falls, nor any City-owned facilities. The Lost River affects the Cities of Bonanza and Merrill and some portions of Highways 140E and 39. Historically there have been no major issues with this watershed. The Varney and Fourmile Creeks areas near the community of Rocky Point occasionally cause minor flooding in that community in extreme weather conditions. Detailed floodplain maps are available from the Klamath County Planning Department and Emergency Management office.

Existing Hazard Mitigation Activities

Klamath County and the City of Klamath Falls participate in the (NFIP).

Hazard Mitigation Action Items

**Flood Action Item #1:** Continue compliance with NFIP through enforcement of ordinances.

**Flood Action Item #2:** For structures within the 100 year floodplain, explore mitigation options with property owners upon request.

**Action item completed from 2011 iteration of NHMP:** Advocate for FIRM modernization. As is mentioned above, FEMA is currently revising the floodplain maps in Klamath County. The update has been ongoing since 2014; new map publish date has not been released.
Landslide

Causes and Characteristics of the Hazard

Landslides are a major geologic threat in almost every state in the United States. In Oregon, a significant number of locations are at risk from dangerous landslides and debris flows. While not all landslides result in property damage, many landslides do pose serious risk to people and property. Increasing population in Oregon and the resultant growth in home ownership has caused the siting of more development in or near landslide areas. Often these areas are highly desirable owing to their location along the coast, rivers and on hillsides.

Landslides are fairly common, naturally occurring events in various parts of Oregon. In simplest terms, a landslide is any detached mass of soil, rock, or debris that falls, slides or flows down a slope or a stream channel. Landslides are classified according to the type and rate of movement and the type of materials that are transported.

In understanding a landslide, two forces are at work: 1) the driving forces that cause the material to move down slope, and 2) the friction forces and strength of materials that act to retard the movement and stabilize the slope. When the driving forces exceed the resisting forces, a landslide occurs.

Landslides can be grouped as “on-site” and “off-site” hazards. An “on-site” slide is one that occurs on or near a development site and is slow moving. It is slow moving slides that cause the most property damage in urban areas. On-site landslide hazards include features called slumps, earthflows and block slides. “Off-site” slides are typically rapid moving and begin on steep slopes at a distance from homes and development. A 1996 “off-site” slide in southern Oregon began a long distance away from homes and road, traveled at high velocity and killed five people and injured a number of others.

Landslides are classified based on causal factors and conditions and can be grouped into three basic categories.

Falls

This type of landslide involves the movement of rock and soil which detaches from a steep slope or cliff and falls through the air and/or bounces or rolls down slope. This type of slide is termed a rock fall and is very common along Oregon highways where they have been cut through bedrock in steep canyons and along the coast.

Slides

This kind of landslide exists where the slide material moves in contact with the underlying surface. Here the slide moves along a plane and either slumps by moving along a curved surface (called a rotational slide) or along a flat surface (called a translational slide). While slow-moving slides that occur on relatively gentle slopes are less likely to cause serious injuries or fatalities, they can result in very significant property damage.
Flows
In this case the landslide is characterized as plastic or liquid in nature in which the slide material breaks up and flows during movement. This type of landslide occurs when land moves down slope as a semi-fluid mass scouring or partially scouring rock and soils from the slope along its path. A flow landslide is typically rapid moving and tends to increase in volume as it moves down slope and scours out its channel.

Rapidly moving flow landslides are often referred to a debris flows. Other terms given to debris flows are mudslides, mudflows, or debris avalanches. Debris flows frequently take place during or following an intense rainfall on previously saturated soil. Debris flows usually start on steep hillsides as slumps or slides that liquefy, accelerate to speeds as high as 35 miles per hour or more, and travel down slopes and channels onto gentle sloping or flat ground. Most slopes steeper than 70 percent are risk from debris flows.

The consistency of a debris flow ranges from watery mud to thick, rocky, mud-like, wet cement which is dense enough to carry boulders, trees and cars. Separate debris flows from different starting points sometimes combine in canyons and channels where their destructive energy is greatly increased. Debris flows are difficult for people to outrun or escape from and present the greatest risk to human life. Debris flows have caused most of their damage in rural areas and were responsible from most of landslide-related deaths and injuries during the 1996 storm in Oregon.

Conditions Affecting Landslides
Natural conditions and human activities can both play a role in causing landslides. Certain geologic formations are more susceptible to landslides than others. Locations with steep slopes are at the greatest risk of slides. However, the incidence of landslides and their impact on people and property can be accelerated by development. Developers who are uninformed about geologic conditions and processes may create conditions that can increase the risk of or even trigger landslides.

There are four principal factors that affect or increase the likelihood of landslides:

- Natural conditions and processes including the geology of the site, rainfall, wave and water action, seismic tremors and earthquakes and volcanic activity.
- Excavation and grading on sloping ground for homes, roads and other structures.
- Drainage and groundwater alterations that are natural or human-caused can trigger landslides. Human activities that may cause slides include broken or leaking water or sewer lines, water retention facilities, irrigation and stream alterations, ineffective storm water management and excess runoff due to increased impervious surfaces.
- Change or removal of vegetation on very steep slopes due to timber harvesting, land clearing and wildfire.
History of the Hazard in Your Community

Klamath County has not experienced many landslide events that impact the population or economy of the jurisdiction.

A rock fall occurred in conjunction with the 1993 Klamath earthquake along US97, which is detailed below as an area of concern for future hazards. Mitigation was performed by the Oregon Department of Transportation after this rock fall, including fences and nets to prevent falling rocks from blocking the highway.

Risk Assessment

How are Hazard Areas Identified?

Geologic and geographic factors are important in identifying landslide-prone areas. Stream channels, for example, have major influences on landslides, due to undercutting of slopes by stream erosion and long-term hillside processes.

The Oregon Department of Forestry (ODF) Storm Impacts Study conducted after the 1996-97 landslide events found that the highest probability for the initiation of shallow, rapidly moving landslides was on slopes of 70 to 80 percent. A moderate hazard of shallow rapid landslide initiation can exist on slopes between 50 and 70 percent.

In general, areas at risk to landslides have steep slopes (25 percent or greater,) and/or a history of nearby landslides. In otherwise gently sloped areas, landslides can occur along steep river and creek banks, and along ocean bluff faces. At natural slopes under 30 percent, most landslide hazards are related to excavation and drainage practices, or the reactivation of preexisting landslide hazards.

In 2008, the Department of Geology and Mineral Industries (DOGAMI) developed the Statewide Landslide Information Database of Oregon (SLIDO) to improve the understanding of the landslide hazard in Oregon and to create a statewide base level of landslide data. The database includes more than 15,000 landslide and landslide-related features extracted from 257 published and non-published studies. Using this database, DOGAMI developed the interactive SLIDO map. Figures LS 1 and LS 2 from the SLIDO identify documented landslide hazards in Klamath County. The yellow dots near Upper Klamath Lake indicate the area where the 1993 rock fall occurred during the Klamath earthquake, which blocked US97 and killed a passing motorist.
Figure LS 1: Klamath County Landslides (as accessed April 2017)

Source: DOGAMI, Statewide Landslide Information Database Oregon,
The severity or extent of landslides is typically a function of geology and the landslide triggering mechanism. Rainfall initiated landslides tend to be smaller, and earthquake induced landslides may be very large. Even small slides can cause property damage, result in injuries, or take lives.

**Probability of Future Occurrence**

The probability of rapidly moving landslides occurring depends on a number of factors. These factors include steepness of slope, slope materials, local geology, vegetative cover, human activity, and water. There is a strong correlation between intense winter rainstorms and the occurrence of rapidly moving landslides (debris flows).

The Klamath Steering Committee rated Klamath County’s probability of future occurrence to be low. This means that one event is likely every 75-100 years.

**Vulnerability Assessment**

In Klamath County, there is little developed property that is vulnerable to landslides. The greatest impacts could occur to US 97. The Klamath Steering Committee rated the county’s vulnerability to landslides as moderate, meaning that 1% - 10% of the population or regional...
assets will be affected by a landslide event, and this risk rating is mostly due to the affects a landslide could cause to US97.

**Risk Analysis**

A risk analysis estimating the potential loss of life and property for the landslide hazard in Klamath County has not been completed at this time.

**Community Hazard Issues**

Depending upon the type, location, severity and area affected, severe property damage, injuries and loss of life can be caused by landslide hazards. Landslides can damage or temporarily disrupt utility services, roads and other transportation systems and critical lifeline services such as police, fire, medical, utility and communication systems, and emergency response. In addition to the immediate damage and loss of services, serious disruption of roads, infrastructure and critical facilities and services may also have longer term impacts on the economy of the community and surrounding area.

The areas across Klamath County at risk to landslides are highlighted by the SLIDO map above. Of concern are landslides that might impact US97 as it is the major north-south transportation route in the county. A long-duration closure of this highway may result in economic impacts to county and City. There are no identified landslide areas affecting any populated area, to include the City of Klamath Falls. No major impacts are expected outside of potential road closures.

The following factors increase the likelihood that landslides will occur:

- Improper excavation practices, sometimes aggravated by drainage issues, can reduce the stability of otherwise stable slopes.
- Allowing development on or adjacent to existing landslides or known landslide-prone areas raises the risk of future slides regardless of excavation and drainage practices. Homeowners and developers should understand that in many potential landslide settings that there are no development practices that can completely assure slope stability from future slide events.
- Buildings on fairly gentle slopes can still be subject to landslides that begin a long distance away from the development. Sites at greatest risk are those situated against the base of very steep slopes, in confined stream channels (small canyons), and on fans (rises) at the mouth of these confined channels. Home siting practices do not cause these landslides, but rather put residents and property at risk of landslide impacts. In these cases, the simplest way to avoid such potential effects is to locate development out of the impact area, or construct debris flow diversions for the structures that are at risk.
- Certain forest practices can contribute to increased risk of landslides. Forest practices may alter the physical landscape and its vegetation, which can affect the stability of steep slopes. Physical alterations can include slope steepening, slope-water effects, and changes in soil strength. Of all forest management activities, roads have the greatest
effects on slope stability and can increase erosion on slopes. However, recent changes in road construction and maintenance practices are reducing the negative effects of roads on slope stability.

**Existing Hazard Mitigation Activities**

Klamath County’s development and zoning regulations contain regulations regarding development on steep slopes, which help mitigate long-term vulnerability to the hazard. Specifically:

- Section J104.3: A soils report prepared by registered design professionals shall be provided which shall identify the nature and distribution of existing soils; conclusions and recommendations for grading procedures; soil design criteria for any structures or embankments required to accomplish the proposed grading; and, where necessary slope stability studies and recommendations and conclusions regarding site geology.

Also the code designates that no excavation or fill slope can exceed a 50 percent grade.

**Hazard Mitigation Action Items**

**Landslide Action Item #1:** Consider adoption of a Klamath County hillside development ordinance with the intent of monitoring and regulating grading, excavation, development and cut and fill activities on steep or unstead slopes.

**Landslide Action Item #2:** Educate homeowners in areas vulnerable to landslides of their risk.

**Action item completed from 2011 iteration of NHMP:** Develop a GIS data layer that identifies areas of probably landslides. As is shown in the DOGAMI SLIDO maps in the landslide hazards section above, DOGAMI completed this action for us.
Volcano
Causes and Characteristics of the Hazard

The Cascades, which run from British Columbia through Washington and Oregon into northern California, contain more than a dozen major volcanoes and hundreds of smaller volcanic features. In the past 200 years, seven of the Cascade volcanoes in the United States have erupted: Mt. Baker, Glacier Peak, Mt. Rainier, Mount St. Helens, Mt. Hood, Mt. Shasta, and Mt. Lassen.

Over the past 4000 years in Oregon there have been three eruptions of Mt. Hood, four eruptions in the Three Sisters area, and two eruptions in the Newberry Volcano area and minor eruptions near Mt. Jefferson, at Blue Lake Crater in the Sand Mountain Field (Santiam Pass), near Mt. Washington and near Belknap Crater. During this time period, the most active volcano in the Cascades has been Mount St. Helens with about 14 eruptions.

The numerous volcanoes of the Cascades differ markedly in their geological characteristics. The largest volcanoes are generally what geologists call composite or stratovolcanoes. These volcanoes may be active for tens of thousands of years to hundreds of thousands of years. In some cases, these large volcanoes may have explosive eruptions such as Mt. St. Helens in 1980 or Crater Lake about 7,700 years ago. The much more numerous sites of volcanic activity are generally what geologists call mafic volcanoes. This type of volcano is typically active for much shorter time periods, up to a few hundred years, and generally forms small craters or cones. Mafic volcanoes are not subject to large explosive events. Prominent mafic volcanoes include North Sister, Mount Bachelor, Belknap Crater, Black Butte, and Mount Washington. Mafic volcanoes often form broad fields of volcanic vents such as in the Sand Mountain Field near the Santiam Pass, north of the Three Sisters.

The existence, position and recurrent activity of Cascades volcanoes are generally thought to be related to the convergence of shifting crustal plates. As population increases in the Pacific Northwest, areas near volcanoes are being developed and recreational usage is expanding. As a result more and more people and property are at risk from volcanic activity.

Volcanic eruptions often involve several distinct types of hazards to people and property, as well evidenced by the Mount St. Helens eruption. Major volcanic hazards include: lava flows, blast effects, pyroclastic flows, ash flows, lahars, and landslides or debris flows.

Some of these hazards (e.g. lava flows) only affect areas very near the volcano. Other hazards may affect areas 10 or 20 miles away from the volcano, while ash falls may affect areas many miles downwind of the eruption site.

**Lava flows** are eruptions of molten rock. Lava flows for the major Cascades volcanoes tend to be thick and viscous, forming cones and thus typically affecting areas only very near the
eruption vent. However, flows from the smaller mafic volcanoes may be less viscous flows that spread out over wider areas. Lava flows obviously destroy everything in their path.

**Blast effects** may occur with violent eruptions, such as Mount St. Helens in 1980. Most volcanic blasts are largely upwards. However, the Mount St. Helens blast was lateral, with impacts 17 miles from the volcano. Similar or larger blast zones are possible in future eruptions of any of the major Cascades volcanoes.

**Pyroclastic flows** are high-speed avalanches of hot ash, rock fragments and gases. Pyroclastic flows can be as hot as 1500 °F and move downslope at 100 to 150 miles per hour. Pyroclastic flows are extremely deadly for anyone caught in their path.

**Ash falls** result when explosive eruptions blast rock fragments into the air. Such blasts may include tephra (solid and molten rock fragments). The largest rock fragments (sometimes called “bombs”) generally fall within two miles of the eruption vent. Smaller ash fragments (less than about 0.1”) typically rise into the area forming a huge eruption column. In very large eruptions, ash falls may total many feet in depth near the vent and extent for hundreds or even thousands of miles downwind.

**Lahars** or mudflows are common during eruptions of volcanoes with heavy loading of ice and snow. These flows of mud, rock and water can rush down channels at 20 to 40 miles an hour and can extend for more than 50 miles. For some volcanoes, lahars are a major hazard because highly populated areas are built on lahar flows from previous eruptions.

**Landslides or debris flows** are the rapid downslope movement of rocky material, snow and/or ice. Volcano landslides can range from small movements of loose debris to massive collapses of the entire summit or sides of a volcano. Landslides on volcanic slopes may be triggered by eruptions or by earthquakes or simply by heavy rainfall.

**History of the Hazard**

The history of volcanic activity in the Cascades is contained in its geologic record and the age of the volcanoes vary considerably. Figure V.1 below shows the history of volcanic events in the Cascades.
Figure V.1: Historic Cascade Eruptions

Cascade Eruptions During The Past 4,000 Years


In Oregon, awareness of the potential for volcanic eruptions was greatly increased by the May 18, 1980 eruption of nearby Mount St. Helens in Washington which killed 57 people. In this eruption, lateral blast effects covered 230 square miles and reached 17 miles northwest of the crater, pyroclastic flows covered six square miles and reached 5 miles north of the crater, and landslides covered 23 square miles. Ash accumulations were about 10 inches at 10 miles downwind, 1 inch at 60 miles downwind, and ½ inch at 300 miles downwind. Lahars (mudflows) affected the North and South Forks of the Toutle River, the Green River, and ultimately the Columbia River as far as 70 miles from the volcano.

Risk Assessment

How are Hazard Areas Identified?

To identify the areas that are likely to be affected by future events, pre-historic rock deposits are mapped and studied to learn about the types and frequency of past eruptions at each volcano. This information helps scientists to better anticipate future activity at a volcano, and provides a basis for preparing for the effects of future eruptions through emergency planning.

Scientists also use wind direction to predict areas that might be affected by volcanic ash. During an eruption that emits ash, the ashfall deposition is controlled by the prevailing wind.
direction. The predominant wind pattern over the Cascades is from the west, and previous eruptions seen in the geologic record have resulted in most ashfall drifting to the east. The potential and geographical extent of volcanic ashfall from Mt. Hood and Mt. St. Helens are depicted in Figures V.2 and V.3, respectively.

**Figure V.2:** Map showing annual probability of ~4 inches or more tephra accumulation in Oregon and Washington from eruptions throughout the Cascade Range.

**Figure V.3:** Map of Washington and Oregon showing the percentage probability of accumulation of four or more inches of tephra from Mount St. Helens.

Source: USGS
Several of the 20 active volcanoes in Oregon are located along the crest of the Cascades near Klamath County. These volcanoes include the Three Sisters, Mt. Bachelor and the Davis Lake volcanic field. Other relatively nearby active volcanoes include: Mt. Jefferson, Blue Lake Crater, Mt. Washington, the Belknap Crater field, and the Sand Mountain field. Some of the more prominent active volcanoes and their potential impacts on the region are described below in Table V.1.

**Table V.1: Prominent Cascade Volcanoes**

<table>
<thead>
<tr>
<th>NAME</th>
<th>ELEVATION</th>
<th>TYPE</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Jefferson</td>
<td>10,495 ft.</td>
<td>Composite</td>
<td>Capable of large explosive eruptions. Not extinct. Partly on Warm Springs Reservation. Lahar inundation zones on Shitike Creek; Warm Springs settlement endangered. Lahars could enter Lake Billy Chinook via the White River, overtop dam and create damage below. (USGS OFR 99-24)</td>
</tr>
<tr>
<td>Mt. Washington</td>
<td>7,796 ft.</td>
<td>Mafic volcano</td>
<td>Popular recreation area. Information on Mt. Washington is very limited. Best source: USGS Cascade Volcano Observatory (CVO) web sites. No report on potential hazards. Mafic volcanoes are less explosive than composite volcanoes.</td>
</tr>
<tr>
<td>North Sister</td>
<td>10,085 ft.</td>
<td>Mafic volcano</td>
<td>May erupt explosively in the future (USGS OFR 99-437)</td>
</tr>
<tr>
<td>Middle Sister</td>
<td>10,047 ft.</td>
<td>Composite volcano</td>
<td>May erupt explosively in the future (USGS OFR 99-437)</td>
</tr>
<tr>
<td>South Sister</td>
<td>10,358 ft.</td>
<td>Composite volcano</td>
<td>May erupt explosively in the future. Carver Lake on mountain is formed by a natural debris dam. Dam failure, for any reason, could send flood water down Squaw Creek toward City of Sisters (Ref. USGS OFR 87-41 and Deschutes Co. Flood Insurance Study). In addition, the McKenzie River Channel could be impacted by sediment filling the channel, increasing turbidity in the McKenzie River. (USGS OFR 99-437) Recent uplift detected near the South Sister (about 1 in./yr), but no indication of pending eruption.</td>
</tr>
<tr>
<td>Broken Top</td>
<td>9,152 ft.</td>
<td>Composite volcano</td>
<td>Popular hiking destination; Source of Bend water supply</td>
</tr>
<tr>
<td>Mt. Bachelor</td>
<td>9,065 ft.</td>
<td>Mafic volcano</td>
<td>All-season recreation area. Mt. Bachelor ski resort.</td>
</tr>
<tr>
<td>Mt. Thielsen</td>
<td>9,187 ft.</td>
<td>Basalt/andesite Shield volcano</td>
<td>Popular hiking / climbing destination</td>
</tr>
<tr>
<td>Crater Lake (Mt. Mazama)</td>
<td>8,926 ft. (Mt. Scott)</td>
<td>Overlapping shield and composite volcanoes</td>
<td>Popular destination.</td>
</tr>
<tr>
<td>Mt. McLaughlin</td>
<td>9,496 ft.</td>
<td>Mafic volcano</td>
<td>Less explosive than composite volcanoes</td>
</tr>
</tbody>
</table>

Source: USGS Cascades Volcano Observatory.
The active volcanoes that pose the most threat to Klamath County are Mt. Thielsen, Crater Lake and Mt. McLaughlin. This distance is large enough that the populated areas of Klamath County are unlikely to experience lava flow, pyroclastic flows, or debris flows/avalanches from an eruption in the any one of these three volcanoes.

Ash fall could also extend to impact Klamath County. In all but the most extreme events (those not involving the three volcanoes listed above), ash falls are likely to be very minor with an inch or less of ash likely. There is also a possibility that a major eruption in the Cascades could affect public water supplies via heavy ash falls or lahars into streams/rivers upstream from irrigation supply intakes.

**Probability of Future Occurrence**

Given the presence but relative inactivity of active volcanoes in the Cascades that could impact the Klamath County, the Klamath Steering Committee estimated the probability of a new volcanic event occurring as **low** for both the county and city. A low rating means that one incident is likely within a 75 to 100 year period.

**Vulnerability Assessment**

The Klamath Steering Committee ranked the vulnerability of Klamath County to a volcanic event as **high**. This ranking indicates that more than 10% of the population would be impacted in a volcanic event.

**Risk Analysis**

Specific estimates for life and property losses due to a volcanic event are not available at this time.

**Community Hazard Issues**

Volcanic eruptions can have significant impacts for Klamath County. Volcanic events in the Three Sisters area, the McKenzie Pass area or in the Santiam Pass area could temporarily close some highways thus affecting transportation to/from the Willamette Valley area and Central Oregon.

**Lahars**

Flooding can be caused by lahars, or mudflows consisting of mud, rock and water that follow a volcanic eruption. Lahars can occur during an eruption and when a volcano is quiet. The water that creates lahars can come from melting snow and ice (especially water from a glacier melted by a pyroclastic flow or surge), intense rainfall, or the breakout of a summit crater lake. Some lahars contain so much rock debris (60 to 90% by weight) that they look like fast-moving rivers of wet concrete. Historically, lahars have been one of the deadliest volcano hazards. Close to their source, these flows are powerful enough to rip up and carry trees, houses and huge
boulders miles downstream. Farther downstream they can entomb in mud everything in their path. Large lahars are a potential hazard to many communities downstream from glacier-clad volcanoes.

**Ash Fall**

An explosive eruption blasts solid and molten rock fragments called tephra and volcanic gases into the air with tremendous force. The largest rock fragments called bombs usually fall back to the ground within two miles of the vent. Small fragments (less than 0.1 inch across) of volcanic glass, mineral and rock (ash) rise high into the air forming a huge, billowing eruption column. Eruption columns creating an eruption cloud can grow rapidly and reach more than 12 miles above a volcano in less than 30 minutes. Volcanic ash clouds can pose serious hazards to aviation. Several commercial jets have nearly crashed because of engine failure from inadvertently flying into ash clouds.

Large eruption clouds can extend hundreds of miles downwind resulting in ash fall over enormous areas. Ash from the May 18, 1980 Mt. St. Helens eruption fell over an area of 22,000 square miles in the western U.S. Heavy ash fall, particularly when mixed with rain, can collapse buildings and even a minor ash fall can damage crops, electronics and machinery. Ash fall additionally hurts tourist-reliant businesses and logging operations, and can damage fish populations and vulnerable plant life. Ash fall could also degrade water quality in Upper Klamath Lake impacting that irrigation water source.

**Existing Hazard Mitigation Activities**

Given the uncertainty of what would be damaged and the high cost of mitigation actions, no volcano-specific mitigation actions are being taken at this time.

**Hazard Mitigation Action Items**

**Volcano Action Item #1:** Educate Klamath County and Klamath Falls residents about the respiratory dangers of ash fall events after a volcanic eruption.
Wildfire

Communities in Klamath County, including the City of Klamath Falls, adhere to the strategies outlined in the Klamath County Community Wildfire Protection Plan (CWPP) for mitigating the wildfire risk to wildland-urban interface areas.

Areas in Klamath County at risk to wildfire are identified on pages 23 and 58 of the CWPP, and a relative risk rating for each area is on page 35. In addition to those areas listed in the CWPP, the City of Klamath Falls considers the neighborhoods of Lakeshore and Moore Park, North Hills, and Hot Springs to have a relative higher risk to wildfire than others inside the city limits because of their proximity in the wildland-urban interface. These areas are identified as the yellow-shaded moderate-risk areas surrounding Klamath Falls on the map on page 58.

See the Klamath County Community Wildfire Protection Plan, 2016 update.

https://www.klamathcounty.org/DocumentCenter/View/957
Winter Storm

Causes and Characteristics of the Hazard

Winter storms affecting Klamath County are characterized by a combination of heavy rains and high winds. Heavy rains can result in flooding, as well as debris slides and landslides. High winds commonly result in tree falls which primarily affect the electric power system, but which may also affect buildings and vehicles. Klamath County is also subject to snowfall events with or without accompanying high winds (blizzard conditions). Road closures can be expected with some individuals and even communities being isolated for hours or even days. This chapter deals primarily with the rain and wind effects of winter storms.

Larger scale flooding is addressed in the Flood Annex. Debris flows and landslides are addressed in the Landslide Annex.

A windstorm is generally a short duration event involving straight-line winds and/or gusts in excess of 50 mph. Although windstorms can affect all of Klamath County, they are especially dangerous in developed areas such as the City of Klamath Falls with significant tree stands and major infrastructure, especially above ground utility lines. A windstorm will frequently knock down trees and power lines, damage homes, businesses, public facilities, and create tons of storm related debris.

The Columbus Day storm in 1962 was the most destructive windstorm ever recorded in Oregon in terms of both loss of life and property. Damage from this event was the greatest in the Willamette Valley. The storm killed 38 people and left over $200 million in damage. Hundreds of thousands of homes were without power for short periods, while others were without power for two to three weeks. More than 50,000 homes suffered some damage and nearly 100 were destroyed. Entire fruit and nut orchards were destroyed and livestock killed as barns collapsed and trees blew over. In Portland, the highest gusts were 116 miles per hour.

History of the Hazard

The following list describes the history of wind storms in Klamath County:

**Dec. 1861** - Storm over the entire state produced between 1 and 3 feet of snow.

**Jan. 1916** - Two storms over the state produce heavy snowfall, especially in mountainous areas.

**Jan. 1950** - Record snowfalls and property damage throughout state.


**Feb. 1986** - Heavy snow in and around the Deschutes Basin. Traffic accidents; broken power lines.

**Nov. 1993** - Heavy snow throughout the Cascade Mountains.
Mar. 1994 - Heavy snow throughout the Cascade Mountains.

Winter 1998-99 - One of the snowiest winters in Oregon history (Snowfall at Crater Lake: 586 inches).

2008 - Heavy snow in Klamath County. Removal costs for Klamath Falls exceeded $200,000.

**How are Hazard Areas Identified?**

Klamath County is vulnerable to winter storms. The extent of the hazard is due to a multitude of variables, such as wind speed, precipitation, direction, and temperature.

**Probability of Future Occurrence**

The Klamath Steering Committee has ranked the probability of winter storms for Klamath County as **high**. This ranking indicates that one event is likely over the next 10-35 years. This ranking is consistent with the one found in the 2016 Klamath County Hazard Analysis.

**Vulnerability Assessment**

The Klamath Steering Committee rated the county’s vulnerability to winter storms as **high**, meaning that more than 10% of the population or would be affected. The high ranking is consistent with the 2016 Klamath County Hazard Analysis.

**Risk Analysis**

A risk analysis estimating the potential loss of life and property for the winter storm hazard in Klamath County has not been completed at this time. Currently data does not allow for specific estimates of life and property losses during a given scenario.

**Community Hazard Issues**

**What is susceptible to damage during a hazard event?**

Severe winter weather can be a deceptive killer. Winter storms which bring snow, ice and high winds can cause significant impacts on life and property. Many winter storm deaths occur as a result of traffic accidents on icy roads, heart attacks when shoveling snow, and hypothermia from prolonged exposure to the cold. The temporary loss of home heating can be particularly hard on the elderly, young children and other vulnerable individuals. Property is at risk due to flooding and landslides that may result if there is a heavy snowmelt. Additionally, ice, wind and snow can affect the stability of trees, power and telephone lines and TV and radio antennas. Down trees and limbs can become major hazards for houses, cars, utilities and other property. Such damage in turn can become major obstacles to providing critical emergency response, police, fire and other disaster recovery services. Winter storms can result in collapsed or damaged buildings, damaged or blocked roads and bridges, damaged traffic signals, streetlights, and parks, among others. Roads blocked by fallen trees during a winter storm
may have severe consequences to people who need access to emergency services. Emergency response operations can be complicated when roads are blocked or when power supplies are interrupted.

Historically, falling trees have been the major cause of power outages in winter storms. Windstorms can cause flying debris which can also damage utility lines. Overhead power lines can be damaged even in relatively minor windstorm events.

Industry and commerce can suffer losses from interruptions in electric service and from extended road closures. They can also sustain direct losses to buildings, personnel, and other vital equipment. There are direct consequences to the local economy resulting from winter storms related to both physical damages and interrupted services.

**Existing Hazard Mitigation Activities**

The Oregon Building Code sets standards for structures to withstand 80 mph winds, with additional requirements addressing high exposure areas.

**Hazard Mitigation Action Items**

**Winter Storm Action Item #1:** Develop and implement programs to keep trees from threatening lives, property, and public infrastructure as a result of severe weather events.

**Winter Storm Action Item #2:** Educate property owners on how to properly maintain trees to prevent power loss on power lines off the right of way.

**Winter Storm Action Item #3:** Encourage upgrading lines and poles to improve wind/ice loading, undergrounding critical lines, and adding interconnect switches to allow alternative feed paths and disconnect switches to minimize outage areas.
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Appendix A: Action Item Forms
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Multi Hazard #1 – Develop NHMP

<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Alignment with Plan Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop Klamath NHMP Steering Committee to oversee the Klamath NHMP implementation.</td>
<td>Goals 1, 2, 3, 4, 5, 6</td>
</tr>
</tbody>
</table>

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

It is important to provide an avenue to implement Action Items identified in the hazard mitigation planning process.

The Disaster Mitigation Act of 2000 requires communities to identify how the community will continue to involve the public in the plan maintenance process [201.6(c)(4)(iii)]. The Klamath NHMP Steering Committee is one way the community can stay involved with the plan.

Ideas for Implementation:

Use the NHMP Klamath Steering Committee’s expertise in semi-annual meetings to review and update as necessary the Klamath NHMP.

The Klamath Emergency Management Council was recently set up. This organization will function as the coordinating body for this plan.

Coordinating Organization: Klamath Emergency Management

<table>
<thead>
<tr>
<th>Internal Partners:</th>
<th>External Partners:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Management Council</td>
<td></td>
</tr>
</tbody>
</table>

Potential Funding Sources: N/A, course of normal duties and no costs associated

Estimated cost: N/A

Timeline: Ongoing

Form Submitted by: Klamath County

Action Item Status: Revised and updated (2017); roll-over from 2011
### Drought #1 – Conduct Public Outreach

**Proposed Action Item:**

Conduct public outreach campaigns to raise awareness about drought hazards and mitigation actions residents can take to reduce the impact of drought on the county.

**Alignment with Plan Goals:**

Goal 2, Goal 3

**Alignment with Existing Plans/Policies:**

**Rationale for Proposed Action Item:**

Drought is a frequent problem in Klamath County, and residents should be informed about the risks that drought poses to their homes, such as the increase in wildland fire risk. In addition, homeowners should be aware of controlling water use during drought conditions to conserve water.

The Disaster Mitigation Act of 2000 requires communities to identify comprehensive actions and projects that reduce the effects of a hazard on the community [201.6(c)(3)(ii)], such as actions protecting natural resources. Conducting public outreach campaigns that raise awareness about drought hazards and mitigation actions they can implement can significantly reduce the impact of drought on Klamath County.

**Ideas for Implementation:**

Conduct an outreach program to inform residents of the drought status in their community, the importance of conserving water in drought periods, and strategies residents can use to limit water usage.

Develop an education outreach program to encourage homeowners to install water-efficient devices in their homes.

Use existing websites to post multi-lingual advertisements to inform residents about measures they can take to mitigate against drought.

Develop wasteful water ordinances to minimize water waste in drought conditions.

**Coordinating Organization:** Klamath Emergency Management

<table>
<thead>
<tr>
<th>Internal Partners</th>
<th>External Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Management Council, Planning Department, Water Resources Board</td>
<td>Pacific Power and Light, Water Master, Extension Service Department, BOR</td>
</tr>
</tbody>
</table>

**Potential Funding Sources:**

N/A, course of normal duties and no costs associated

**Estimated**

N/A

**Timeline:**

Ongoing

**Form Submitted by:** Klamath County

**Action Item Status:** Revised and updated (2017); roll-over from 2011
## Drought #2 – Information Availability (electronic/radio)

<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Make information regarding droughts available to the public in either electronic or radio formats.</th>
<th>Alignment with Plan Goals:</th>
<th>Goal 2</th>
</tr>
</thead>
</table>

### Alignment with Existing Plans/Policies:

### Rationale for Proposed Action Item:
Drought situations increase the risk of fire hazards. Drought situations cause visibility hazards.

Drought situations cause critical water shortages for humans, animals and vegetation.

The Disaster Mitigation Act of 2000 requires communities to identify comprehensive actions and projects that reduce the effects of a hazard on the community [201.6(c)(3)(ii)]. Agriculture is an economic driver in Klamath County and drought can negatively impact agriculture.

### Ideas for Implementation:
Add items to new Emergency Management website that can hold drought information including:

- Current Drought Status
- What Homeowners can Do
- Water Efficient Tips

### Coordinating Organization:
Klamath Emergency Management

<table>
<thead>
<tr>
<th>Internal Partners:</th>
<th>Emergency Management Council</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Partners:</td>
<td>Local Media</td>
</tr>
</tbody>
</table>

### Potential Funding Sources:
N/A, course of normal duties and no costs associated

### Estimated cost:
N/A

### Timeline:
Ongoing

### Form Submitted by:
Klamath County

### Action Item Status:
Revised and updated (2017); roll-over from 2011
### Drought #3 – Support training for farmers/ranchers

<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Alignment with Plan Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support local agencies’ training on water conservation measures for farmers and ranchers.</td>
<td>Goal 2, Goal 4</td>
</tr>
</tbody>
</table>

### Alignment with Existing Plans/Policies:

### Rationale for Proposed Action Item:
Klamath County has been experiencing drought conditions on and off for many years. By supporting local agencies’ training and education efforts, some effects of the drought can be mitigated.

The Disaster Mitigation Act of 2000 requires communities to identify comprehensive actions and projects that reduce the effects of a hazard on the community [201.6(c)(3)(ii)]. Agriculture is an economic driver in Klamath County and drought can negatively impact agriculture.

### Ideas for Implementation:
Partner with local agencies on publicizing training or education events.

Have a member of the Klamath Steering Committee attend training events to discuss the Klamath NHMP.

### Coordinating Organization:
Klamath Emergency Management

<table>
<thead>
<tr>
<th>Internal Partners:</th>
<th>External Partners:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Management Council</td>
<td>Bureau of Reclamation, USDA Farm Service Agency, County Extension Department</td>
</tr>
</tbody>
</table>

### Potential Funding Sources:
N/A, course of normal duties and no costs associated

### Estimated cost:
N/A

### Timeline:
Ongoing

### Form Submitted by:
Klamath County

### Action Item Status:
Revised and updated (2017); roll-over from 2011
### Earthquake #1 - Educate Homeowners

<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Alignment with Plan Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educate homeowners about structural and non-structural retrofitting of vulnerable homes and encourage retrofit.</td>
<td>Goal 1, Goal 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alignment with Existing Plans/Policies:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rationale for Proposed Action Item:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Klamath NHMP indicates that the vulnerability for Klamath County is high. Increasing public outreach to educate residents about retrofitting homes and structures can help mitigate the area’s vulnerability to future earthquakes.</td>
</tr>
</tbody>
</table>

The Disaster Mitigation Act of 2000 requires communities to identify how the community will continue to involve the public in the plan maintenance process [201.6(c)(4)(iii)]. Educating the public helps keep the public informed of what is being done with the plan, how Klamath County is working to mitigate its risk to hazards, and allows for feedback and suggestions from the public for improving, updating, and maintaining the plan.

<table>
<thead>
<tr>
<th>Ideas for Implementation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop dissemination methods for structural and non-structural earthquake retrofitting to homeowners that would likely include:</td>
</tr>
</tbody>
</table>

New Emergency Management Website; Television public service announcements; Newspaper inserts/spots Distribute Institute for Business and Home Safety Homeowner Retrofit Guides when requested.

<table>
<thead>
<tr>
<th>Coordinating Organization:</th>
<th>Klamath Emergency Management</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Internal Partners:</th>
<th>External Partners:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Management Council</td>
<td>USGS, DOGAMI, FEMA OEM, Homebuilders Association, County and City Planning Depts.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potential Funding Sources:</th>
<th>Estimated cost:</th>
<th>Timeline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A, course of normal duties and no costs associated</td>
<td>N/A</td>
<td>Ongoing</td>
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</table>

<table>
<thead>
<tr>
<th>Form Submitted by:</th>
<th>Klamath County</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Action Item Status:</th>
<th>Revised and updated (2017); roll-over from 2011</th>
</tr>
</thead>
</table>
### Earthquake #2 – Advise Owners of High Risk Structures

<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Alignment with Plan Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alert the owners of the buildings whose probability of collapse in DOGAMI’s rapid visual assessment is “high” or “very high” of their building’s status.</td>
<td>Goal 1, Goal 2</td>
</tr>
</tbody>
</table>

### Rationale for Proposed Action Item:

In 2007 DOGAMI completed a Statewide Seismic Needs Assessment that used Rapid Visual Screening (RVS) to assess the seismic risk, also known as collapse potential, of schools, hospitals, and critical facilities such as police and fire stations in the state of Oregon. The RVS assessment is based on the maximum considered earthquake for the location being assessed, and rates buildings by a Very High, High, Moderate, or Low seismic risk. The Seismic Needs Assessment assessed that a total of 79 buildings in Klamath County had a ‘moderate,’ ‘high’ or ‘very high’ risk of collapse. The full data set can be found here: [http://www.oregongeology.com/sub/projects/rvs/SSNA-abridged-data.pdf](http://www.oregongeology.com/sub/projects/rvs/SSNA-abridged-data.pdf)

The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Assessing the “probability of collapse” for buildings surveyed by DOGAMI and seismically retrofitting them will reduce their vulnerability by preventing damage to life and property.

### Ideas for Implementation:

Prioritize buildings for seismic retrofit and coordinate with OEM seismic grants coordinator to apply for funding.

Write a letter of notice to those buildings on DOGAMI’s RVS list that have a ‘high’ or ‘very high’ rating alerting them of this fact.

### Coordinating Organization:

Klamath Emergency Management

### Internal Partners:

Emergency Management Council

### External Partners:

School Districts, OIT Engineering, City & County Planning Depts.

### Potential Funding Sources:

N/A, course of normal duties and very low costs associated

### Estimated cost:

>$100 for letters/postage

### Timeline:

Ongoing

### Form Submitted by:

Klamath County

### Action Item Status:

Revised and updated (2017); roll-over from 2011
**Earthquake #3 – Develop Mitigation Projects (Schools)**

<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Alignment with Plan Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assist K-12 schools, child care facilities and private schools to develop mitigation projects and emergency response plans to improve safety.</td>
<td><em>Goal 1, Goal 5</em></td>
</tr>
</tbody>
</table>

**Alignment with Existing Plans/Policies:**

**Rationale for Proposed Action Item:**
Assisting schools and childcare facilities to develop vulnerability assessments and mitigation projects can improve the safety of citizens in Klamath County and mitigate the affect that natural hazards have on the area’s assets and critical infrastructure. Such activities can assist in reducing the area’s overall earthquake risk.

The Disaster Mitigation Act of 2000 requires communities to assess their vulnerability to natural hazards, particularly by identifying the types and number of buildings, infrastructure, and critical facilities that could be affected [201.6(c)(2)(ii)(A)].

**Ideas for Implementation:**
Develop a list of all K-12 schools, childcare facilities, and other schools within Klamath County. Use vulnerability assessments to identify mitigation projects.

Provide resources from FEMA and Red Cross on developing emergency response plans for schools.

**Coordinating Organization:** Klamath Emergency Management

**Internal Partners:** Emergency Management Council

**External Partners:** School Safety Officers, Principals and Risk Management

**Potential Funding Sources:** N/A, course of normal duties and no costs associated

**Estimated cost:** N/A  

**Timeline:** Ongoing

**Form Submitted by:** Klamath County

**Action Item Status:** Revised and updated (2017); roll-over from 2011
Earthquake #4 – Encourage LEPC Participation

<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Alignment with Plan Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encourage participation in the Local Emergency Preparedness Committee for special hazard private facilities such as bulk fuel storage and hazmat facilities</td>
<td>Goal 5</td>
</tr>
</tbody>
</table>

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:
Conducting a benefit-cost analysis is the first step toward FEMA-funding of mitigation projects and can help determine whether a project is financially beneficial to implement. However, these analyses are often costly and can only be conducted if funding is present.

The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(ii)]. Identifying critical and essential facilities for seismic retrofit will help to identify major seismic issues and appropriate mitigation actions to protect critical and essential facilities.

Ideas for Implementation:
Determine possible vendors capable of conducting seismic benefit-cost analyses.

Consult with the Capital Improvement Plans to determine which facilities will be replaced relatively soon and which will be in service for the foreseeable future.

Coordinating Organization: Klamath Emergency Management

<table>
<thead>
<tr>
<th>Internal Partners:</th>
<th>External Partners:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Management Council (Klamath LEPC)</td>
<td>Hazardous Materials Facilities</td>
</tr>
</tbody>
</table>

Potential Funding Sources:

<table>
<thead>
<tr>
<th>Estimated cost:</th>
<th>Timeline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>State and federal seismic grants</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

Form Submitted by: Klamath County
Action Item Status: Revised and updated (2017); roll-over from 2011
**Earthquake #5 – Encourage Insurance Purchase**

<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Alignment with Plan Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encourage the purchase of earthquake insurance.</td>
<td>Goal 2</td>
</tr>
</tbody>
</table>

**Alignment with Existing Plans/Policies:**

**Rationale for Proposed Action Item:**
Unlike flood insurance, which is underwritten by the US Government (through the National Flood Insurance Program), earthquake insurance is offered by insurance company agents and generally “packaged” as a rider to a standard homeowner or business property insurance policy. For some people, the question should not be whether or not to purchase earthquake insurance, but rather, how much to get. For others, the decision requires a risk assessment. Earthquake insurance rates are determined differently by each insurance company and can vary widely depending on several rating factors. Generally, older homes cost more to insure than new homes. Wood homes get better rates than brick ones because they tend to withstand earthquake stresses better. Because earthquake insurance is a type of catastrophic coverage, most policies carry a *high deductible*; usually anywhere from 5% to 15% of the value of a house. It is recommended that Klamath County and local private sector insurance companies promote the purchase of earthquake insurance.

**Ideas for Implementation:**
Coordinate with insurance companies and organizations such as the Insurance Information Service of Oregon and Idaho (IISOI) to produce and distribute earthquake insurance information; Make contacts with insurance industry representatives to keep current about their requirements, rates, and plans; Work with real estate industry representatives to educate them about what types of structures are resistant to earthquakes; and Include information on County and City website.

**Coordinating Organization:** Klamath Emergency Management

<table>
<thead>
<tr>
<th>Internal Partners:</th>
<th>External Partners:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Management Council</td>
<td>IISOI, City and County Planning Depts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potential Funding Sources:</th>
<th>Estimated cost:</th>
<th>Timeline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A, course of normal duties and no costs associated</td>
<td>N/A</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

**Form Submitted by:** Klamath County

**Action Item Status:** Revised and updated (2017); roll-over from 2011
## Flooding #1 – Continue NFIP Through Enforcement

<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Alignment with Plan Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continue compliance with the National Flood Insurance Program (NFIP) through enforcement of local floodplain ordinances.</td>
<td>Goal 2, Goal 4</td>
</tr>
</tbody>
</table>

### Alignment with Existing Plans/Policies:

### Rationale for Proposed Action Item:

The National Flood Insurance Program provides communities with federally-backed flood insurance to homeowners, renters, and business owners, provided that communities develop and enforce adequate floodplain management ordinances. The benefits of adopting NFIP standards for communities are a reduced level of flood damage in the community and stronger buildings that can withstand floods. According to the NFIP, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance.

The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will help reduce the level of flood damage to new and existing buildings in communities while providing homeowners, renters and business owners additional flood insurance protection.

### Ideas for Implementation:

Actively participate with DLCD and FEMA during Community Assistance Visits. The Community Assistance Visit (CAV) is a scheduled visit to a community participating in the NFIP for the purpose of 1) conducting a comprehensive assessment of the community’s floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered.

Mitigate areas that are prone to flooding and/or have the potential to flood.

### Coordinating Organization:

Klamath Emergency Management

### Internal Partners:

Emergency Management Council

### External Partners:

State Floodplain Manager, City & County Planning Depts

### Potential Funding Sources:

FEMA Hazard Mitigation Grants

### Estimated cost:

Unknown

### Timeline:

Ongoing

### Form Submitted by:

Klamath County

### Action Item Status:

Revised and updated (2017); roll-over from 2011
Flooding #2 – Explore Mitigation with Property Owners

**Proposed Action Item:**
For structures within the 100 year floodplain, explore mitigation options with property owners upon request.

**Alignment with Plan Goals:**
Goal 1, Goal 2

**Alignment with Existing Plans/Policies:**

**Rationale for Proposed Action Item:**
Providing appropriate mitigation options with property owners upon their request will help inform property owners on how to reduce their risk to floods and inform Klamath County on structures that need flood mitigation. In addition, providing information with property owners upon their request reduces the need for Klamath County to waste resources contacting all property owners in the floodplain.

The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Exploring and providing mitigation options with property owners upon request will help to reduce the impact of floods on new and existing buildings and infrastructure.

**Ideas for Implementation:**
Develop education and outreach materials regarding flood mitigation options to provide to property owners who request it.

Coordinate flood mitigation options with Oregon Emergency Management to see if federal funding would be available to pay for mitigation actions.

Consider posting flood mitigation options on the city website or hosting a public forum to educate property owners about flood mitigation options.

**Coordinating Organization:** Klamath County Emergency Management

**Internal Partners:**

<table>
<thead>
<tr>
<th>Emergency Management Council</th>
</tr>
</thead>
</table>

**External Partners:**

<table>
<thead>
<tr>
<th>Klamath Falls and Klamath County Planning Departments</th>
</tr>
</thead>
</table>

**Potential Funding Sources:**

<table>
<thead>
<tr>
<th>N/A, course of normal duties and no costs associated</th>
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</table>

**Estimated cost:**

<table>
<thead>
<tr>
<th>N/A</th>
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</thead>
</table>

**Timeline:**

<table>
<thead>
<tr>
<th>Ongoing</th>
</tr>
</thead>
</table>

**Form Submitted by:** Klamath County

**Action Item Status:** Revised and updated (2017); roll-over from 2011
Landslide #1 – Klamath County Hillside Development Ordinance

<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Alignment with Plan Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consider adoption of a Klamath County hillside development ordinance with the intent of monitoring and regulating grading, excavation, development and cut and fill activities on steep or unstable slopes.</td>
<td>Goal 1, Goal 2, Goal 4</td>
</tr>
</tbody>
</table>

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:
Ordinances of this kind have been used to promote public safety by controlling land disturbing activities in hazardous areas that may contribute to or be impacted by landslides.

The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Adopting development ordinances that would regulate grading, excavation, development, and cut and fill activities could help limit development that would increase a slope’s vulnerability to landslides, or limit development that could increase the potential for loss of life or property due to landslides. Such actions would help the area mitigate its risk to landslides.

Ideas for Implementation:
Review ordinances in other counties and cities.

Coordinating Organization: Klamath County Emergency Management

<table>
<thead>
<tr>
<th>Internal Partners:</th>
<th>External Partners:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Management Council</td>
<td>Homebuilders Association, Realtors Klamath County Building Department</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potential Funding Sources</th>
<th>Estimated cost</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A, course of normal duties and no costs associated</td>
<td>N/A</td>
<td>Short Term (0-2 years)</td>
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</table>

Form Submitted by Klamath County

Action Item Status: Revised and updated (2017); roll-over from 2011
**Landslide #2 – Educate Homeowners**

<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Alignment with Plan Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educate homeowners in areas vulnerable to landslides of their risk.</td>
<td><em>Goal 1, Goal 2</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alignment with Existing Plans/Policies:</th>
</tr>
</thead>
</table>

**Rationale for Proposed Action Item:**
Depending on the type, location, severity and area affected, severe property damage, injuries and loss of life can be caused by landslide hazards.

Landslides can damage or temporarily disrupt utility services, roads, and other transportation / communication systems, including emergency response, fire, medical, police, etc.

The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Identifying areas vulnerable to landslides can reduce the impacts of landslides on new and existing developments and infrastructure.

**Ideas for Implementation:**
Improve knowledge of debris flow (rapid moving) landslide hazard areas. Alert homeowners in those areas.

Research existing community ordinances related to steep slope development.

**Coordinating Organization:** Klamath Emergency Management

<table>
<thead>
<tr>
<th>Internal Partners:</th>
<th>External Partners:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Management Council</td>
<td>Klamath GIS Department, City &amp; County Planning Depts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potential Funding Sources:</th>
<th>Estimated cost:</th>
<th>Timeline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A, course of normal duties and no costs associated</td>
<td>N/A</td>
<td>Long Term (2-4+ years)</td>
</tr>
</tbody>
</table>

**Form Submitted by:** Klamath County

**Action Item Status:** Revised and updated (2017); roll-over from 2011
<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Alignment with Plan Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educate Klamath County and Klamath Falls residents about the respiratory dangers of ash fall events after a volcanic eruption</td>
<td>Goal 1</td>
</tr>
</tbody>
</table>

**Alignment with Existing Plans/Policies:**

**Rationale for Proposed Action Item:**
In the aftermath of a volcanic eruption, ash fall can seriously impact the respiratory health of residents in Klamath County and Klamath Falls. By educating residents prior to an event, the health of those residents can be protected.

**Ideas for Implementation:**
- Stock N-95 masks for emergency responder use in a disaster.
- Use electronic, radio or television media to educate residents.

**Coordinating Organization:** Klamath Emergency Management

<table>
<thead>
<tr>
<th>Internal Partners:</th>
<th>External Partners:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Management Council</td>
<td>Klamath County Public Health</td>
</tr>
</tbody>
</table>

**Potential Funding Sources:**
- Regular County Budgetary Processes

<table>
<thead>
<tr>
<th>Estimated cost:</th>
<th>Timeline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;$500</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

**Form Submitted by:** Klamath County

**Action Item Status:** Revised and updated (2017); roll-over from 2011
### Winter Storms #1 – Tree Hazard Education

<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Alignment with Plan Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop and implement programs to keep trees from threatening lives, property, and public infrastructure as a result of severe weather events.</td>
<td>Goal 5, Goal 6</td>
</tr>
</tbody>
</table>

### Alignment with Existing Plans/Policies:

### Rationale for Proposed Action Item:
The Klamath Steering Committee rated the vulnerability to winter storms as high.

The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)].

### Ideas for Implementation:
Develop partnerships between utility providers, county and city agencies to document known hazard areas and minimize risks.

Coordinate with overhead utilities in developing GIS layers for power lines and at-risk trees. Provide residents with a list of acceptable trees for under power lines.

### Coordinating Organization:
Klamath Emergency Management

<table>
<thead>
<tr>
<th>Internal Partners:</th>
<th>External Partners:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Management Council</td>
<td>Pacific Power and Light</td>
</tr>
</tbody>
</table>

### Potential Funding Sources:
N/A, course of normal duties and no costs associated

### Estimated cost:
N/A

### Timeline:
Ongoing

### Form Submitted by:
Klamath County

### Action Item Status:
Revised and updated (2017); roll-over from 2011
## Winter Storm #2 – Tree Maintenance Education

<table>
<thead>
<tr>
<th>Proposed Action Item:</th>
<th>Alignment with Plan Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educate property owners on how to properly maintain trees to prevent power loss on power lines off the right of way.</td>
<td><em>Goal 2, Goal 3</em></td>
</tr>
</tbody>
</table>

### Alignment with Existing Plans/Policies:

**Rationale for Proposed Action Item:**
Overhead electrical lines are subject to high winds and winter storm damage. Educating property owners about how to prevent power outages on their private property can help reduce impacts of windstorm events on these homeowners.

The Disaster Mitigation Act of 2000 requires communities to develop comprehensive actions to reduce the impacts of natural hazards.[201.6(c)(3)(ii)] Educating property owners on how to properly maintain trees to prevent power loss on power lines off the right of way will reduce the impact of severe winter storms.

### Ideas for Implementation:
Coordinate with arboricultural groups, public agencies, and utilities to promote proper tree pruning and care practices that can reduce the risk of tree failure and property damage. Common messages refined by state level entities such as the Oregon Department of Forestry (ODF) and OSU Extension can help provide continuity and efficiency across the state.

### Coordinating Organization:
Klamath Emergency Management

<table>
<thead>
<tr>
<th>Internal Partners:</th>
<th>External Partners:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Management Council</td>
<td>Pacific Power and Light, Klamath County Public Works, Klamath County Planning Department</td>
</tr>
</tbody>
</table>

### Potential Funding Sources:
N/A, course of normal duties and no costs associated

<table>
<thead>
<tr>
<th>Estimated cost:</th>
<th>Timeline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

### Form Submitted by:
Klamath County

### Action Item Status:
Revised and updated (2017); roll-over from 2011
**Winter Storm #3 – Upgrade Electrical Infrastructure**

**Proposed Action Item:**
Encourage upgrading lines and poles to improve wind/ice loading, undergrounding critical lines, and adding interconnect switches to allow alternative feed paths and disconnect switches to minimize outage areas.

**Alignment with Plan Goals:**

<table>
<thead>
<tr>
<th>Goal 2</th>
</tr>
</thead>
</table>

**Alignment with Existing Plans/Policies:**

**Rationale for Proposed Action Item:**
The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Improving power infrastructure by upgrading lines and poles to improve wind/ice loading, undergrounding critical lines, adding interconnect switches to allow alternative feed paths, and disconnecting switches to minimize outage areas will all help to improve electrical service in area and protect this critical infrastructure from winter storms.

**Ideas for Implementation:**
Identify areas that are subject to frequent power outages and develop appropriate solutions to reduce the likelihood of a power outage.

Seek funding for specific areas subject to frequent power outages from winter storms. For a list of funding resources, see the Resources Appendix in this mitigation plan.

**Coordinating Organization:** Klamath Emergency Management

**Internal Partners:**
Emergency Management Council

**External Partners:**
Pacific Power and Light

**Potential Funding Sources:**
Utility Providers

**Estimated cost:** Unknown

**Timeline:** Long Term (2-4+ years)

**Form Submitted by:** Klamath County

**Action Item Status:** Revised and updated (2017); roll-over from 2011
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Appendix B: Planning Process

Meeting: Klamath County Emergency Management Council - September 26, 2016
Time: 12:00 pm – 3:00 pm
Location: Klamath Falls Police Department

Agenda:

Introductions

Review purpose and structure of Council

Review updated County Hazard Analysis (Emergency Management)

Review Readiness Training Identification and Preparedness Planning (Emergency Management)

Discuss County Emergency Alerting options (Emergency Management)

National Preparedness Month Update (Emergency Management)

Communications Capabilities – GETS/WPS, Sat Phones, Multi-agency protocols

Sub-committees

   Schools Emergency Planning Group

   Community Emergency Response Teams

   Community Organizations Active in Disasters

   Local Emergency Planning Committee

Agency Updates

Conclusion – Review Action Items
<table>
<thead>
<tr>
<th>EMC NAME</th>
<th>26 SEPT 2016 AGENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>RON MILLER</td>
<td>EMERGENCY MANAGEMENT</td>
</tr>
<tr>
<td>STUART SACKMAN</td>
<td>OREGON TECH</td>
</tr>
<tr>
<td>KEITH ENDOGOTT</td>
<td>KINGSLEY FIELD EM</td>
</tr>
<tr>
<td>WILLIAM AUGUST</td>
<td>ISLAND FIRE</td>
</tr>
<tr>
<td>JOHN KEIGHTON</td>
<td>KC 911</td>
</tr>
<tr>
<td>TODD REGARDO</td>
<td>Klamath Tribes</td>
</tr>
<tr>
<td>COUNCIL VANBRAAT</td>
<td>Klamath Public Health</td>
</tr>
<tr>
<td>LAMANDA QUANDI</td>
<td>KOPH</td>
</tr>
<tr>
<td>BRIAN DALVEN</td>
<td>KFD4</td>
</tr>
<tr>
<td>STUART HOLMES</td>
<td>Sky Lakes Medical</td>
</tr>
<tr>
<td>KAREN RICH</td>
<td>Klamath Tribes</td>
</tr>
<tr>
<td>KATHYNE STILES</td>
<td>Oregon Public Health Division</td>
</tr>
<tr>
<td>JIM CANNY</td>
<td>Klamath Health</td>
</tr>
<tr>
<td>DENNIS NARROW</td>
<td>Klamath Comm. College</td>
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<tr>
<td>TADD ANDERSON</td>
<td>Pacific Power</td>
</tr>
<tr>
<td>JOHN SPREDDAY</td>
<td>KCFD4</td>
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<tr>
<td>BRINN BICKLEY</td>
<td>Merrill Police</td>
</tr>
<tr>
<td>REYNA McINTY MORRIS</td>
<td>ALC County</td>
</tr>
<tr>
<td>MIKE HECKAN</td>
<td>KICS</td>
</tr>
<tr>
<td>MARK WILLHEIT</td>
<td>CITY KP</td>
</tr>
<tr>
<td>VIM SMITH</td>
<td>Klamath Co. Sch. Dist.</td>
</tr>
<tr>
<td>STEVE JOHNSON</td>
<td>KCPD</td>
</tr>
<tr>
<td>STAN STRICKLAND</td>
<td>American Red Cross</td>
</tr>
<tr>
<td>SAMANTHER TOTTEN-PERRY</td>
<td>SKY CASE 98 MED. CENTER</td>
</tr>
<tr>
<td>RICK VELAURIA</td>
<td>KCFD1</td>
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<tr>
<td>CARR ANDERSEN</td>
<td>ODOT</td>
</tr>
<tr>
<td>SARAH HENDERSON</td>
<td>KCFEM</td>
</tr>
<tr>
<td>MORGAN LINDSAY</td>
<td></td>
</tr>
</tbody>
</table>
Meeting:    NHMP Goals, Actions, Maintenance and Implementation - January 20, 2017
Time:       12:00 pm – 3:00 pm
Location:   Klamath Falls Police Department
Agenda:

Meeting Overview

Mission and Goals Discussion

Natural Hazards Review (see June 2016 Assessment)

Previous Action Items

Review Action Item Forms (reference: NHMP 2017 draft)

New Action Items

Add/Remove Action Item Forms (reference: NHMP 2017 draft)

Maintenance and Implementation Discussion

FEMA Approval Process and Adoption Discussion

Next Steps Discussion
<table>
<thead>
<tr>
<th>NAME</th>
<th>AGENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>George Bechtingen</td>
<td>KC EM</td>
</tr>
<tr>
<td>Jessica Chastain</td>
<td></td>
</tr>
<tr>
<td>Courtney Vanbragt</td>
<td>KC IT</td>
</tr>
<tr>
<td>Mark Wiltott</td>
<td>KC PH</td>
</tr>
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<td>Nathan Chaves</td>
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Meeting: Klamath County Emergency Management Council - May 24, 2017
Time: 12:00 pm – 3:00 pm
Location: Klamath Falls Police Department

Agenda:

Introductions

Topics

Mass Communications System (Emergency Management)

   Tornado warning review

Solar Eclipse Planning Update (All)

Community Points of Distribution Plan (Emergency Management)

Community Fuel Points of Distribution Plan (Emergency Management)

Natural Hazards Mitigation Plan Update (Emergency Management)

   Public Comment June 1-June 30, on website

Training and Exercise Plan (Emergency Management/KCIT)

Sub-committees

   Schools Emergency Planning Group

   Community Emergency Response Teams

   Community Organizations Active in Disasters

   Local Emergency Planning Committee

Agency Updates

Conclusion – Review Action Items
June 22, 2017

BOARD OF COUNTY COMMISSIONERS
PRESS RELEASE – FOR IMMEDIATE RELEASE

Klamath County is seeking review of and comment on the Natural Hazards Mitigation Plan. The Plan is the County’s vehicle for identifying the natural hazards the County is subject to and mitigation strategies that can alleviate the hazards. The Plan is a requirement of the Department of Homeland Security and the Federal Emergency Management Agency in order to receive post-disaster Stafford Act and Emergency Assistance funding.

The public is invited to review the plan via this link: http://www.klamathcounty.org/depts/ems/Klamath%20Natural%20Hazard%20Mitigation%20Plan%206-21-17.pdf or go to klamathcounty.org and click on Emergency Management under Departments.

Send comments to Klamath County Emergency Management at mlindsay@klamathcounty.org or 541-851-3741.
NATURAL HAZARDS ASSESSMENT MEETING
JUNE 19, 2017
9:00 A.M.
CITY PUBLIC WORKS CONFERENCE ROOM

Attendees: Craig Andresen (Fire Marshall), David Henslee (Chief of Police), Mark Willrett (Public Works Director), Morgan Lindsay (County Emergency Manager), Erik Nobel (Planning Manager).

Meeting called to Order at 9:03 a.m.

Morgan Lindsay says that this plan is a FEMA requirement and has to be updated every 5 years. The county has been working on updating the plan but in order for the City to be eligible for FEMA funding it has to have its own plan or an addendum to the county plan. Need to have general discussion about mitigation for natural hazards as well.

Willrett says that the County’s list is very long and has prepared a reduced list for the City. The group discusses the ratings. Group finishes ratings assessment and discusses mitigation for the hazards. Morgan shares Klamath County’s mitigation plan action items and encourages City to review them and develop theirs. Willrett says that the City is member of a couple of cooperative/mutual aid organizations such as ORWARN. Lindsay says that she will verify with the State that she can package up the City’s portion of the natural hazards assessment with the County’s and have it sent for approval at the same time.

Meeting adjourned at 10:03 a.m.
Appendix C: Grant Programs

Hazard Mitigation Programs

Post-Disaster Federal Programs
- Hazard Mitigation Grant Program
  - The Hazard Mitigation Grant Program (HMGP) provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.
- Physical Disaster Loan Program
  - When physical disaster loans are made to homeowners and businesses following disaster declarations by the U.S. Small Business Administration (SBA), up to 20% of the loan amount can go towards specific measures taken to protect against recurring damage in similar future disasters.

Pre-Disaster Federal Programs
- Pre-Disaster Mitigation Grant Program
  - The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds.
- Flood Mitigation Assistance Program
  - The overall goal of the Flood Mitigation Assistance (FMA) Program is to fund cost-effective measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other National Flood Insurance Program (NFIP) insurable structures. This specifically includes:
    - Reducing the number of repetitively or substantially damaged structures and the associated flood insurance claims;
    - Encouraging long-term, comprehensive hazard mitigation planning;
    - Responding to the needs of communities participating in the NFIP to expand their mitigation activities beyond floodplain development activities; and
    - Complementing other federal and state mitigation programs with similar, long-term mitigation goals.

State Programs
- Community Development Block Grant Program
  - Promotes viable communities by providing: 1) decent housing; 2) quality living environments; and 3) economic opportunities, especially for low and moderate income persons. Eligible Activities Most Relevant to Hazard Mitigation include: acquisition of property for public purposes; construction/reconstruction of public infrastructure; community planning activities. Under special circumstances, CDBG funds also can be used to meet urgent community development needs arising in the last 18 months which pose immediate threats to health and welfare.
- Oregon Watershed Enhancement Board
  - While OWEB’s primary responsibilities are implementing projects addressing coastal salmon restoration and improving water quality statewide, these projects can sometimes also benefit efforts to reduce flood and landslide hazards. In addition, OWEB conducts watershed workshops for
landowners, watershed councils, educators, and others, and conducts a biennial conference highlighting watershed efforts statewide. Funding for OWEB programs comes from the general fund, state lottery, timber tax revenues, license plate revenues, angling license fees, and other sources. OWEB awards approximately $20 million in funding annually.

- http://www.oweb.state.or.us/

Federal Mitigation Programs, Activities & Initiatives

Basic & Applied Research/Development

- National Earthquake Hazard Reduction Program (NEHRP), National Science Foundation. Through broad based participation, the NEHRP attempts to mitigate the effects of earthquakes. Member agencies in NEHRP are the US Geological Survey (USGS), the National Science Foundation (NSF), the Federal Emergency Management Agency (FEMA), and the National Institute for Standards and Technology (NIST). The agencies focus on research and development in areas such as the science of earthquakes, earthquake performance of buildings and other structures, societal impacts, and emergency response and recovery. http://www.nehrp.gov/

- Decision, Risk, and Management Science Program, National Science Foundation. Supports scientific research directed at increasing the understanding and effectiveness of decision making by individuals, groups, organizations, and society. Disciplinary and interdisciplinary research, doctoral dissertation research, and workshops are funded in the areas of judgment and decision making; decision analysis and decision aids; risk analysis, perception, and communication; societal and public policy decision making; management science and organizational design. The program also supports small grants for exploratory research of a time-critical or high-risk, potentially transformative nature. http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5423&org=SES

Hazard ID and Mapping


- Soil Survey, USDA-NRCS. Maintains soil surveys of counties or other areas to assist with farming, conservation, mitigation or related purposes. http://soils.usda.gov/survey/

Project Support

- Coastal Zone Management Program, NOAA. Provides grants for planning and implementation of non-structural coastal flood and hurricane hazard mitigation projects and coastal wetlands restoration. http://coastalmanagement.noaa.gov/

- Community Development Block Grant Entitlement Communities Program, HUD. Provides grants to entitled cities and urban counties to develop viable communities (e.g. decent housing, a suitable living environment, expanded economic opportunities), principally for low- and moderate-income persons. http://www.hud.gov/offices/cpd/communitydevelopment/programs/entitlement/


- Assistance to Firefighters Grant Program, FEMA. Grants are awarded to fire departments to enhance their ability to protect the public and fire service personnel from fire and related hazards. Three types of grants are available: Assistance to Firefighters Grant (AFG), Fire Prevention and
Safety (FP&S), and Staffing for Adequate Fire and Emergency Response (SAFER).
http://www.firegrantsupport.com/

- **Emergency Watershed Protection Program**, USDA-NRCS. Provides technical and financial assistance for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas damaged by severe natural hazard events.
http://www.nrcs.usda.gov/programs/EWP/

- **Rural Development Assistance – Utilities**, USDA. Direct and guaranteed rural economic loans and business enterprise grants to address utility issues and development needs.
http://www.usda.gov/rus/

- **Rural Development Assistance – Housing**, USDA. Grants, loans, and technical assistance in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster necessary.
http://www.rurdev.usda.gov/rhs/

- **Public Assistance Grant Program**, FEMA. The objective of the Federal Emergency Management Agency's (FEMA) Public Assistance (PA) Grant Program is to provide assistance to State, Tribal and local governments, and certain types of Private Nonprofit organizations so that communities can quickly respond to and recover from major disasters or emergencies declared by the President.
http://www.fema.gov/government/grant/pa/index.shtm

- **National Flood Insurance Program**, FEMA. Makes available flood insurance to residents of communities that adopt and enforce minimum floodplain management requirements.
http://www.fema.gov/business/nfip/

- **HOME Investments Partnerships Program**, HUD. Grants to states, local government and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons.
http://www.hud.gov/offices/cpd/affordablehousing/programs/home/

- **Disaster Recovery Initiative**, HUD. Grants to fund gaps in available recovery assistance after disasters (including mitigation).
http://www.hud.gov/offices/cpd/communitydevelopment/programs/dri/driquickfacts.cfm

- **Emergency Management Performance Grants**, FEMA. Helps state and local governments to sustain and enhance their all-hazards emergency management programs.
http://www.fema.gov/government/grant/empg/index.shtm#0

- **Partners for Fish and Wildlife**, DOI – FWS. Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.
http://www.fws.gov/partners/

http://www.doi.gov/partnerships/wetlands.html

- **Federal Land Transfer / Federal Land to Parks Program**, DOI-NPS. Identifies, assesses, and transfers available Federal real property for acquisition for State and local parks and recreation, such as open space. http://www.nps.gov/ncrc/programs/flp/flp_questions.html

- **Wetlands Reserve program**, USDA-NCRS. Financial and technical assistance to protect and restore wetlands through easements and restoration agreements.
http://www.nrcs.usda.gov/Programs/WRP/

- **Secure Rural Schools and Community Self-Determination Act of 2000**, US Forest Service. Reauthorized for FY2008-2011, it was originally enacted in 2000 to provide five years of transitional assistance to rural counties affected by the decline in revenue from timber harvests on federal lands. Funds have been used for improvements to public schools, roads, and stewardship projects. Money is also available for maintaining infrastructure, improving the health of watersheds and ecosystems, protecting communities, and strengthening local economies.
http://www.fs.fed.us/srs/

More resources at: http://www.oregonshowcase.org/stateplan/part4
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Appendix D: Economic Analysis of Natural Hazard Mitigation Projects

This appendix was developed by the Oregon Partnership for Disaster Resilience at the University of Oregon’s Community Service Center. It has been reviewed and accepted by the Federal Emergency Management Agency as a means of documenting how the prioritization of actions shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

The appendix outlines three approaches for conducting economic analyses of natural hazard mitigation projects. It describes the importance of implementing mitigation activities, different approaches to economic analysis of mitigation strategies, and methods to calculate costs and benefits associated with mitigation strategies. Information in this section is derived in part from: The Interagency Hazards Mitigation Team, State Hazard Mitigation Plan, (Oregon State Police – Office of Emergency Management, 2000), and Federal Emergency Management Agency Publication 331, Report on Costs and Benefits of Natural Hazard Mitigation.

This section is not intended to provide a comprehensive description of benefit/cost analysis, nor is it intended to evaluate local projects. It is intended to (1) raise benefit/cost analysis as an important issue, and (2) provide some background on how economic analysis can be used to evaluate mitigation projects.

Why Evaluate Mitigation Strategies?

Mitigation activities reduce the cost of disasters by minimizing property damage, injuries, and the potential for loss of life, and by reducing emergency response costs, which would otherwise be incurred. Evaluating possible natural hazard mitigation activities provides decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Evaluating mitigation projects is a complex and difficult undertaking, which is influenced by many variables. First, natural disasters affect all segments of the communities they strike, including individuals, businesses, and public services such as fire, police, utilities, and schools. Second, while some of the direct and indirect costs of disaster damages are measurable, some of the costs are non-financial and difficult to quantify in dollars.

Third, many of the impacts of such events produce “ripple-effects” throughout the community, greatly increasing the disaster’s social and economic consequences.

While not easily accomplished, there is value, from a public policy perspective, in assessing the positive and negative impacts from mitigation activities, and obtaining an instructive benefit/cost comparison.

Otherwise, the decision to pursue or not pursue various mitigation options would not be based on an objective understanding of the net benefit or loss associated with these actions.
**What are some Economic Analysis Approaches for Evaluating Mitigation Strategies?**

The approaches used to identify the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into three general categories: benefit/cost analysis, cost-effectiveness analysis and the STAPLE/E approach. The distinction between the three methods is outlined below:

**Benefit/Cost Analysis**

Benefit/cost analysis is a key mechanism used by the state Office of Emergency Management (OEM), the Federal Emergency Management Agency, and other state and federal agencies in evaluating hazard mitigation projects, and is required by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended.

Benefit/cost analysis is used in natural hazards mitigation to show if the benefits to life and property protected through mitigation efforts exceed the cost of the mitigation activity. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Benefit/cost analysis is based on calculating the frequency and severity of a hazard, avoiding future damages, and risk. In benefit/cost analysis, all costs and benefits are evaluated in terms of dollars, and a net benefit/cost ratio is computed to determine whether a project should be implemented. A project must have a benefit/cost ratio greater than 1 (i.e. the net benefits will exceed the net costs) to be eligible for FEMA funding.

**Cost-Effectiveness Analysis**

Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. This type of analysis, however, does not necessarily measure costs and benefits in terms of dollars. Determining the economic feasibility of mitigating natural hazards can also be organized according to the perspective of those with an economic interest in the outcome. Hence, economic analysis approaches are covered for both public and private sectors as follows.

*Investing in Public Sector Mitigation Activities*

Evaluating mitigation strategies in the public sector is complicated because it involves estimating all of the economic benefits and costs regardless of who realizes them, and potentially to a large number of people and economic entities. Some benefits cannot be evaluated monetarily, but still affect the public in profound ways. Economists have developed methods to evaluate the economic feasibility of public decisions which involve a diverse set of beneficiaries and non-market benefits.
Investing in Private Sector Mitigation Activities

Private sector mitigation projects may occur on the basis of one or two approaches: it may be mandated by a regulation or standard, or it may be economically justified on its own merits. A building or landowner, whether a private entity or a public agency, required to conform to a mandated standard may consider the following options:

- Request cost sharing from public agencies;
- Dispose of the building or land either by sale or demolition;
- Change the designated use of the building or land and change the hazard mitigation compliance requirement; or
- Evaluate the most feasible alternatives and initiate the most cost effective hazard mitigation alternative.

The sale of a building or land triggers another set of concerns. For example, real estate disclosure laws can be developed which require sellers of real property to disclose known defects and deficiencies in the property, including earthquake weaknesses and hazards to prospective purchases.

Correcting deficiencies can be expensive and time consuming, but their existence can prevent the sale of the building. Conditions of a sale regarding the deficiencies and the price of the building can be negotiated between a buyer and seller.

STAPLE/E Approach

Considering detailed benefit/cost or cost-effectiveness analysis for every possible mitigation activity could be very time consuming and may not be practical. There are some alternate approaches for conducting a quick evaluation of the proposed mitigation activities which could be used to identify those mitigation activities that merit more detailed assessment.

One of those methods is the STAPLE/E approach.

Using STAPLE/E criteria, mitigation activities can be evaluated quickly by steering committees in a synthetic fashion. This set of criteria requires the committee to assess the mitigation activities based on the Social, Technical, Administrative, Political, Legal, Economic and Environmental (STAPLE/E) constraints and opportunities of implementing the particular mitigation item in your community. The second chapter in FEMA’s How-To Guide “Developing the Mitigation Plan – Identifying Mitigation Actions and Implementation Strategies” as well as the “State of Oregon’s Local Natural Hazard Mitigation Plan: An Evaluation Process” outline some specific considerations in analyzing each aspect. The following are suggestions for how to examine each aspect of the STAPLE/E approach from the “State of Oregon’s Local Natural Hazard Mitigation Plan: An Evaluation Process.”

Social: Community development staff, local non-profit organizations, or a local planning board can help answer these questions.
- Is the proposed action socially acceptable to the community?
- Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- Will the action cause social disruption

**Technical:** The city or county public works staff, and building department staff can help answer these questions.

- Will the proposed action work?
- Will it create more problems than it solves?
- Does it solve a problem or only a symptom?
- Is it the most useful action in light of other community goals?

**Administrative:** Elected officials or the county administrator, can help answer these questions.

- Can the community implement the action?
- Is there someone to coordinate and lead the effort?
- Is there sufficient funding, staff, and technical support available?
- Are there ongoing administrative requirements that need to be met?

**Political:** Consult the mayor, city council or county planning commission, city or county administrator, and local planning commissions to help answer these questions.

- Is the action politically acceptable?
- Is there public support both to implement and to maintain the project?

**Legal:** Include legal counsel, land use planners, risk managers, and city council or county planning commission members, among others, in this discussion.

- Is the community authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity?
- Are there legal side effects? Could the activity be construed as a taking?
- Is the proposed action allowed by the comprehensive plan, or must the comprehensive plan be amended to allow the proposed action?
- Will the community be liable for action or lack of action?
- Will the activity be challenged?

**Economic:** Community economic development staff, civil engineers, building department staff, and the assessor’s office can help answer these questions.

- What are the costs and benefits of this action?
- Do the benefits exceed the costs?
- Are initial, maintenance, and administrative costs taken into account?
- Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private?)
- How will this action affect the fiscal capability of the community?
- What burden will this action place on the tax base or local economy?
- What are the budget and revenue effects of this activity?
- Does the action contribute to other community goals, such as capital improvements or economic development?
- What benefits will the action provide? (This can include dollar amount of damages prevented, number of homes protected, credit under the CRS, potential for funding under the HMGP or the FMA program, etc.)

**Environmental**: Watershed councils, environmental groups, land use planners and natural resource managers can help answer these questions.

- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

The STAPLE/E approach is helpful for doing a quick analysis of mitigation projects. Most projects that seek federal funding and others often require more detailed benefit/cost analyses.

**When to use the Various Approaches**

It is important to realize that various funding sources require different types of economic analyses. The following figure is to serve as a guideline for when to use the various approaches.

**Figure D.1: Economic Analysis Flowchart**
Implementing the Approaches

Benefit/cost analysis, cost-effectiveness analysis, and the STAPLE/E are important tools in evaluating whether or not to implement a mitigation activity. A framework for evaluating mitigation activities is outlined below. This framework should be used in further analyzing the feasibility of prioritized mitigation activities.

1. Identify the Activities

Activities for reducing risk from natural hazards can include structural projects to enhance disaster resistance, education and outreach, and acquisition or demolition of exposed properties, among others. Different mitigation projects can assist in minimizing risk to natural hazards, but do so at varying economic costs.

2. Calculate the Costs and Benefits

Choosing economic criteria is essential to systematically calculating costs and benefits of mitigation projects and selecting the most appropriate activities. Potential economic criteria to evaluate alternatives include:

- **Determine the project cost.** This may include initial project development costs, and repair and operating costs of maintaining projects over time.

- **Estimate the benefits.** Projecting the benefits, or cash flow resulting from a project can be difficult. Expected future returns from the mitigation effort depend on the correct specification of the risk and the effectiveness of the project, which may not be well known. Expected future costs depend on the physical durability and potential economic obsolescence of the investment. This is difficult to project. These considerations will also provide guidance in selecting an appropriate salvage value. Future tax structures and rates must be projected. Financing alternatives must be researched, and they may include retained earnings, bond and stock issues, and commercial loans.

- **Consider costs and benefits to society and the environment.** These are not easily measured, but can be assessed through a variety of economic tools including existence value or contingent value theories. These theories provide quantitative data on the value people attribute to physical or social environments. Even without hard data, however, impacts of structural projects to the physical environment or to society should be considered when implementing mitigation projects.

- **Determine the correct discount rate.** Determination of the discount rate can just be the risk-free cost of capital, but it may include the decision maker’s time preference and also a risk premium. Including inflation should also be considered.
3. **Analyze and Rank the Activities**

Once costs and benefits have been quantified, economic analysis tools can rank the possible mitigation activities. Two methods for determining the best activities given varying costs and benefits include net present value and internal rate of return.

- **Net present value.** Net present value is the value of the expected future returns of an investment minus the value of the expected future cost expressed in today’s dollars. If the net present value is greater than the projected costs, the project may be determined feasible for implementation. Selecting the discount rate, and identifying the present and future costs and benefits of the project calculates the net present value of projects.

- **Internal rate of return.** Using the internal rate of return method to evaluate mitigation projects provides the interest rate equivalent to the dollar returns expected from the project. Once the rate has been calculated, it can be compared to rates earned by investing in alternative projects. Projects may be feasible to implement when the internal rate of return is greater than the total costs of the project. Once the mitigation projects are ranked on the basis of economic criteria, decision-makers can consider other factors, such as risk, project effectiveness, and economic, environmental, and social returns in choosing the appropriate project for implementation.

**Economic Returns of Natural Hazard Mitigation**

The estimation of economic returns, which accrue to building or land owners as a result of natural hazard mitigation, is difficult. Owners evaluating the economic feasibility of mitigation should consider reductions in physical damages and financial losses. A partial list follows:

- Building damages avoided
- Content damages avoided
- Inventory damages avoided
- Rental income losses avoided
- Relocation and disruption expenses avoided
- Proprietor’s income losses avoided

These parameters can be estimated using observed prices, costs, and engineering data. The difficult part is to correctly determine the effectiveness of the hazard mitigation project and the resulting reduction in damages and losses. Equally as difficult is assessing the probability that an event will occur. The damages and losses should only include those that will be borne by the owner. The salvage value of the investment can be important in determining economic feasibility. Salvage value becomes more important as the time horizon of the owner declines. This is important because most businesses depreciate assets over a period of time.
Additional Costs from Natural Hazards

Property owners should also assess changes in a broader set of factors that can change as a result of a large natural disaster. These are usually termed “indirect” effects, but they can have a very direct effect on the economic value of the owner’s building or land. They can be positive or negative, and include changes in the following:

- Commodity and resource prices
- Availability of resource supplies
- Commodity and resource demand changes
- Building and land values
- Capital availability and interest rates
- Availability of labor
- Economic structure
- Infrastructure
- Regional exports and imports
- Local, state, and national regulations and policies
- Insurance availability and rates

Changes in the resources and industries listed above are more difficult to estimate and require models that are structured to estimate total economic impacts. Total economic impacts are the sum of direct and indirect economic impacts. Total economic impact models are usually not combined with economic feasibility models. Many models exist to estimate total economic impacts of changes in an economy. Decision makers should understand the total economic impacts of natural disasters in order to calculate the benefits of a mitigation activity. This suggests that understanding the local economy is an important first step in being able to understand the potential impacts of a disaster, and the benefits of mitigation activities.

Additional Considerations

Conducting an economic analysis for potential mitigation activities can assist decision-makers in choosing the most appropriate strategy for their community to reduce risk and prevent loss from natural hazards.

Economic analysis can also save time and resources from being spent on inappropriate or unfeasible projects. Several resources and models are listed on the following page that can assist in conducting an economic analysis for natural hazard mitigation activities.

Benefit/cost analysis is complicated, and the numbers may divert attention from other important issues. It is important to consider the qualitative factors of a project associated with mitigation that cannot be evaluated economically. There are alternative approaches to implementing mitigation projects. With this in mind, opportunity rises to develop strategies that integrate natural hazard mitigation with projects related to watersheds, environmental planning.
community economic development, and small business development, among others.
Incorporating natural hazard mitigation with other community projects can increase the viability of project implementation.

Resources


Interagency Hazards Mitigation Team, State Hazard Mitigation Plan, (Oregon State Police – Office of Emergency Management, 2000.)


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Appendix E: FEMA Review Tool

The Local Mitigation Plan Review Tool demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to participating jurisdictions.

1. The Multi-Jurisdiction Summary Sheet is used to document how each jurisdiction met the requirements in the Plan.
2. The Regulation Checklist provides a summary of FEMA’s evaluation of whether the Plan has addressed all requirements.
3. The Plan Assessment identifies the plan’s strengths as well as documents areas for future improvement.

The FEMA Mitigation Planner must reference the Local Mitigation Plan Review Guide when completing this Local Mitigation Plan Review Tool.

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<tr>
<td>Local Point of Contact: Morgan Lindsay</td>
<td>Mailing Address: 305 Main St 305 Main St 305 Main St 2543 Shasta Way 2543 Shasta Way 2543 Shasta Way</td>
<td>Office Address: Klamath Falls, OR 97601 Klamath Falls, OR 97601 Klamath Falls, OR 97601</td>
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<td>Phone Number: 541-851-3741</td>
<td>E-Mail: <a href="mailto:mlindsay@co.klamath.or.us">mlindsay@co.klamath.or.us</a></td>
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**SECTION 1: MULTI-JURISDICTION SUMMARY SHEET (used only for multi-jurisdictional plans)**

**INSTRUCTIONS:** The Multi-Jurisdiction Summary Spreadsheet is completed by listing each participating jurisdiction and which required Elements for each jurisdiction were ‘Met’ or ‘Not Met,’ and when the adoption resolutions were received. This Summary Sheet does not imply that a mini-plan be developed for each jurisdiction; it is used to ensure that each jurisdiction participating in the Plan has been documented and has met the requirements for those Elements (A through E).

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<th>B. Hazard Identification &amp; Risk Assessment</th>
<th>C. Mitigation Strategy</th>
<th>D. Plan Review, Evaluation &amp; Implementation</th>
<th>E. Plan Adoption</th>
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<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>2</td>
<td>Klamath Falls</td>
<td>City</td>
<td>Nathan Cherpeski</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>n/a</td>
</tr>
</tbody>
</table>
**SECTION 2: REGULATION CHECKLIST**

**INSTRUCTIONS:** The Regulation Checklist is completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been ‘Met’ or ‘Not Met.’ The ‘Required Revisions’ summary at the bottom of each Element is completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions are explained for each plan sub-element that is ‘Not Met.’ Sub-elements are referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable.

<table>
<thead>
<tr>
<th>Regulation (44 CFR 201.6 Local Mitigation Plans)</th>
<th>Location in Plan (section or page)</th>
<th>Met</th>
<th>Not Met</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ELEMENT A. PLANNING PROCESS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))</td>
<td>p. 11-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))</td>
<td>p.11-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))</td>
<td>p. 11-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))</td>
<td>p. 20-21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A5. Is there discussion of how the communities will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))</td>
<td>p. 26-32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))</td>
<td>p. 26-32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ELEMENT A: REQUIRED REVISIONS**
## ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT

<table>
<thead>
<tr>
<th></th>
<th>Regulation (44 CFR 201.6 Local Mitigation Plans)</th>
<th>Location in Plan</th>
<th>Met</th>
<th>Not Met</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B1.</strong> Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))</td>
<td>Volume II beginning on page 35&lt;br&gt;Drought - p.41&lt;br&gt;Earthquake - p.46-47&lt;br&gt;Flood - p.55&lt;br&gt;Landslide - p.58&lt;br&gt;Volcano - p.65-66&lt;br&gt;Wildfire – p.72&lt;br&gt;Winter Storm – p.73</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B2.</strong> Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))</td>
<td>Volume II beginning on page 35&lt;br&gt;Drought – p.42-43&lt;br&gt;Earthquake – p.47&lt;br&gt;Flood – p.55-56&lt;br&gt;Landslide – p.60&lt;br&gt;Volcano – p.66-67&lt;br&gt;Wildfire – p.72&lt;br&gt;Winter Storm – p.73-74</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B3.</strong> Is there a description of each identified hazard’s impact on the community as well as an overall summary of the community’s vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))</td>
<td>Volume II beginning on p.35&lt;br&gt;Drought – p.44&lt;br&gt;Earthquake – p.50-54</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B4.</strong> Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))</td>
<td>Volume II, Flood p.56-57</td>
<td>x</td>
<td></td>
<td></td>
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</tbody>
</table>

## ELEMENT B: REQUIRED REVISIONS

<table>
<thead>
<tr>
<th></th>
<th>Regulation (44 CFR 201.6 Local Mitigation Plans)</th>
<th>Location in Plan</th>
<th>Met</th>
<th>Not Met</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C1.</strong> Does the plan document each jurisdiction’s existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))</td>
<td>Volume I, Section 2. p.20-26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>C2.</strong> Does the Plan address each jurisdiction’s participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))</td>
<td>Volume II, p.57, Volume III, p.90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>C3.</strong> Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(ii))</td>
<td>Volume II, Landslide p.62, Volume III, Flood, p.107</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>C4.</strong> Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))</td>
<td>Volume III: Mitigation Resources p.81-97</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### ELEMENT C: REQUIRED REVISIONS

**C5.** Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))

Location in Plan: Volume III, Appendix D p.111-120

**C6.** Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(iii))


### ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)

**D1.** Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))

Location in Plan: Volume I, Section 2, 3, 4. p.13-32

**D2.** Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))

Location in Plan: Volume I, Section 2, 3, 4. p.13-32

**D3.** Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))

Location in Plan: Volume I, Section 2, 3, 4. p.13-32

### ELEMENT E. PLAN ADOPTION

**E1.** Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))

Location in Plan: To Include After Pre-Approval

**E2.** For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))

Location in Plan: To Include After Pre-Approval

### ELEMENT F. ADDITIONAL STATE REQUIREMENTS

(.equalsIgnoreCase("STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA")

The State of Oregon imposes no additional requirements upon local mitigation plans.

### SECTION 3: PLAN ASSESSMENT

**A. Plan Strengths and Opportunities for Improvement**
This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

**Element A: Planning Process**

<table>
<thead>
<tr>
<th>How does the Plan go above and beyond minimum requirements to document the planning process with respect to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Involvement of stakeholders (elected officials/decision makers, plan implementers, business owners, academic institutions, utility companies, water/sanitation districts, etc.);</td>
</tr>
<tr>
<td>• Involvement of Planning, Emergency Management, Public Works Departments or other planning agencies (i.e., regional planning councils);</td>
</tr>
<tr>
<td>• Diverse methods of participation (meetings, surveys, online, etc.); and</td>
</tr>
<tr>
<td>• Reflective of an open and inclusive public involvement process.</td>
</tr>
</tbody>
</table>

**Plan Strengths**

- Opportunities for Improvement

**Element B: Hazard Identification and Risk Assessment**

*In addition to the requirements listed in the Regulation Checklist, 44 CFR 201.6 Local Mitigation Plans identifies additional elements that should be included as part of a plan’s risk assessment. The plan should describe vulnerability in terms of:*

1) A general description of land uses and future development trends within the community so that mitigation options can be considered in future land use decisions;
2) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; and
3) A description of potential dollar losses to vulnerable structures, and a description of the methodology used to prepare the estimate.

<table>
<thead>
<tr>
<th>How does the Plan go above and beyond minimum requirements to document the Hazard Identification and Risk Assessment with respect to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use of best available data (flood maps, HAZUS, flood studies) to describe significant hazards;</td>
</tr>
<tr>
<td>• Communication of risk on people, property, and infrastructure to the public (through tables, charts, maps, photos, etc.);</td>
</tr>
<tr>
<td>• Incorporation of techniques and methodologies to estimate dollar losses to vulnerable structures;</td>
</tr>
<tr>
<td>• Incorporation of Risk MAP products (i.e., depth grids, Flood Risk Report, Changes Since Last FIRM, Areas of Mitigation Interest, etc.); and</td>
</tr>
<tr>
<td>• Identification of any data gaps that can be filled as new data became available.</td>
</tr>
</tbody>
</table>

**Plan Strengths**

-
Opportunities for Improvement

- Element C: Mitigation Strategy

How does the Plan go above and beyond minimum requirements to document the Mitigation Strategy with respect to:

- Key problems identified in, and linkages to, the vulnerability assessment;
- Serving as a blueprint for reducing potential losses identified in the Hazard Identification and Risk Assessment;
- Plan content flow from the risk assessment (problem identification) to goal setting to mitigation action development;
- An understanding of mitigation principles (diversity of actions that include structural projects, preventative measures, outreach activities, property protection measures, post-disaster actions, etc);
- Specific mitigation actions for each participating jurisdictions that reflects their unique risks and capabilities;
- Integration of mitigation actions with existing local authorities, policies, programs, and resources; and
- Discussion of existing programs (including the NFIP), plans, and policies that could be used to implement mitigation, as well as document past projects.

Plan Strengths

- Opportunities for Improvement

- Element D: Plan Update, Evaluation, and Implementation (Plan Updates Only)

How does the Plan go above and beyond minimum requirements to document the 5-year Evaluation and Implementation measures with respect to:

- Status of previously recommended mitigation actions;
- Identification of barriers or obstacles to successful implementation or completion of mitigation actions, along with possible solutions for overcoming risk;
- Documentation of annual reviews and committee involvement;
- Identification of a lead person to take ownership of, and champion the Plan;
- Reducing risks from natural hazards and serving as a guide for decisions makers as they commit resources to reducing the effects of natural hazards;
- An approach to evaluating future conditions (i.e. socio-economic, environmental, demographic, change in built environment etc.);
- Discussion of how changing conditions and opportunities could impact community resilience in the long term; and
- Discussion of how the mitigation goals and actions support the long-term community vision for increased resilience.

Plan Strengths
Opportunities for Improvement

B. Resources for Implementing Your Approved Plan

<table>
<thead>
<tr>
<th>Ideas may be offered on moving the mitigation plan forward and continuing the relationship with key mitigation stakeholders such as the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• What FEMA assistance (funding) programs are available (for example, Hazard Mitigation Assistance (HMA)) to the jurisdiction(s) to assist with implementing the mitigation actions?</td>
</tr>
<tr>
<td>• What other Federal programs (National Flood Insurance Program (NFIP), Community Rating System (CRS), Risk MAP, etc.) may provide assistance for mitigation activities?</td>
</tr>
<tr>
<td>• What publications, technical guidance or other resources are available to the jurisdiction(s) relevant to the identified mitigation actions?</td>
</tr>
<tr>
<td>• Are there upcoming trainings/workshops (Benefit-Cost Analysis (BCA), HMA, etc.) to assist the jurisdictions(s)?</td>
</tr>
<tr>
<td>• What mitigation actions can be funded by other Federal agencies (for example, U.S. Forest Service, National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA) Smart Growth, Housing and Urban Development (HUD) Sustainable Communities, etc.) and/or state and local agencies?</td>
</tr>
</tbody>
</table>