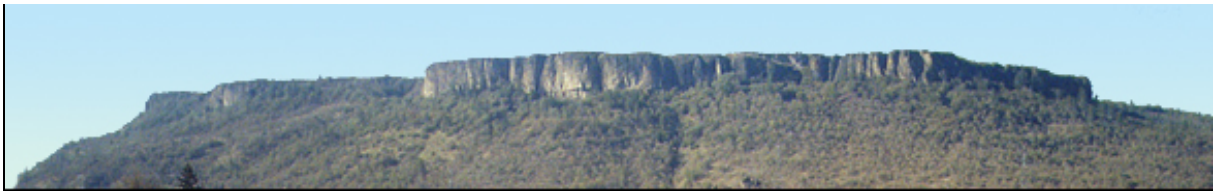

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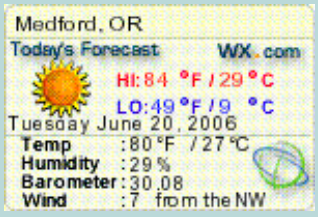

Natural Hazards Mitigation Plan

The Jackson County Natural Hazards Mitigation Plan includes resources and information that will assist county residents, public and private sector organizations and other interested people in participating in natural hazard mitigation activities. The Plan is organized around seven goals. Each goal includes a set of actions the County can take or coordinate to mitigate risk from natural hazards. The key activities are summarized in a five-year action plan. The Five-Year Action Plan Matrix lists the activities that will assist Jackson County in reducing risk and preventing loss from future natural hazard events. The action items address multi-hazard issues, as well as activities for flood, landslide, severe winter storm, windstorm, wildfire, earthquake and volcanic eruption hazards. This plan has been approved by FEMA and approved and adopted by the Board of Commissioners on January 31, 2006.

BOC ORDER NO 33-06.PDF (248.1KB)
Board Order No. 33-06
Approval and adoption of plan on January 31, 2006.

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Cover and Acknowledgements

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BEFORE THE BOARD OF COUNTY COMMISSIONERS

STATE OF OREGON, COUNTY OF JACKSON

IN THE MATTER OF APPROVING THE JACKSON COUNTY NATURAL HAZARDS MITIGATION PLAN	)))	ORDER NO. 33-06

WHEREAS, the Jackson County Natural Hazards Mitigation Plan has received final approval from FEMA, contingent upon approval and adoption by the Jackson County Board of Commissioners; and

WHEREAS, this plan's adoption and approval would allow the county to seek federal mitigation grants to assist with performing some of the mitigation actions identified within the Natural Hazards Mitigation Plan.

Now, therefore,

The Board of County Commissioners of Jackson County ORDERS:

1. The attached Natural Hazards Mitigation Plan is hereby adopted.

2. The County Administrator is hereby authorized to execute any and all future grant agreements, contracts, amendments, addendums, or any other type of document related to the Natural Hazards Mitigation Plan hereby adopted.

DATED this 31st day of January, 2006, at Medford, Oregon.

JACKSON COUNTY BOARD OF COMMISSIONERS

Dave Gilmour, Chair

Dennis C.W. Smith, Commissioner

Jack Walker, Commissioner

ORDER

Jackson County
Natural Hazards Mitigation Action Plan

Prepared by:

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November 2005

Community Planning Workshop

Special Thanks & Acknowledgements

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Mike Mathews, Applegate River Watershed Council
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Geographic Information Systems (GIS) Maps:

Keith Massie, Jackson County Information Technology
Community Planning Workshop developed maps for the Jackson County Natural Hazards Mitigation Plan with assistance from InfoGraphics at the University of Oregon and the Jackson County Planning Department.
Matthew Mattia, Community Planning Workshop
Ken Kato, InfoGraphics, Dept. of Geography, University of Oregon

Additional Thanks:

Rivernet/Rogue Valley Community Organizations Active in Disaster
Rogue Valley Fire Chiefs Association
Jackson County Department Directors
EMS/Mass Casualty Incident group
The Executive Board for the Jackson County Fire Plan
The Domestic Preparedness Bio-terrorism Committee
Community Planning Workshop staff: Jennifer Brost, Julie Foster, Kathy Lynn, Nancy Owen-Myers, and Adam Zimmerman

Jackson County
Natural Hazards Mitigation Action Plan

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Executive Summary:

Five-Year Action Plan

What is the mitigation plan?

The Jackson County Natural Hazards Mitigation Plan includes resources and information that will assist county residents, public and private sector organizations and other interested people in participating in natural hazard mitigation activities. The Plan is organized around seven goals. Each goal includes a set of actions the County can take or coordinate to mitigate risk from natural hazards. The key activities are summarized in a five-year action plan. The Five-Year Action Plan Matrix lists the activities that will assist Jackson County in reducing risk and preventing loss from future natural hazard events. The action items address multi-hazard issues, as well as activities for flood, landslide, severe winter storm, windstorm, wildfire, earthquake and volcanic eruption hazards.

What is the plan's mission?

The mission of the Jackson County Natural Hazards Mitigation Action Plan is to *reduce risk, prevent loss and protect life, property and the environment from natural hazard events through coordination and cooperation among public and private partners*.

This mission was formulated by the steering committee during discussions about goals and the overall plan mission.

Who participated in developing the plan?

This mitigation plan is the result of a collaborative planning effort between Jackson County citizens, public agencies, non-profit organizations, the private sector, and state and regional organizations. The original project steering committee, convened in 2001, was comprised of representatives from the following organizations:

- Jackson County Emergency Management Office;
- Jackson County Planning;
- Applegate River Watershed Council;
- Southern Oregon University;
- Southern Oregon Regional Economic Development,Inc.;
- Jackson County Engineering;
- American Red Cross.

During the second phase of plan development and refinement, Jackson County Emergency Management continued to have an instrumental role, and broader connections were forged with groups in the region's emergency response community and with local voluntary organizations interested in disaster. (For details, see Appendix A: Public Participation Process.)

What are plan goals?

Plan goals are broad statements of direction and help focus future efforts. Goals are important because they are a bridge between the far-reaching, overall mission and the individual action items, or activities, identified to reduce Jackson County's risk from flood, landslide, wildfire, severe winter storm and windstorm, seismic and volcanic events.

Plan goals were formulated through research, reviewing other local and national mitigation goals, and through interviews with stakeholders in Jackson County. Goals were refined through discussions with the steering committee and input from public workshops. The seven goals and associated goals statements are:

Goal #1: PROPERTY PROTECTION

Goal Statement: Lessen impact from natural disaster on individual properties, businesses and public facilities by increasing awareness at the individual level and encouraging activities that can prevent damage and loss of life from natural hazards.

Goal #2: EDUCATION AND OUTREACH

Goal Statement: Further the public's awareness and understanding of natural hazards and potential risk, including economic vulnerability and mitigation efforts.

Goal #3: PREVENTATIVE

Goal Statement: Reduce the threat of loss of life and property from natural hazards by incorporating information on known hazards and providing incentives to make hazard mitigation planning a priority in land use policies and decisions, including plan implementation.

Goal #4: PARTNERSHIP AND COORDINATION

Goal Statements:

- Identify mitigation or risk reduction measures that address multiple areas (i.e. environment, transportation, telecommunications);
- Coordinate public/private sector participation in planning and implementing mitigation projects throughout the county; and
- Seek funding and resource partnerships for future mitigation efforts.

Goal #5: STRUCTURAL PROJECTS

Goal Statement: When applicable, utilize structural mitigation activities to minimize risks associated with natural hazards.

To read about the community's priority of plan goals, see *Section 3: Multi-Hazard Goals and Action Items.*

Goal #6: NATURAL RESOURCE PROTECTION

Goal Statement: Preserve and rehabilitate natural systems to serve natural hazard mitigation functions (i.e. floodplains, wetlands, watersheds and urban interface areas).

Goal #7: EMERGENCY SERVICES

Goal Statement: Minimize life safety issues by promoting, strengthening and coordinating emergency response plans.

What are action items?

Action items are more specific than goals. Action items are defined activities or strategies meant to achieve the plan goals. One action item might address several plan goals. There are some action items that are considered "multi-hazard" action items because the scope of the activities apply to all natural hazards rather than a narrower scope that applies to one natural hazard in particular. The action items are organized here into a matrix, which lists all of the multi-hazard and hazard-specific action items included in the mitigation plan.

The matrix identifies action items determined through meetings with the project steering committee, local, regional, state and federal programs, stakeholder input and public workshops attended by residents of Jackson County. Activities within the matrix may be considered for funding through federal and state grant programs, and through the Federal Emergency Management Agency's Hazard Mitigation Grant Program, should funds be made available. The matrix includes the following five elements for each action item to help ensure implementation of the activities:

1. *Coordinating organization(s)*
2. *Partner organizations*
3. *Timeline*
4. *Notes and implementation ideas*
5. *Plan goals addressed.*

More information about multi-hazard goals and action items can be found in *Section 3: Multi-Hazard Goals and Action Items*.

The ***coordinating organization*** is the agency or public/private sector organization that is willing and able to organize resources, find appropriate funding and oversee activity implementation, monitoring and evaluation. Coordinating organizations may include local, county or regional agencies and public/private sector organizations that are in relative proximity to the county to be able to implement activities and programs.

Partner organizations are those agencies or public/private sector organizations that will assist the coordinating organization in implementing action items by providing relevant resources. Partner organizations may include regional, state and federal agencies, as well as local and county public and private sector organizations.

The partner organizations listed in the Jackson County Natural Hazards Mitigation Action Plan are potential partners recommended by the project steering committee, but not necessarily contacted during the development of the mitigation plan. Partner organizations should be contacted by the coordinating organization to establish commitment of time and or resources to action items.

The ***timeline*** for action items is divided into short term and long-term activities.

- *Short-term action items* are activities which agencies and organizations are capable of implementing within their existing resources and authorities during a 1 to 2 year period. Usually, only county agencies are listed as coordinating organizations. Occasionally, federal and state agencies, local governments, and other organizations may be included as potential cooperating partners in implementing the activity.
- *Long-term action items* are actions that will require new or additional resources or authorities to implement, and those actions that will occur within 3 to 5 years.

Each action item includes ***notes and implementation ideas***, and ***potential resources***, which may include grant programs, or human and organizational resources. The individual hazard sections detail this information for each action item. The matrix includes the page number within the Mitigation Plan where the more detailed information can be found.

Plan goals addressed identifies the plan goal(s) each action item addresses. The Jackson County Natural Hazard Mitigation Plan has seven plan goals, and associated goal statements, to meet the overall mission of *reduce risk, prevent loss and protect life, property and the environment from natural hazard events through coordination and cooperation among public and private partners.*

Natural Hazard	Action Item	Coordinating Organization	Partner Organizations	Timeline	Action Item Notes	Plan Goals Addressed						
						Property Protection	Education & Outreach	Preventative	Partnership and Coordination	Structural Projects	Natural Resource Protection	Emergency Services
Short-Term Multi-Hazard #1	Sustain a public awareness campaign about natural hazards.	County and City Emergency Management Agencies	ARC, CERT, RVCOG, SOU, FEMA, SOREDI, Emergency Response Agencies, OEM, Media, Utility & Telecommunications Companies, County Roads & Public Works	ongoing	pg. 3-5	✓	✓	✓	✓			
Short-Term Multi-Hazard #2	Sustain an education and outreach program for local jurisdictions and assist them in developing emergency operations, public information and hazard mitigation plans.	County Emergency Management	City Emergency Management Agencies, MCI Committee, ARC, Emergency Response Agencies, RVCOG, OEM, FEMA	ongoing	pg. 3-6		✓	✓	✓			
Short-Term Multi-Hazard #3	Maintain a GIS inventory of all critical facilities, large employers/public assembly areas and lifelines, and use GIS to evaluate their vulnerability by comparing them with hazard-prone areas.	County GIS	County & City Emergency Management Agencies, County Roads, ODOT, City Public Works, Utility & Telecommunications Companies, Emergency Response Agencies, RVCOG, SOU, ODF, BLM, USFS	ongoing	pg. 3-6		✓	✓				✓
Short-Term Multi-Hazard #4	Promote natural hazards safety education.	School Districts, Facility Safety Personnel	County & City Emergency Mgmt., CERT, SOU, Search & Rescue, Emergency Response, ARC, OEM, LEPC, Association of Safety Engineers, REAL Corps, FEMA, Utility & Telecommunications Companies, Media, RVCOG	ongoing	pg. 3-7		✓		✓			
Short-Term Multi-Hazard #5	Establish partnerships to coordinate and collect geo-science and technical information for identifying potential areas of risk.	County GIS, RVCOG	County & City Emergency Management Agencies, SOU, ODF, BLM, USFS, USGS, DOGAMI, Emergency Response Agencies, OEM, FEMA	ongoing	pg. 3-7		✓		✓			

Natural Hazard	Action Item	Coordinating Organization	Partner Organizations	Timeline	Action Item Notes	Plan Goals Addressed						
						Property Protection	Education & Outreach	Preventative	Partnership and Coordination	Structural Projects	Natural Resource Protection	Emergency Services
Short-Term Multi-Hazard #6	Create and maintain a system to support populations with special needs (e.g., elderly and disabled persons) during a disaster.	County Emergency Management	RVCOG Senior & Disabled Services, Community Works, City Emergency Management Agencies, County GIS, RVIRNet, ARC, Emergency Response Agencies	1-2 years	pg. 3-7		✓		✓			✓
Short-Term Multi-Hazard #7	Explore funding sources and grant opportunities for community-wide natural hazard mitigation activities.	Mitigation Plan Steering Committee	County Administrative Office, SOREDI, OEM, FEMA, IISOI	1-2 years	pg. 3-8		✓	✓				
Long-Term Multi-Hazard #1	Update the Jackson County Emergency Operations Plan and the Natural Hazards Mitigation Action Plan on an annual basis. Conduct a complete review of the plans and have them officially promulgated by the approving authorities every five years.	County Emergency Management	County, Mitigation Plan Steering Committee, City Emergency Management Agencies, ARC, RVFCA, Law Enforcement Heads, EMS Committee, National Weather Service, Utility & Telecommunications Companies, OSP, ODF, ODOT, National Guard, RVIRNet, ARES	ongoing	pg. 3-8							✓
Long-Term Multi-Hazard #2	Make the Jackson County Emergency Operations Plan and the Natural Hazards Mitigation Action Plan available to the public by publishing the plans electronically.	County Emergency Management	County GIS	3-5 years	pg. 3-9		✓					
Long-Term Multi-Hazard #3	Establish post-development inspection procedures for safety requirements (i.e. flood, earthquake, fire safety).	County Building	County Planning, FEMA	non-established	pg. 3-9			✓				
Long-Term Multi-Hazard #4	Use hazard information as a basis for county ordinances and regulations that govern site-specific land use decisions.	County Planning	County GIS	non-established pending funding for task	pg. 3-9		✓	✓				

Natural Hazard	Action Item	Coordinating Organization	Partner Organizations	Timeline	Action Item Notes	Plan Goals Addressed						
						Property Protection	Education & Outreach	Preventative	Partnership and Coordination	Structural Projects	Natural Resource Protection	Emergency Services
Long-Term Multi-Hazard #5	Investigate the need for an emergency disaster fund.	County Emergency Management	SOREDI, RVCOG, City Councils, City Emergency Management Agencies	3-5 years	pg. 3-10			✓	✓			
Long-Term Multi-Hazard #6	Improve planning, notification and training for volunteers.	County Emergency Management	RVIRNet, City Emergency Management Agencies, CERT, ARC, ARES, Search & Rescue	3-5 years	pg. 3-10		✓		✓			✓
Long-Term Multi-Hazard #7	Promote hazard resistant utility and telecommunication construction and maintenance methods.	RVCOG	County & City Emergency Management Agencies, ARES	3-5 years	pg. 3-10		✓	✓				
Long-Term Multi-Hazard #8	Develop a system for data collection for non-declared natural hazard events.	County & City Emergency Management Agencies	IISOI, County Building, County GIS, Farm Services, Insurance Companies	3-5 years	pg. 3-11		✓		✓			✓
Long-Term Multi-Hazard #9	Improve coordination and evaluate technical and engineering limitations for catastrophic event response, and develop a long-term recovery plan for Jackson County from the effects of catastrophic hazards.	County Emergency Management	Klamath County Emergency Management, Regional Search & Rescue, Army National Guard, hospitals, SOU, USGS, DOGAMI, ARC	1-5 years	pg. 3-11		·	·	✓			✓
Short-Term Flood #1	Continue to coordinate with appropriate agencies, and maintain an inventory of all aggregate operations adjacent to or within the floodplain to ensure operations protect streams.	DOGAMI, County Planning, County Engineering	County GIS, Watershed Councils, DEQ, ODFW, USACE, DSL	ongoing	pg. 4-18			✓	✓		✓	
Short-Term Flood #2	Coordinate river gauge information.	NWS (Medford Office)	Watershed Councils, Cities, RVCOG, OSU Extension Service, USGS, WRD, USACE, BOR, private river gauges	1-2 years	pg. 4-18				✓			

Natural Hazard	Action Item	Coordinating Organization	Partner Organizations	Timeline	Action Item Notes	Plan Goals Addressed						
						Property Protection	Education & Outreach	Preventative	Partnership and Coordination	Structural Projects	Natural Resource Protection	Emergency Services
Short-Term Flood #3	Maintain an inventory of all permitted dams in Jackson County .	County Emergency Management, Water Master	Watershed Councils, USACE, BOR, WRD	1-2 years	pg. 4-18		✓	✓		✓		
Short-Term Flood #4	Conduct workshops for target audiences on National Flood Insurance Programs, mitigation activities, and potential assistance from FMA and HMGP.	County Planning, County & City Emergency Management Agencies	Watershed Councils, DLCD, OEM, FEMA	ongoing	pg. 4-19	✓	✓	✓	✓			
Long-Term Flood #1	Update the Flood Insurance Rate (FIRM) Maps for Jackson County as funding becomes available.	FEMA, DLCD	County Planning, County GIS	3 to 5 years	pg. 4-19	✓		✓	✓			
Long-Term Flood #2	Encourage private property owners to restore natural areas related to flooding, and to manage riparian areas and wetlands for flood abatement.	RVCOG, County Emergency Management	County Parks & Planning, FEMA, Watershed Councils, Cities, USACE, DSL	3-5 years	pg. 4-19	✓					✓	
Long-Term Flood #3	Use federal grant funds to acquire or elevate individual properties adjacent to/within the 100-year floodplain as opportunities arise.	County Emergency Management	FEMA, County Planning, County Administrator's, Office, OEM, DLCD, OECDD	3-5 years	pg. 4-20	✓		✓			✓	
Long-Term Flood #4	Continue to increase Jackson County's CRS (Community Rating System) rating over time through activities outlined by FEMA.	County & City Emergency Management, County Planning	Watershed Councils, OEM, DLCD, OECDD, USACE, FEMA	ongoing	pg. 4-20	✓		✓	✓			
Long-Term Flood #5	Preserve water quality by using storm water best management practices.	County Roads, RVCOG, DEQ	Watershed Councils, WRD, USACE	3-5 years	pg.4-20						✓	
Short-Term Landslide #1	Compile Relative Landslide Risk maps for Jackson County.	DOGAMI, County GIS	County Planning, County Emergency Management, ODF, SOU	Dependent on DOGAMI funding	pg. 5-14		✓	✓	✓			

Natural Hazard	Action Item	Coordinating Organization	Partner Organizations	Timeline	Action Item Notes	Plan Goals Addressed						
						Property Protection	Education & Outreach	Preventative	Partnership and Coordination	Structural Projects	Natural Resource Protection	Emergency Services
Short-Term Landslide #2	Increase public education related to landslide hazards by distributing DOGAMI landslide informational brochure.	County Emergency Management	County Planning, City Emergency Managers, DOGAMI, OEM, ODF, DLCD	1-2 years	pg. 5-14		✓		✓			
Long-Term Landslide #1	Investigate the development and implementation of a county landslide ordinance.	County Planning	County Emergency Management, County GIS, DOGAMI, ODF, County Roads	3-5 years	pg. 5-14			✓				
Short-Term Winter Storm & Windstorm #1	Map areas where extreme weather, such as road icing or wind damage occurs.	County GIS	County Planning, NWS, ODOT, NOAA	1-2 years	pg. 6-17		✓		✓			
Long-Term Winter Storm & Windstorm #1	Promote the benefits of tree-trimming and tree replacement programs and help to coordinate local efforts by public and private agencies.	County Roads, Vegetation Management	Utility and Telecommunications Companies, ODOT, City Public Works, USFS, BLM	3-5 years	pg. 6-17		✓	✓	✓			
Short-Term Wildfire #1	Continue working with the Rogue Valley Fire Prevention Cooperative in the review of plans and inspection of structures for fire code compliance.	County Building	Rogue Valley Fire Prevention Cooperative, State Fire Marshal	ongoing	pg. 7-13			✓	✓			
Short-Term Wildfire #2	Advocate water storage facilities with fire-resistant electrical pump systems in development that is not connected to a community water/hydrant system.	RVFCA, Rural Fire Districts, State Fire Marshal	County Planning, ODF	ongoing	pg. 7-13	✓		✓				
Short-Term Wildfire #3	Continue to promote public awareness campaigns for individual property owners living in interface areas.	RVFCA, RVCOG, Rural Fire Districts, ODF, County & City Emergency Management Agencies	Media, County Planning, OEM, FEMA	ongoing	pg. 7-13	✓	✓	✓	✓			

Natural Hazard	Action Item	Coordinating Organization	Partner Organizations	Timeline	Action Item Notes	Plan Goals Addressed						
						Property Protection	Education & Outreach	Preventative	Partnership and Coordination	Structural Projects	Natural Resource Protection	Emergency Services
Long-Term Wildfire #1	Promote the expansion of rural fire districts.	Rural Fire Districts, County Assessor	Rogue Valley Fire Training Association	3-5 years	pg. 7-14	✓		✓	✓			✓
Long-Term Wildfire #2	Reduce wildfire fuels.	Rogue Recycling, BioMass	County Planning, Rural Fire Districts, ODF, State Fire Marshal, BLM, USFS, Co-generation facilities, Applegate Community Partnerships	3-5 years	pg. 7-14	✓	✓	✓				
Short-Term Earthquake #1	Promote building safety through nonstructural improvements.	County & City Emergency Management Agencies	County Building Officials, County Emergency Response Agencies, Builder's Association, IISOI, Red Cross, OSSPAC, OIT, DOGAMI	1-2 years	pg. 8-12	✓	✓	✓				
Short-Term Earthquake #2	Encourage purchase of earthquake hazard insurance.	IISOI through local insurance companies	Mortgage companies	1-2 years	pg. 8-12	✓	✓					
Short-Term Earthquake #3	Maintain an inventory of all permitted dams in Jackson County.	County & City Emergency Management Agencies, Water Master	Watershed Councils, USACE, BOR, WRD	1-2 years	pg. 8-12		✓	✓		✓		
Long-Term Earthquake #1	Compile Relative Earthquake Hazard maps for Jackson County.	DOGAMI, County GIS	County Planning, County Emergency Management, USGS, BLM, SOU	3-5 years	pg. 8-13		✓	✓	✓			
Long-Term Earthquake #2	Promote the use of earthquake loss estimation program (HAZUS) at the local level by providing for the training to use the computer model.	County GIS, DOGAMI	Utility & Telecommunications Companies, County & City Emergency Management Agencies, OEM, FEMA	3-5 years	pg. 8-13		✓	✓	✓			

Natural Hazard	Action Item	Coordinating Organization	Partner Organizations	Timeline	Action Item Notes	Plan Goals Addressed						
						Property Protection	Education & Outreach	Preventative	Partnership and Coordination	Structural Projects	Natural Resource Protection	Emergency Services
Long-Term Earthquake #3	Develop public/private partnerships – with building contractors, architects – to pursue retrofitting projects.	SOREDI	County Roads, Builder's Association, IISOI	3-5 years	pg. 8-13		✓		✓			
Short-Term Volcano #1	Increase awareness of volcanic eruptions for county residents.	County & City Emergency Management Agencies, CVO	DOGAMI, SOU, National Park Service (Crater Lake)	1-2 years	pg. 9-13		✓		✓			
Long-Term Volcano #1	Create and map hypothetical eruption scenarios to display potential eruption hazards.	SOU, USGS-CVO	County GIS, DOGAMI	3-5 years	pg. 9-13		✓					
Long-Term Volcano #2	Collaborate with county environmental health for immediate warning to communities about air quality.	County Environmental Health, DEQ	County & City Emergency Management Agencies, Media	3-5 years	pg. 9-14				✓			✓

Section 1:
Mitigation Plan Introduction

Jackson County Presidential Disaster Declaration

In 1996 and 1997, storms and severe weather conditions led to significant flooding and landslides in Oregon, which caused substantial property damage and the death of five people in Douglas County. Jackson County was among the counties in Oregon to receive a presidential disaster declaration during these storm events.

As a result of the 1996/1997 events, Jackson County received an Oregon Community Development Block Grant from the U.S. Department of Housing and Urban Development (HUD). The grant was disbursed through the Oregon Economic and Community Development Department to develop a Natural Hazards Mitigation Action Plan. Jackson County initiated development of the Natural Hazards Mitigation Plan in 2000.

Jackson County Natural Hazards Mitigation Plan Mission: *to reduce risk, prevent loss and protect life, property and the environment from natural hazard events through coordination and cooperation among public and private partners.*

Why Develop a Mitigation Plan?

A mitigation plan seeks to provide resources, information and strategies for risk reduction, while helping to guide and coordinate mitigation activities throughout the county. The plan provides a set of action items to reduce risk from natural hazards through education, outreach programs, the development of partnerships, and the implementation of preventative activities such as land use or watershed planning programs.

The resources and information within the mitigation plan establish a foundation for coordination and collaboration among agencies and the public in Jackson County, identify and prioritize future mitigation projects, and assist in meeting qualifications for federal assistance programs. The plan works in conjunction with other county plans, including the local and county comprehensive plans and emergency operations plans. The plan offers mitigation strategies for coordination among all the county's plans.

The Role of State Agencies in Natural Hazards

All mitigation occurs at the local level, and the primary responsibility for development and implementation of risk reduction strategies and policies lies with the local jurisdictions. Local jurisdictions, however, are not alone in risk reduction efforts. Partners and resources do exist at the state and federal level. Numerous Oregon State agencies

Mitigation is the development and implementation of activities designed to reduce or eliminate impacts resulting from natural hazards.

have a role in natural hazards and natural hazard mitigation. Some of the key agencies involved in natural hazards are:[1]

- **Oregon State Police - Office of Emergency Management (OEM),** are responsible for disaster mitigation, preparedness, response, recovery, and the administration of federal funds after a major disaster declaration;
- **Oregon Building Codes Division (BCD)** and local counterparts, are responsible for construction and for some hazards that are building-specific in their occurrence (such as earthquakes); also included are provisions for expansive soils, and damage assessment of buildings after an earthquake.
- **Oregon Department of Geology and Mineral Industries, (DOGAMI)** is responsible for geologic hazard characterization, public education, the development of partnerships aimed at reducing risk, and exceptions (based on science-based refinement of tsunami inundation zone delineation) to state mandated tsunami zone restrictions; and
- **Oregon Department of Land Conservation and Development (DLCD),** is responsible for planning-based hazard management including implementation of land use planning and Goal 7 (natural hazards), with attention given to hazard assessments and hazard mitigation.

For more information about these agencies, please see *Appendix B: Resource Directory* and the hazard specific resources in each hazard section.

Natural Hazards Land Use Policy in Oregon

Planning for natural hazards is an integral element of the Oregon land use planning program, which was begun in 1973. All Oregon cities and counties have comprehensive plans and implementing ordinances that comply with the statewide planning goals. The continuing challenge faced by local officials and state government is to keep this network of coordinated local plans effective in responding to the changing conditions and needs of Oregon communities.

This is particularly true in the case of planning for natural hazards, where communities must balance development pressures with information on the nature and extent of hazards. Oregon's land use program has given its communities and citizens a unique opportunity to ensure that natural hazards will be included in the development and implementation of local comprehensive plans, thus reducing the risk and damage from future natural disasters.

National Initiatives

The rising cost of natural disasters over the past decade has led to a renewed interest in identifying effective ways to reduce vulnerability to disasters.

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[1] Descriptions derived from Oregon Department of Geology and mineral Industries, *Special Paper 31 Mitigating Geologic Hazards in Oregon: A Technical Reference Manual, 1999.*

Communities face a number of barriers to implementing natural hazard risk reduction measures. In 1996 FEMA estimated that Oregon saved about $10 million a year in flood losses because of strong land-use planning. Statewide land-use planning Goal 7 calls for local plans to include inventories, policies, and ordinances to guide development in hazard areas.[2] Goal 7, along with other land-use planning goals, has helped to reduce losses from natural hazards such as severe winter storms.

Public awareness and the number of activities related to planning for natural hazards are increasing throughout the state. As Oregon's population continues to grow at a rapid pace, land development and increasing population density is putting a greater percentage of people and the environment at risk from natural hazards.

Who will benefit from this Mitigation Plan?

The Jackson County Natural Hazards Mitigation Plan affects the jurisdictions within the county, including all rural, unincorporated communities. While this plan has no direct influence over the eleven cities in Jackson County, it provides a framework for planning for natural hazards in Jackson County. The resources and information provided pertain to all areas within the county and the recommendations can lay groundwork for localized mitigation plans and partnerships.

Phase One of the Planning Process: 2001- 2003

The development of this NHMP took place over a five-year period with significant changes in personnel. The first phase of the planning process began in 2001 with the assistance of a consulting group, the Community Planning Workshop; it ended in 2003 with the submission of a draft NHMP. The process was under the wing of Sandra Eccker, then Jackson County Emergency Services Coordinator. Data sources and contributors during this first phase of the planning process included:

- ***Input from the steering committee:*** Community Planning Workshop assisted Jackson County Emergency Management in organizing a steering committee to help guide the development of the mitigation plan. The steering committee played an integral role in developing the mission, goals and action items for the mitigation plan. The steering committee was comprised of eight people representing various agencies and organizations in Jackson County, including:
  - Southern Oregon Regional Economic Development, Inc.;
  - The American Red Cross;
  - Southern Oregon University;
  - Applegate River Watershed Council; and

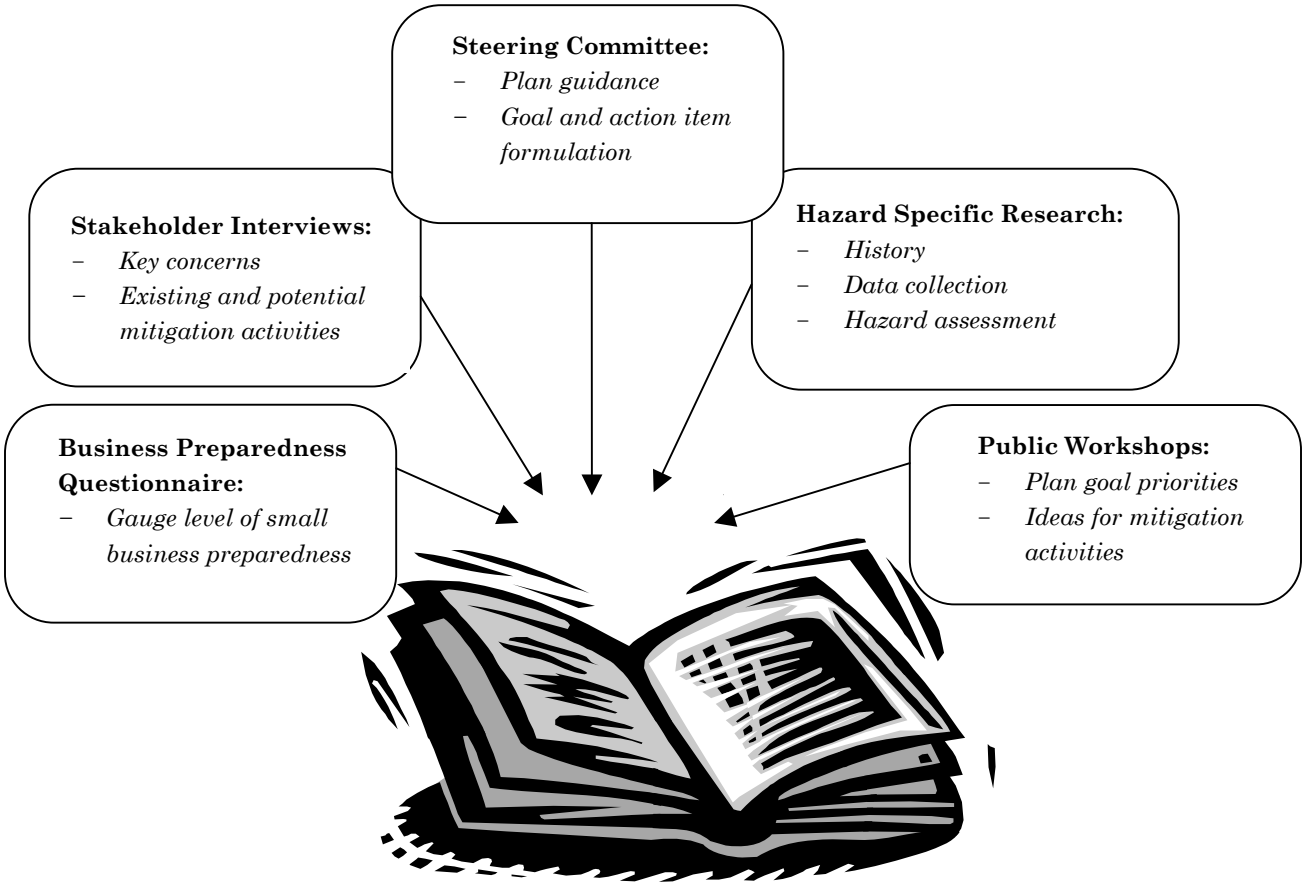
[2] Land Conservation and Development Commission (LCDC) http://www.lcd.state.or.us/goalsrul.html

  - Jackson County Engineering, Planning and Emergency Management Offices.

- ***Stakeholder interviews:*** CPW conducted 22 interviews with individuals, specialists and organizations working in natural hazards planning. These interviews were avenues of participation for county stakeholders not present on the steering committee. The interviews helped identify common concerns related to natural hazards and identified key short and long-term activities to reduce risk from natural hazards in Jackson County.
- ***Statewide and National Plan Review:*** CPW reviewed natural hazard mitigation plans from around the country and looked at current FEMA planning standards, including the Community Rating System. Plans from Tampa Bay, Florida and Narragansett, Rhode Island, and the *Planning For Natural Hazards: Oregon Technical Resource Guide, State of Oregon Natural Hazards Mitigation Plan,* and *Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments* helped identify reference materials and models for use in the development of the mitigation plan, and as a resource to communities in Jackson County.
- ***Business preparedness survey:*** CPW implemented a survey to gauge the level of preparedness of individual businesses in Jackson County, and to assess information needs regarding mitigation activities, and local, state and national resources and programs. The results of this survey identified potential strategies for reducing Jackson County's economic risk from natural hazards.
- ***Hazard specific research:*** CPW collected data and compiled research on seven specific natural hazards, including flood, landslide, severe winter storm and windstorm, wildfire, earthquake, and volcanic eruption. Specific research materials came from state agencies including OEM, DOGAMI, DLCD and the Oregon Department of Forestry. Current mitigation activities, resources, programs and specific short-term and long-term actions aimed to reduce hazard risk are also listed in each section.
- ***Public workshops:*** CPW facilitated two workshops to inform the public on Jackson County hazards, and gather comments and ideas from the citizens of Jackson County about mitigation planning. The public also prioritized goals that will help guide mitigation activities in reducing the risk from natural hazards.

These different components and inputs to the mitigation plan help ensure a strong local perspective and identify strategies and activities to make Jackson County more disaster resilient over time. The key outcomes from the different types of participation are essential to the formulation of the five-year action plan. Figure 2.1 shows the components of the mitigation planning process and each of the key outcomes.

Figure 2.1 Hazard Mitigation Planning Process
Hazard Assessment



The Jackson County Mitigation Plan compiles data for seven natural hazards in the county, and establishes mitigation goals and activities that should be revisited annually. Updating the action plan contents allows for the introduction of new data and technical resources, and maintains strong ties between cooperating agencies, organizations, non-profits, and governments. This continuous integration of new knowledge improves the assessment of each of the hazards in this plan, and improves Jackson County's ability to plan for, and withstand, the impacts of natural hazard events.

Conducting a hazard assessment can provide information on the location of the hazard, the value of existing land and property in the hazard location, and an analysis of risk to life, property and the environment that may result in a natural hazard event. Specifically, the three levels of a hazard assessment are:

1) ***Hazard Identification*** identifies the geographic extent of the hazard, the intensity of the hazard, and the probability of its occurrence. Maps are frequently used to display hazard identification data.

2) ***Vulnerability Assessment*** combines hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard.

3) ***Risk Analysis*** involves estimating the damage, injuries, and financial losses likely to be sustained in a geographic area over a given period of time. This

level of analysis involves using mathematical models. The two measurable components of risk analysis are magnitude of the harm that may result and the likelihood of the harm occurring.

Hazard assessments are subject to the availability of hazard-specific data. Gathering data for a hazard assessment requires a commitment of resources on the part of participating organizations and agencies. Each hazard-specific section of the Jackson County Mitigation Plan includes a section on hazard identification using data and information from county or state agency sources.

CPW conducted a vulnerability assessment for the flood hazard using a Geographic Information System (GIS) to identify the geographic extent of the hazard and assess the land use and value at risk from the flood hazard. The vulnerability assessment for the earthquake hazards is described using the Federal Emergency Management Agency's HAZUS analysis model. Insufficient data exists to conduct vulnerability assessments for the other natural hazards addressed in the plan: landslide, severe winter storm and windstorm, wildfire, and volcanic eruption. Furthermore, CPW did not conduct risk analyses for any of the natural hazards addressed in this mitigation plan, due to insufficient data.

Mitigation strategies can reduce disruption to critical services, reduce the risk to human life, and alleviate damage to personal and public property and infrastructure. Strategies the County can consider to assist in reducing risk are described in the action items detailed in section 3 of this plan. Action items in the hazard-specific sections also provide recommendations to collect further data to map hazard locations and conduct hazard assessments.

Maps showing "the geographic extent of a hazard, its intensity, and its probability of occurrence," with the land use types vulnerable to that hazard can be powerful educational tools for community members and decision makers.[3] In choosing to commit more resources to hazard assessment, a community achieves greater resistance to natural hazards and less disruption from unexpected hazard events. Mitigation strategies implemented before natural hazards occur can further reduce disruption to essential and business services, reduce the risk to human life and alleviate damage to personal and public property and infrastructure.

Phase Two of the Planning Process: 2004-2005

Jackson County's draft NHMP was first submitted to OEM and FEMA in 2003. That fall, FEMA's critique of the draft plan was received by the County. The critique called for revisions. However, when the Emergency Services Coordinator moved on to a new position, the plan was effectively put on hold until the County recruited a new Coordinator.

[3] Burby, R. (Ed.) (1998) *Cooperating with Nature: Confronting Natural Hazards with Land Use Planning for Sustainable Communities*. Washington DC: Joseph Henry Press.

Further progress on the plan was made once the County hired the new Emergency Program Manager, Mike Curry, in 2004. The second phase of the planning process began at that point. Curry responded to the FEMA critique by revising the plan and enhancing it with a set of GIS disaster-related maps to clarify the risks and hazards faced by Jackson County. Additionally, Curry reviewed all mitigation goals and objectives in the plan, updating the plan with respect to those already accomplished since 2003. There was no attempt to reconvene the Steering Committee, since half of the members of the original group were no longer in the same positions.

In 2005, the Plan was resubmitted with all required changes for review by OEM and FEMA. The Emergency Program Manager again received notice from FEMA that additional work was required, mainly in the arena of updating public and government involvement.

Thus, in the summer of 2005, the Emergency Program Manager undertook a campaign to bring the revised NHMP to the attention of the general public, interested voluntary groups and members of the region's emergency services community. The purpose was to ensure that the revised plan, the body of which had been developed some two years earlier, reflected the current perspective and approach of County government and the public.

By placing the NHMP on Jackson County's internet website, www.co.jackson.or.us, in May 2005, the Coordinator made the plan available to the general public.

From May 2005 through July 2005, the Emergency Program Manager made presentations on the NHMP to several government and public groups, including:

- Jackson County Department Directors
- The Domestic Preparedness Bio-terrorism Committee
- Jackson County Emergency Management Advisory Council (EMAC)
- The Rogue Valley Fire Chiefs Association
- The Executive Board for the Jackson County Fire Plan
- The EMS/MCI (Mass Casualty Incident) group
- Rivernet/COAD (Community Organizations Active in Disasters).

By taking the plan to each of these groups and posting the draft plan on the Internet, Curry connected with several publics, namely the emergency services community, the directors of all non-emergency response county departments, a set of private citizens who are informed about disasters and committed to helping when a disaster hits, and finally, the general public. Half the meetings with these groups were open to public attendance and participation.

The last group mentioned, the Rivernet/COAD group, is made up of several non-profits, voluntary organizations and interested members of the public, that plan to offer their services during disaster response and recovery. Members of these groups expressed interest in the plan and asked a variety of questions about the plan. The Manager, however, did not receive input that required changes to the plan, either in the form of new ideas to be included or desired revisions to what had been

written. He concluded that the plan met the needs and expectations of pertinent officials/personnel, the informed public and the general public.

In October 2005, two Jackson County Commissioners and the Emergency Program Manager were guests on the local government television program "Jackson County Live". They spoke about disaster preparedness and the NHMP during the show, which had a live call-in feature. This particular program was rebroadcast more than 20 times on two local stations, providing broad public exposure to the plan.

For many more details on the Public Participation Process used to develop this plan, the reader is referred to Appendix A of this document.

How can I use this plan?

This plan is organized on three levels. First, the Executive Summary and Five-Year Action Plan are intended to provide an overview of how the plan was developed and what action items are proposed. Second, the hazard-specific chapters are intended to provide background information on each hazard, specific action items, and local, county, and state resources. Finally, the appendices provide information on the plan development process and other specific issues.

Plan Organization

The Mitigation Plan contains ten sections and six appendices, including the plan introduction. The twelve sections of the plan include: a five-year action plan, background on the purpose and methodology used to develop the mitigation plan, information on business preparedness, and sections on seven natural hazards that occur in Jackson County.

- ***Executive Summary and Five-Year Action Plan Matrix*** provides an overview of plan goals, and focuses on the ***47*** short and long-term action items presented in the plan. These action items address multi-hazard issues, as well as hazard-specific activities that can be implemented to reduce risk and prevent loss from future natural hazard events.
- ***Section 1: Mitigation Plan Introduction*** describes the background and purpose of developing the mitigation plan for Jackson County.
- ***Section 2: Picture of Jackson County*** paints a portrait of the history, landscape, demographics and socio-economics of Jackson County. This section also provides a historical perspective on natural hazards in the county.
- ***Section 3: Multi-Hazard Goals and Action Items*** provides information on the process used to develop the multi-hazard action items that cut across the seven natural hazards addressed in the Mitigation Plan.
- ***Sections 4 through 7: Chronic Hazards*** include hazards that recur with some regularity such as *Flood, Landslide, Wildfire, Severe Winter Storm and Windstorm*.
- ***Sections 8 & 9: Catastrophic Hazards*** include hazards that recur infrequently but with devastating and far-reaching affect, like *Earthquake* and *Volcanic Eruption*. Each of the hazard sections includes information on the background of the hazard, hazard assessment, community issues, mitigation

goals and action items, and the local, state and national resources relevant to that hazard.

- ***Section 10: Business Preparedness Assessment*** includes a discussion of business vulnerability and an analysis of the Business Preparedness Survey.
- ***Appendices A through G*** include specific information on the various *public participation processes (Appendix A)* used during the development of the mitigation plan. Other appendices include a resource directory of county, regional, state and national resources and programs that may be of assistance to Jackson County during implementation of this plan *(Appendix B);* background information on the *Business Preparedness Assessment (Appendix C)* and the *GIS Analyses (Appendix D)*; an *Economic Analysis of Natural Hazard Mitigation Projects (Appendix E)* explaining FEMA's requirements, as well as techniques for applying benefit cost analysis in implementing specific hazard risk reduction strategies; as well as a list of the *Acronyms (Appendix F)* used in the plan. *Appendix G* presents a *Hazard Analysis Matrix*, a quantitative approach to looking at the risk presented by all natural and man-made hazards in Jackson County.

How is new data incorporated?

Part of any successful plan is keeping the plan current through continuous maintenance. The Jackson County Natural Hazards Mitigation Action Plan is designed so that each of the sections stand on their own, yet all the sections work together to assist county agencies and organizations achieve the mission of reducing risk from natural hazards in the county. This plan structure is as practical as it is efficient: a concerned citizen can request the Wildfire Section and focus on the material of interest, and when new wildfire data becomes available, the County can review and update the Wildfire Section without disrupting the rest of the plan or compromising the plan's integrity.

The ability to update the mitigation plan section by section places less of a financial burden on the county by allowing decision makers to strategically allocate funding and staff resources to the specific sections in need of review, instead of undertaking a full update, which can be costly and time-consuming. Updating sections at a time permits new data to easily be incorporated so that the Natural Hazards Mitigation Action Plan is current and relevant to Jackson County.

Plan Maintenance & Action Item Prioritizing Methodology

Background

The plan maintenance chapter of this document details the formal process that will ensure that the Jackson County Natural Hazards Mitigation Action Plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the Plan annually and producing a plan revision every five years. This chapter describes how the County will integrate public participation throughout the plan maintenance process. Finally, this chapter includes an explanation of how the County intends to incorporate the mitigation strategies outlined in this Plan into existing planning mechanisms such as the County comprehensive land use plan, capital improvement plans, and building codes.

Adopting, Coordinating and Implementing the Plan

The success of the Jackson County Natural Hazard Mitigation Action Plan depends on how well the outlined action items are implemented. In an effort to ensure that the activities identified are implemented, the following steps will be taken. After plan approval by FEMA and OEM, the Jackson County Board of Commissioners will formally adopt and promulgate the plan.

The County Administrator/Emergency Manager will appoint a Hazard Mitigation Steering Committee to oversee the implementation and periodic update of the Plan. This Committee will be comprised of representatives from pertinent County departments, including Environmental Health, GIS, Roads, Parks and Planning, Building. Representatives from Southern Oregon University, the American Red Cross, and the Rogue Valley COAD will be invited to join.

The Emergency Program Manager will coordinate and convene this Committee on at least a bi-annual basis. These meetings will be used to select action items for implementation, to identify those parties responsible for implementation, and to maintain essential partnerships. Members of the Hazard Mitigation Steering Committee will be accountable to the County Administrator. The Emergency Program Manager will have overall responsibility for ensuring that the Mitigation Steering Committee continues its focus on implementing mitigation action items.

Upon plan approval by FEMA, Jackson County will gain eligibility for Flood Mitigation Assistance, Hazard Mitigation Grant Program and Pre-Disaster Mitigation program funds.

Implementation through Existing Programs

Jackson County addresses statewide planning goals and legislative requirements through its comprehensive land use plan, capital improvement plans, and building codes. The Natural Hazard Mitigation Action Plan is non-regulatory in nature and provides a series of recommendations – many of which are closely related to the

goals and objectives of existing planning programs. The County will incorporate the recommended mitigation action items into existing programs and procedures in a variety of ways.

The goals and action items will help the County address statewide land-use planning Goal 7 which was developed to protect life and property from natural disasters and hazards through planning strategies that restrict development in areas of known hazards. Goal 7 requires that local governments base development plans on inventories of known areas of natural disasters and hazards and that the intensity of development should be limited by the degree to which the natural hazard occurs within the areas of proposed development. The County can use review of this plan as an avenue to update the Goal 7: Natural Hazards element of their comprehensive plan and to integrate mitigation into zoning and planning documents.

Certain elements of the county's Comprehensive Plan address issues related to natural hazards. The Comprehensive Plan is continually undergoing revision. As these updates are undertaken, pertinent mitigation goals and action items will be incorporated into the document.

The County Building Division is responsible for administering the building codes in County. After the adoption of the mitigation plan, they will work with the State Building Code Office to make sure that the County adopts, and is enforcing, the minimum standards established in the new State Building Code. In addition, the Hazard Mitigation Steering Committee will work with other agencies for promoting more stringent building codes regarding natural hazard mitigation at the state level. This is to ensure that life/safety criteria are met for new construction.

Capitol improvement planning that occurs in the future will also contribute to the goals in the Hazard Mitigation Plan. Various County Departments develop Capital Improvement Programs (CIPs), and review them on an annual basis. Upon annual review of the CIPs, the Hazard Mitigation Steering Committee will work with the County departments to integrate the Jackson County Natural Hazard Mitigation Action Plan into appropriate sections of the CIPs.

The policies listed above will be incorporated into the process of existing planning mechanisms at the County level. The meetings of the Hazard Mitigation Steering Committee will provide an opportunity for committee members to report back on the integration progress of mitigation planning elements and action items into County planning documents and procedures.

Evaluating and Updating the Plan

Formal Review Process

The Emergency Program Manager will ensure that a regular review and update of the Hazard Mitigation Plan occurs annually. All Hazard Mitigation Steering Committee members will be engaged in monitoring and evaluating the progress of the mitigation strategies in their area of expertise.

The committee will review each goal and objective to determine their relevance to changing situations in the County, as well as changes in State or Federal policy, and

to ensure they are addressing current and expected conditions. The committee will also review the risk assessment portion of the Plan to determine if this information should be updated or modified.

The Emergency Program Manager will be responsible for incorporating the changes and updates to the plan before submitting the final document to the County Commissioners for approval. It will then be submitted to the State Hazard Mitigation Officer for review.

Continued Public Involvement

Jackson County is dedicated to involving the public directly in the continual reshaping and updating of the Hazard Mitigation Plan. The financial and personnel resources, however, for an extensive public involvement process will not be available without special grant funds.

Every five years, during the process of updating the plan, the Emergency Program Manager will invite the public to a Public Workshop where they can express their concerns, opinions, or ideas about the Plan. The County Emergency Manager will be responsible for using County resources, e.g., county web page, to publicize these meetings, as well as public television and local newspapers.

On an annual basis, the general public will be notified that the plan has been reviewed and have the opportunity to provide feedback. Copies of the Plan will be accessible to all members of the public; they will be catalogued and kept at the Jackson County public library. The location of these copies will be publicized through a newsletter. The Plan includes the address and the phone number of the Emergency Program Manager, responsible for keeping track of public comments on the Plan.

In addition, copies of the plan and any proposed changes will be posted on the County website. This site will also contain an email address and phone number to which people can direct their comments and concerns.

Selecting & Prioritizing Mitigation Measures

The Hazard Mitigation Steering Committee will use three screens for selecting and prioritizing mitigation measures. The first screen is the County's Hazard Analysis Matrix (Appendix G). This matrix uses a FEMA methodology to quantify the risk from each natural and man-made hazard, and then rank the relative risk among that set of hazards. The County will strive to concentrate its available resources on mitigating those hazards posing the greatest threat to the greatest number of residents. This could mean a focus on mitigation aimed at one particular hazard or a focus on multi-hazard mitigation measures that effectively reduce risk across several hazards.

Within the context of this overarching framework that focuses on relative risk, the county will use the citizens' ranking of plan goals. These goals represent approaches to mitigation. Community members ranked Plan Goals during a workshop held in June 2001. This ranking by community members reflects their sense of relative priority among mitigation goals.

Priority 1: Strengthening Emergency Services

Priority 2: Expanding Education and Outreach

Priority 3: Increase Property Protection

Priority 4: Maximize Partnerships and Coordination

Priority 5: Emphasize Prevention

Priority 6: Protect Natural Resources

Priority 7: Develop Structural Projects

Thus, since severe storms pose the greatest threat to the County, the County will look first at action items that strengthen pertinent emergency services and later at those that protect natural resources or develop structural projects.

The Hazard Mitigation Steering Committee's third and critically important screen is Benefit Cost analysis. (An entire appendix to this plan, Appendix E, is dedicated to the various Approaches to Economic Analysis and includes information on Benefit Cost analyses.) When considering options or different approaches to implementing a prioritized action item, the Committee will apply a benefit/cost analysis. This will allow the Committee to rank options and select from among them.

FEMA's methods of identifying the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis. 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. 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.

The Hazard Mitigation Steering Committee will use a FEMA-approved cost benefit methodology as a tool for identifying and prioritizing mitigation action items when applying for federal mitigation funding. For other projects and funding sources, the Hazard Mitigation Steering Committee will continue to use a version of benefit/cost analysis, albeit potentially less formal. For less expensive projects, community values may influence the selection process.

Notwithstanding this definition of a three-pronged approach to prioritizing mitigation measures, Jackson County reserves the option to implement any action items at any time. This option keeps the door open to responding to special funding opportunities which may arise that would fund a lower priority action item.

Section 2:
A Picture of Jackson County

Why Plan for Natural Hazards in Jackson County?

Across the United States, natural hazards cost communities billions of dollars, taking a toll on the built environment, human life, and the local economy. Jackson County is no exception. Since its early settlement in the late 1800s, the county and its residents have been subject to financial loss and property damage from flooding, landslides, wildfires, windstorms, and severe winter storms. Natural hazards will inevitably impact Jackson County in the future. This fact illustrates the critical need for strategies to reduce risk from natural hazards. (See Appendix G: Hazard Analysis Matrix for a quantitative approach to assessing the risk of various natural and man-made hazards.)

Events such as flooding and wildfires are part of natural processes. They become natural disasters when they impact humans and development. Jackson County's growing population places increased demands on the county's infrastructure and undeveloped areas. The number of people living in rural areas in Jackson County highlights this interface between people, property, and the natural environment, and places them at risk from natural hazards.

This plan represents the county's long-term commitment to reducing risk and preventing future losses from natural hazard events by coordinating education, outreach, and mitigation activities to reduce the county's risk from natural hazard events now and in the future.

Chronic Natural Events

Chronic hazards occur with some degree of frequency and include flooding, landslides, windstorms, severe winter storms, and wildfires. These hazards impact communities with devastating economic consequences. During the last century, Jackson County experienced at least 11 major floods, the landmark event occurring in 1964. This flood set most of the high-water records for the region. In late December 1996 and early 1997, Jackson County experienced another destructive event, known as the "New Year's Day Flood." Similar to the event in 1964, a warm rain followed weeks of heavy snowfall and the streams and rivers of the county immediately filled their channel capacity. This flood caused over $12 million in damages to homes, businesses and infrastructure in Jackson County. More than 1,500 people were evacuated and over 1,000 properties damaged.[1] In January 1997 President Clinton declared fourteen Oregon counties, including Jackson County, eligible for disaster assistance due to damages resulting from these severe winter storms.

During the 1997 New Year's Day flood, heavy rainfall saturated area soils, causing over 70 landslides throughout the county.[2] Ashland suffered significant residential

[1] *Jackson County Emergency Preparedness Plan for Families*, Jackson County Emergency Management Advisory Council, (1999).

[2] Atkinson, Clinton, *Landslide Mapping Results: Jackson County Oregon*, Southern Oregon University (1998).

property loss and the Talent Irrigation District lost the ability to operate for approximately six weeks due to these landslides.[3]

Oregon's biggest storms over the last twenty years include events in February 1979, November 1981, January 1990, and December 1995; all of which affected Jackson County. These four storms were similar in overall intensity because of the large differential between coastal and inland wind speeds. Only "the granddaddy of all Oregon wind storms," the Columbus Day Storm of 1962, had higher inland wind speeds.[4]

Over the past century, Jackson County has also experienced scores of major fire events resulting in over $14 billion dollars in damage and suppression activities. Lightening is the primary cause of wildfire in the county. However, the potential risk for human caused fires increases as more people move into the urban wildland interface. Human activities like running saws or other equipment, or burning debris piles can contribute to increased wildfire risk.

Catastrophic Natural Hazard Events

Catastrophic events do not occur with the same frequency as chronic hazards, but can have devastating consequences. Earthquakes and volcanoes are two types of catastrophic hazards. These types of natural hazards are difficult to predict, affect a wide geographic area, and can severely impact entire regions.

Jackson County has been relatively unaffected by seismic events since its settlement. During the late nineteenth century, an earthquake originating in Crescent City, California shook the county. Broken chimneys were reported in Jacksonville and other southwest Oregon communities. More recently, a series of earthquakes originated from an active fault near Klamath Falls during the 1990s. The most devastating of these earthquakes occurred in September 1993. Jackson County was spared but two fatalities and over $7 million in damages, including complete destruction of the Klamath County Courthouse occurred in neighboring Klamath County.

There have been no documented volcanic events affecting Jackson County during Oregon's recorded history. However, Mt. McLoughlin, a dormant volcano, lies inside county boundaries as part of the volcanically active Cascades. Depending on weather and wind patterns, the region is susceptible to eruptive ejecta from even 100 miles away meaning nearby Mt. Shasta poses a distant threat.

Understanding the characteristics of hazards that affect Jackson County helps define strategies to minimize the risk to personal safety and reduce potential damage to public and private property, the economy, and environment. Communities engaged in natural hazards mitigation also have access to federal resources, such as FEMA's Hazard Mitigation Grant Program that can be used in the wake of a variety of natural hazard events. These funds become available to communities after the President of the United States declares a particular region a disaster area, as in the 1997 New Year's Day Flood.

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[3] Fattig, Paul, *Irrigation District turns to power generation to cover costs*, Medford Mail Tribune, (December, 20 1997).

[4] Taylor, George H., *The Oregon Weather Book: A State of Extremes*, Corvallis, Oregon: Oregon State University Press, (1999).

The Jackson County Landscape

Jackson County occupies the upper Rogue River Valley in southwestern Oregon, covering 2,182 square miles. The area is rich in natural resources: forests, mountains, rivers and lakes dominate the landscape. Jackson County's climate is pleasant and diverse, characterized by four distinct seasons. Consequently, the area's natural beauty has increased its popularity in recent decades. The growing population and increased development in Jackson County increases its risk from natural hazard events by threatening loss of life, property, and long-term economic disruption.

Climate

Late October marks the beginning of the rainy season in Jackson County. Surrounding mountain ranges help moderate the area's annual rainfall, which averages 20 inches on the valley floor in the Medford area. This is in sharp contrast to the 37 to 50 inches normally seen in other parts of the Pacific Northwest. In most winters, there are one or two severe windstorms and in some years, accompanying heavy rains cause serious flooding. Summer precipitation is very low, increasing the risk of wildfire and requiring irrigation for crops.

Topography

Three major mountain ranges characterize Jackson County boundaries: the Klamath Mountains to the west and south, Western Cascades in the north and the High Cascades to the east with the Bear Creek Valley within the central lowlands. The Rogue River and its tributaries cut through each of these regions on its journey towards the Pacific Ocean. This river corridor through the mountains provides an avenue for westerly winds and Pacific Storms to travel into Jackson County with relative ease.

Slopes are generally steep and topsoil, unique to the Northwest in structure and chemistry, is susceptible to landslides, torrential flooding, and sheet erosion. Those mountains subjected to extensive weathering, large-scale faulting, or consisting of softer parent rock have gentler slopes, in which earthflow (debris flow) and slump (creep) are common natural hazards.[5]

Klamath Mountains

The Klamath Mountains encompass approximately 12,000 square miles, and consist of several north-south-trending belts of rock that formed in an ocean setting (terrane) and subsequently collided with the North American crustal plate about 150 million years ago. The area is rugged with narrow canyons. Mt. Ashland, at 7,530 feet, is the highest peak in the Oregon Klamaths.

Cascade Mountains

The geologic story of the Cascades begins around 40 million years ago when the Pacific [Juan de Fuca] plate began moving beneath the North American crustal plate. Convergence of these crustal plates has slowed considerably, from an estimated 3 inches per year 35 million years ago to only ½ inch at present; less subduction means less volcanic activity.

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[5] Beaulieu, John D. and Paul W. Hughes, *Land Use Geology of Central Jackson County*, Department of Geology and Mineral Industries, Oregon, (1977).

The tallest point in Jackson County, Mt. McLoughlin, a young and dormant volcano, rises to 9,760 feet. It lies just within the county's eastern boundary in the High Cascades and although it is the tallest volcanic peak between Crater Lake and Mt. Shasta, it is dwarfed by their bulk. The entire northwest slope of the mountain is the catchment area for Big Butte Springs. These large-volume springs gush from the end of the lava flows and are the domestic water source for Medford and other towns in the Bear Creek Valley.[6]

Nearby volcanic neighbors include Mt. Bailey, Mt. Thielsen, and the remnants of Mt. Mazama (Crater Lake) to the north. While dramatic eruptions have been absent during the last century, continued subduction and presence of numerous faults indicate that a significant seismic or volcanic event could occur at any time. Seismic activity can also trigger landslides and cause flashflood events due to breached dams, jeopardizing the safety of downstream communities.

Bear Creek Valley

This broad valley separates the older Klamath Mountains from the Cascade Range. Bear Creek, along with the Rogue River and other river valleys in the county, contain soft sediments over bedrock. Hazards include ponding, high ground water, flooding, and stream bank erosion.[7] Much of the development in Jackson County has occurred in the Bear Creek Valley and the I-5 corridor, which includes the Cities of Central Point, Medford, Phoenix, Talent, and Ashland.

Rogue River (Source: Oregon Historical Society)

Land Use

Due to the topography and climate described above, land is used most intensively by people in the Bear Creek, middle Rogue and to a lesser extent, the Applegate Valleys. Development has followed the land use patterns of the early settlers; farmers located on the rich valley floors, and miners and woodsmen claimed the foothill areas.[8] Agriculture, rural, suburban, urban, industrial, and rural service center land uses are concentrated in these fertile valleys, whereas forest and open space and pockets of agriculture occur in surrounding mountainous regions of the county. Subsequently, intense valley development is subject to increased risk from associated flood hazards. Forested mountains and steep slopes surrounding these valleys pose a significant risk to the entire region from wildfire and landslide events.

Population and Demographics

A Historical Perspective

Jackson County's gold rush of the 1850's brought the first major migration of non-native cultures to the area. Gold transformed the region's identity, and its preeminence in the late 19th century is still evident in many place names throughout

[6] United States Geological Survey, Cascades Volcano Observatory, http://vulcan.wr.usgs.gov/home.html.

[7] United States Geological Survey, Cascades Volcano Observatory, http://vulcan.wr.usgs.gov/home.html.

[8] *Jackson County Comprehensive Plan*, (1989), Section 5-1.

the county, such as the town of Gold Hill. Gold mining diminished in importance after the 19th century, but has never completely disappeared.

The valley floors were farmed from the earliest white settlement, and pear production was economically important by the beginning of the 20th century and continues to be an important segment of Jackson County's economy today.

The rise in more efficient, mechanized manufacturing in the 1940's coincided with the post-war housing boom to make logging and lumber production the economic keystone of the county. The influx of population provided workers for Oregon's forests and lumber mills. Lumber was economic engine in the county for the next thirty years.

Demographics

Jackson County's location along the Interstate 5 corridor at Oregon's southern border has combined with its landscape to form a uniquely dynamic economy and population. The economy has shifted away from resource extraction over the last twenty years and has experienced rapid population growth due mostly to high levels of in-migration. Between 1990 and 2000, Jackson County's population grew almost 24%, slightly higher than the State of Oregon's 20% growth rate for the same period.[9] Rapid growth is expected to continue, with Jackson County's population projected to increase by about 45,000 during the next two decades.[10]

The majority of this growth has been in the incorporated cities along Bear Creek. These eleven incorporated jurisdictions make up 65% of the total population, as depicted in Table 2.1, and grew almost six times as much as unincorporated parts of the county. Subsequently, most population growth in the county has mostly been an urban responsibility. The inter-urban lands along Bear Creek have also seen increasing development, placing pressure on efforts to protect the health of the riparian ecology while also mitigating flood hazards through a greenway along Bear Creek. Population growth in the mountainous areas of the county has been slower, so the extent of exposure to natural hazard risks has not been well documented.

[9] U.S. Bureau of Census, (2000), Population of Oregon and its Counties and Incorporated Places, Public Law 94-171 Redistricting Data, 1990-2000, Prepared by Office of Economic Analysis, DAS, State of Oregon.

[10] *Regional Economic Profile*, *Region 8,* Oregon Employment Department, (November 2000), page 6.

Table 2.1 Population of Jackson County Communities

Community	April 1, 2000 Population	April 1, 1990 Population	Population Change 1990-2000	Percent Change 1990-2000
Ashland	19,522	16,234	3,288	20.3%
Butte Falls	439	252	187	74.2%
Central Point	12,493	7,509	4,984	66.4%
Eagle Point	4,797	3,008	1,789	59.5%
Gold Hill	1,073	964	109	11.3%
Jacksonville	2,235	1,896	339	17.9%
Medford	63,154	46,951	16,203	34.5%
Phoenix	4,060	3,239	821	25.3%
Rogue River	1,847	1,759	88	5.0%
Shady Cove	2,307	1,351	956	70.8%
Talent	5,589	3,274	2,315	70.7%
White City *	5,466	5,891	-425	-7.2%
Jackson County	**181,269**	**146,389**	**34,880**	**23.8%**
Incorporated	**117,516**	**86,437**	**31,079**	**36.0%**
Unincorporated	**63,753**	**59,952**	**3,801**	**6.3%**

Source: U.S. Bureau of Census, 2000.
*White City is designated by the U.S. Census as a "designated place" but it is not an incorporated community.

All eleven incorporated cities in Jackson County have seen population growth over the last ten years, and several communities have seen dramatic population growth. Central Point, Eagle Point, Shady Cove and Talent all grew between 59% and 71%, a dramatic rate of growth in a ten-year period.

According to the 2000 Census, Jackson County experienced a net migration rate that compared with the metropolitan counties around Portland, Salem, Eugene, and Bend.[11] Jackson County's migration can largely be attributed to retirees, which represents the need for outreach services to older populations in rural areas.[12]

Another noteworthy demographic trend is the high rate of growth in the number of Hispanic residents, which grew over 100% in ten years and accounted for over 6% of the county's population in 2000.

Special needs in Jackson County

Natural hazards do not discriminate, but the impacts in terms of loss and the ability to recover vary greatly among groups. According to Peggy Stahl of the FEMA Preparedness, Training, and Exercise Directorate, 80% of the disaster burden falls on the public, and within that number, a disproportionate burden is placed upon special needs groups: women, children, minorities, and the poor.[13]

[11] U.S. Bureau of Census, (2000), Population of Oregon and its Counties and Incorporated Places, Public Law 94-171 Redistricting Data, 1990-2000, Prepared by Office of Economic Analysis, DAS, State of Oregon.

[12] *Regional Economic Profile*, *Region 8,* Oregon Employment Dept., (November 2000).

[13] Hazards Workshop Session Summary #16, *Disasters, Diversity, and Equity*. (July 2000). University of Colorado, Boulder.

In 1995, a total of 14.6% of Jackson County residents were living in poverty and 19.3% of persons under the age of 18 were living in poverty. In the central portion of the county, where the majority of the county population lies, poverty-stricken neighborhoods are sandwiched between Interstate 5 and Bear Creek through the heart of Medford, Phoenix, Talent and Ashland. In these small areas, between 17.5% and 45.2% of the population lived in poverty in 1990. Additionally, Eagle Point, to the north of Medford and Jacksonville, to the west, also reported between 17.5% and 45.2% of their populations experiencing poverty in 1990.[14] According to the 2000 U.S. Census, 12,126 Hispanics or Latinos, 6.7% of the county's total population of 181,269 currently resides in Jackson County.[15]

Given these special needs populations, it is important to review hazard mitigation policies for all sectors and populations in a community.[16] Education and outreach services can help all citizens of Jackson County understand the risks from natural hazards and how to be prepared on an individual level for a natural hazard event. Another social issue related to natural hazards, is the potential imbalance between the costs and benefits of natural hazards mitigation and recovery. The cost of natural hazards recovery can place unequal financial responsibility on the general population, when only a small proportion may benefit from government funds used to rebuild private structures.[17] Equity issues should be recognized during natural hazard planning and a key education and outreach goal of this mitigation plan is to "provide public information and education to all residents of the county concerning natural hazard areas and mitigation efforts." (See section 3 of this plan.) Jackson County strives to ensure that all county requirements and restrictions are consistently applied. One example of that commitment was the work undertaken by Jackson County Emergency Management and the Rogue Valley Council of Governments Senior and Disabilities Services to develop a GIS-based Disaster Registry to serve people with physical and cognitive disabilities that impair their mobility, sight, or ability to independently respond to natural hazards.

Economy

During the 1990's, the wood products industry in Jackson County lost 33% of its jobs. Growth in construction and in other manufacturing industries has offset this loss, but the great majority of overall job growth has been in service and trade sectors.[18] Economic growth in Jackson County has come from service, trade, or information sectors rather than the traditional resource-based industries.

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[14] *Economic Well-being and Poverty in Oregon and Its Counties*, Oregon State University Extension Service, EM 8751, (December 1999).

[15] *Race, Hispanic or Latino, and Age: 2000*, Jackson County, Oregon. U.S. Census Bureau, Census 2000 Redistricting Data (Public Law 94-171)

[16] Hazards Workshop Session Summary #16, *Disasters, Diversity, and Equity*. (July 2000). University of Colorado, Boulder.

[17] Olshansky, Robert B., Rogers, David, J., *Unstable Ground: Landslide Policy in the United States*, Ecology Law Quarterly [Vol. 13:939, 1987] p 948.

[18] *Regional Economic Profile, Region 8,* Oregon Employment Dept., (November 2000).

Services are in greater demand, particularly health services. Recreational uses have grown in importance to the county, driving population growth and providing the basis for an increasingly important tourism sector of the economy. The agricultural sector is showing a trend toward vineyards and organic produce farming, reflecting recent public demand for such crops.

Ashland Shakespeare Festival (Source: *www.bluebook.state.or.us*)

Arts and culture are an integral part of the economic base of the county. An example of this is the world-famous Shakespearean Festival located in Ashland. Furthermore, Southern Oregon University, a four-year institution specializing in liberal arts, sciences and select professional programs, is also located in Ashland, and home to 5,800 students from around the world.

Jackson County's economy may be vulnerable to natural hazard events if, for example, highways, streets and railroads become impassable due to flooding, landslides wildfires, earthquakes or other natural hazard events. Employees would be unable to get to work while products and business inventory, including perishable foods, would be stalled along the way. The county's tourism industry would be impacted. As business and industry recover from inventory damage, transportation delays, disruption of communication and utilities, and ultimately loss of customers in the wake of a natural hazard event, the entire community can suffer severe economic consequences.

As Jackson County's population continues to grow, it becomes important that a broad spectrum of partnerships and collaboration exist to comprehensively address natural hazard mitigation, and reduce risk and prevent loss for Jackson County residents. This action plan provides both long-term and short-term strategies to reduce risk and prevent loss from future natural hazard events that may occur in Jackson County.

Section 3:

Multi-Hazard Plan Goals and Action Items

This section lays out the framework for developing successful mitigation strategies. The framework is made up of three parts: the mission, goals and action items. This section also describes the public participation process and outcomes from that process that provided direction for the specific goals and action items within the Mitigation Plan.

As shown at the right, the mission forms the umbrella that encompasses the plan's broad goals as well as specified activities that will take measurable steps toward accomplishing the plan's goals, thus accomplishing the mission.

Mission

Jackson County's mitigation plan mission is to *reduce risk, prevent loss and protect life, property and the environment from natural hazard events through coordination and cooperation among public and private partners.*

Goals

Mitigation plan goals are more specific statements of direction that Jackson County citizens, and public and private partners can take while working to reduce the county's risk from natural hazards. These statements of direction form a bridge between the broad mission statement and particular action items.

Action Items

Action items are detailed recommendations for mitigating the impacts of natural hazard events in Jackson County. These are specific activities that include measurable steps towards achieving the plan mission.

Jackson County Mitigation Plan Goals

Public participation was a key aspect in developing plan goals. Meetings with the project steering committee, stakeholder interviews and public workshops all served as methods to obtain input and priorities in developing goals for reducing risk and preventing loss for natural hazards in Jackson County.

Two public workshops were held during the compilation of the mitigation plan: the first workshop was held on April 26, 2001 and the second one on June 12, 2001. The purpose of these workshops was to inform the public about natural hazards that occur in Jackson County, and identify community priorities, and potential strategies for achieving those priorities.

The information gathered from these public workshops is summarized in Table 3.1, which establishes the community priority for plan goals, and within multi-hazard action items.

In 2005, the Emergency Program Manager set about bringing the draft final plan to County Department heads, community voluntary organizations organizing for disaster response, and several lead regional organizations for law enforcement and fire protection. The draft plan was also placed on the County's website in an effort to reach the highest number of persons in the general public. A complete listing of input methods and public comment is located in *Appendix A: Public Participation Process*.

Jackson County citizens established community priorities for the plan's goals through a voting process that asked each participant to choose three goal statements that were most important to them. After each participant made their choices, the outcomes were tallied. Results are represented in Table 3.1. The highest number of points in the "Choice" column indicates high importance to the workshop participants. All the plan goals are important. Establishing community priorities neither negates nor eliminates any goals, but it determines which action items to fund first, should funding become available.

Table 3.1. Prioritization of Mitigation Goals, June 12, 2001 Natural Hazards Workshop

Goal	Goal Statement	Choice	Community Priority
Property Protection	Lessen impact from natural disaster on individual properties, businesses, and public facilities.	3	**3**
	Increase awareness at the individual level and encourage activities that can prevent damage and loss of life from natural hazards.	2	
Education and Outreach	Further the public's awareness and understanding of natural hazards, potential risk, including economic vulnerability, and options available when natural hazard events occur.		**2**
	Provide public information and education to all residents of the county concerning natural hazard areas and mitigation efforts.	**5**	
Prevention	Reduce the threat of loss of life and property from natural hazards.	1	**5**
	Incorporate information on known hazards and provide incentives to make hazard mitigation planning a priority in land use policies and decisions, which includes plan implementation.	1	
Partnership and Coordination	Identify mitigation or risk reduction measures that address multiple areas (i.e. environment, transportation, telecommunications).		**4**
	Coordinate public/private sector participation in planning and implementing mitigation projects throughout the county.	**4**	
	Seek partnerships in funding and resources for future mitigation efforts.		
Structural Projects	When applicable, utilize structural mitigation activities to minimize risks associated with natural hazards.		**7**
Natural Resource Protection	Preserve and rehabilitate natural systems to serve natural hazard mitigation functions (i.e. floodplains, wetlands, watersheds, and urban interface areas).	1	**6**
Emergency Services	Minimize life safety issues.	2	**1**
	Promote, strengthen, and coordinate emergency response plans.	**9**	
	Evaluate the performance of critical facilities during a natural hazard event.	2	

Coordinating Organization – the entity that is willing and able to organize resources, find appropriate funding and/or oversee activity implementation, monitoring and evaluation. Coordinating organizations may include local, county or regional groups that are in relative proximity to the county to be able to implement activities and programs.

Partner Organizations – agencies or public/private sector organizations that will assist the coordinating organization in implementing action items by providing relevant resources. Partner organizations may include regional, state and federal agencies, as well as local and county public and private sector organizations. P*artner organizations are potential partners recommended by the project steering committee, but not necessarily contacted during plan development. Partner organizations should be contacted by the coordinating organization to establish commitment of time and resources to activities.*

Timeline – distinguished by short and long-term activities, the timeline includes an estimate for implementation:

> ***Short-term action items (ST)*** are activities which county agencies are capable of implementing with existing resources and authorities within one to two years.
>
> ***Long-term action items (LT)*** may require new or additional resources or authorities and may take between one and five years to implement.

Notes and Implementation Ideas – include ideas for implementation and potential resources, which may include grant programs, or human and organizational resources. The multi-hazard and individual hazard action items detail this information.

Plan Goals Addressed – help monitor and evaluate successes during implementation of the mitigation plan. Plan goals are organized into seven goal areas: property protection; education and outreach; preventative; partnership and coordination; structural projects; natural resource protection and emergency services.

Jackson County Action Items

Jackson County, through the public process, identified action items, or specific strategies, that will help meet the plan goals. The action items are both hazard specific (i.e. strategies only for floods, wildfires, landslides, etc.) and multi-hazard (i.e. cuts across all specified hazards).

Mitigation plan action items were determined through meetings with the project steering committee, local, regional, state and federal programs, stakeholder input and public workshops attended by residents of Jackson County.

These activities may be considered for funding through federal and state grant programs, and through the Federal Emergency Management Agency's Hazard Mitigation Grant Program, should funds become available. Each action item addresses the following five elements to help ensure implementation of the activities:

1. Coordinating Organization
2. Partner Organization
3. Timeline
4. Notes and Implementation Ideas
5. Plan Goals Addressed

Short-term (ST) Multi-Hazard Action Items

Short-term multi-hazard action items include general mitigation activities that agencies are capable of implementing during the next two years, given their existing resources and authorities.

ST-MH-1: Sustain a public awareness campaign about natural hazards.

Notes: Inform and educate the public about potential natural hazards in Jackson County, personal preparedness, mitigation activities and opportunities, and options available when natural hazard events occur. The public awareness campaign may take many forms:

- Present hazard specific information at public workshops;
- Distribute preparedness and mitigation information at community fairs and events;
- Disseminate the Jackson County Emergency Preparedness Plan for Families to county residents;
- Maintain a natural hazard display at the Pacific Northwest Museum of Natural History;
- Use Public Service Announcements to educate people about emergency procedures;
- Survey the public to determine their level of preparedness and find out what deters them from taking preventative actions; and
- Develop a hazard information website that contains scientific facts about natural hazards, information on building codes, lists of companies that provide insurance for specific hazards, and educational information on damage prevention.

Coordinating Organizations:	County Emergency Management, City Emergency Management Agencies
Partner Organizations:	ARC, CERT, RVCOG, SOU, SOREDI, Emergency Response Agencies, Utility and Telecommunications Companies, Media, FEMA, OEM, County Roads, County Public Works
Timeline:	Ongoing
Plan Goals Addressed:	Property Protection, Education and Outreach, Preventative, Partnership and Coordination

ST-MH-2: Sustain an education and outreach program for local jurisdictions and assist them in developing emergency operations, public information and hazard mitigation plans.

Notes: County Emergency Management is responsible for helping local jurisdictions develop plans that are compatible and well coordinated with other agency plans. In addition, County Emergency Management should:

- Train local jurisdictions on regional emergency management policies and procedures;

- Help coordinate countywide emergency management training and exercises;
- Help local jurisdictions develop resources and establish emergency facilities;
- Inform local jurisdictions about available resources, grant opportunities and other assistance;
- Disseminate information from Oregon Emergency Management and the Federal Emergency Management Agency.

Coordinating Organization:	County Emergency Management
Partner Organizations:	City Emergency Management Agencies, MCI Committee, ARC, Emergency Response Agencies, RVCOG, OEM, FEMA
Timeline:	Ongoing
Plan Goals Addressed:	Education and Outreach, Preventative, Partnership and Coordination

ST-MH-3: Maintain a GIS inventory of all critical facilities, large employers/public assembly areas and lifelines, and use GIS to evaluate their vulnerability by comparing them with hazard-prone areas.

Notes: County GIS maintains databases containing information about natural hazards, land development, community infrastructure and demographics. These data sets may be used to create hazard maps, assess risk and develop plans.

Coordinating Organization:	County GIS
Partner Organizations:	County and City Emergency Management Agencies, County Roads, ODOT, City Public Works, Utility and Telecommunications Companies, Emergency Response Agencies, RVCOG, SOU, ODF, BLM, USFS
Timeline:	Ongoing
Plan Goals Addressed:	Education and Outreach, Preventative, Emergency Services

ST-MH-4: Promote natural hazards safety education.

Notes: Natural hazards safety education includes earthquake duck-and-cover drills, facility lock-down drills, evacuation drills, fire safety training, hazardous materials training and Hug-A-Tree presentations. Natural hazards safety education may take place in schools, hospitals and businesses, as well as at preparedness fairs and community events.

Coordinating Organization:	School Districts, Facility Safety Personnel
Partner Organizations:	County and City Emergency Management Agencies, CERT, Search and Rescue, Emergency Response Agencies, ARC, Association of Safety Engineers, REAL Corps, Utility and Telecommunications Companies, Media, RVCOG, SOU, LEPC, OEM, FEMA
Timeline:	Ongoing
Plan Goals Addressed:	Education and Outreach, Partnerships and Coordination

ST-MH-5: Establish partnerships to coordinate and collect geo-science and technical information for identifying potential areas of risk.

Notes: Many public agencies in Jackson County collect geo-science and technical information for their internal needs. Often, these agencies contract with County GIS or RVCOG to work with their data and create specialized maps. With the agencies' permission, County GIS or RVCOG would use the data to develop hazard maps for County and City Emergency Management Agencies.

One key outcome would be the coordination of disparate vegetation mapping. This would allow a wildland fire risk assessment to be done at a large scale, rather than on the individual parcel level.

Coordinating Organization:	County GIS, RVCOG
Partner Organizations:	County and City Emergency Management Agencies, SOU, ODF, BLM, USFS, USGS, DOGAMI, Emergency Response Agencies, OEM, FEMA
Timeline:	Ongoing
Plan Goals Addressed:	Education and Outreach, Partnerships and Coordination

ST-MH-6: Maintain a system to support populations with special needs (e.g., elderly and disabled persons) during a disaster.

Notes: Jackson County Emergency Management worked with RVCOG Senior and Disabilities Services to develop a system to serve people who have physical and cognitive disabilities that impair their mobility, sight, or ability to independently respond to disasters. The system provides:

- A database system available to 911 and Emergency Operations Centers that shows the location of senior and disabled persons;

Coordinating Organization:	County Emergency Management
Partner Organizations:	RVCOG Senior and Disabled Services, City Emergency Management Agencies, County GIS, Rivernet and the COAD, ARC, Emergency Response Agencies
Timeline:	Ongoing
Plan Goals Addressed:	Education and Outreach, Partnership and Coordination, Emergency Services

ST-MH-7: Explore funding sources and grant opportunities for community-wide natural hazard mitigation activities.

Notes: Identify grants and appropriate loans for people to take a proactive role in hazards mitigation. There are different types of mitigation grant programs, for example: federal fire money for wildfire hazard mitigation, Hazard Mitigation Grant Program for various types of hazard mitigation, and the Flood Mitigation Assistance Program.

Coordinating Organization:	Mitigation Plan Steering Committee
Partner Organizations:	County Administrative Office, SOREDI, OEM, FEMA, IISOI
Timeline:	1-2 years

Plan Goals Addressed: Education and Outreach, Preventative

Long-Term (LT) Multi- Hazard Action Items

Long-term multi-hazard action items include general mitigation activities that are likely to take more than two years to implement and may require new or additional resources and/or authorities.

LT-MH-1: Update the Jackson County Emergency Operations Plan and the FEMA-approved Natural Hazards Mitigation Action Plan on an annual basis. Conduct a complete review of the plans and have them officially promulgated by the approving authorities every five years.

Notes: Jackson County Emergency Management will coordinate plan updates annually and complete reviews at least every five years. During the complete reviews, the plans will be evaluated with respect to the County's Land Use Ordinance and Comprehensive Plan, mutual aid agreements and new requirements (such as Goal 7 requirements).

Coordinating Organization: County Emergency Management
Partner Organizations: Applicable County Departments, Mitigation Plan Steering Committee, City Emergency Management Agencies, ARC, RVFCA, Law Enforcement Heads, EMS Committee, NWS, Utility and Telecommunications Companies, OSP, ODF, ODOT, National Guard, Rivernet, ARES
Timeline: Ongoing
Plan Goals Addressed: Emergency Services

LT-MH-2: Make the Jackson County Emergency Operations Plan and the Natural Hazards Mitigation Action Plan available to the public by publishing the plans electronically.

Notes: The World Wide Web makes electronic publication and distribution of information relatively simple. Publishing the Emergency Operations Plan and the Natural Hazards Mitigation Plan electronically can foster dissemination of hazards-related information and raise public awareness of natural hazards.

Coordinating Organization: County Emergency Management
Partner Organizations: County GIS
Timeline: 3-5 years
Plan Goals Addressed: Education and Outreach

LT-MH-3: Establish post-development inspection procedures for safety requirements (i.e. flood, earthquake, fire safety).

Notes: A common concern heard in the stakeholder interviews was that the county does not conduct follow-up inspections to ensure that site plan requirements are being met. County policies and available resources only allow post-development inspections to occur after a complaint is received. This practice is currently being re-examined by the Director of County Roads, Parks and Planning.

Coordinating Organization: County Building
Partner Organizations: County Planning, FEMA

Timeline: TBD
Plan Goals Addressed: Preventative

LT-MH-4: Use hazard information as a basis for county ordinances and regulations that govern site-specific land use decisions.

Notes: There is no funding for this particular activity at this time, however, during the next periodic review specific hazard information can be considered and incorporated into the County Comprehensive Plan.

Coordinating Organization: County Planning
Partner Organizations: County GIS
Timeline: TBD
Plan Goals Addressed: Preventative, Education and Outreach

LT-MH-5: Investigate the need for an emergency disaster fund.

Notes: A fund at the local level can be used to fund mitigation efforts or leverage state and federal assistance and grants.

Coordinating Organization: County Emergency Management
Partner Organizations: SOREDI, RVCOG, City Councils, City Emergency Management Agencies
Timeline: 3-5 years
Plan Goals Addressed: Partnership and Coordination, Preventative

LT-MH-6: Improve planning, notification and training for volunteers.

Notes: Volunteers are a valuable resource during a disaster. Many volunteers are members of more than one organization. County Emergency Management needs to give volunteers a clear view of their roles during different types of disasters, and help them to prioritize their efforts. County Emergency Management should:

- Identify and prioritize how volunteers can assist during different types of disaster. Train volunteers about their roles and include them in community disaster exercises;
- Develop a notification process for volunteers that incorporates different thresholds of activation;
- Coordinate registration and training of emergent volunteers;
- Retain a professional coordinator for volunteer programs, activities, grant opportunities, etc.;
- Actively work to expand Community Emergency Response Teams (CERT) countywide and promote CERT to the business community.

Coordinating organization: County Emergency Management
Partner organizations: Rivernet, City Emergency Management Agencies, CERT, ARC, ARES, Search and Rescue, Ashland Fire Department
Timeline: 3-5 years
Plan Goals Addressed: Education and Outreach, Partnership and Coordination, Emergency Services

LT-MH-7: Promote hazard resistant utility and telecommunication construction and maintenance methods.

Notes: Support/encourage utility and telecommunications companies to use construction and maintenance methods that reduce power outages from various natural hazards. Transmission lines can be underground trim lines vs. "T" poles. Maintenance plans that take age, construction and placement of poles into account may help alleviate risk of power outage during natural hazard events.

Coordinating organization:	RVCOG
Partner organizations:	County and City Emergency Management Agencies, ARES
Timeline:	3-5 years
Plan Goals Addressed:	Education and Outreach, Preventative

LT-MH-8: Develop a system for data collection for non-declared natural hazard events.

Notes: Once a system for data collection is in place, the damage information should be collected and stored locally, as well as reported to the National Climate Data Center. This information can include countywide damage totals for each event, with the idea that over time this data will show the geographic patterns of occurrence and vulnerability.

Coordinating Organization:	County and City Emergency Management Agencies
Partner Organizations:	IISOI, County Building, County GIS, Farm Services, Insurance Companies
Timeline:	3-5 years
Plan Goals Addressed:	Education and Outreach, Partnership and Coordination, Emergency Services

LT-MH-9: Improve coordination and evaluate technical and engineering limitations for catastrophic event response, and develop a long-term recovery plan for Jackson County from the effects of catastrophic hazards.

Notes: Where applicable, identify how Jackson County can coordinate with other entities after a seismic event, and identify what limitations exist that prevents coordinated event response. Where possible, develop mutual aid agreements for assistance after catastrophic natural hazard events.

A long-term recovery plan identifies how and where Jackson County communities will rebuild after a catastrophic event. A long-term plan identifies likely scenarios for rebuilding structures, transportation routes, and infrastructure conduits. These types of plans can be viewed as an opportunity to reconstruct the community in the wake of a large-scale natural disaster.

Coordinating organization:	County Emergency Management
Partner organizations:	SOU, USGS, DOGAMI, Klamath County Emergency Management, Regional Search and Rescue, Army National Guard, ARC, hospitals,
Timeline:	1-5 years
Plan Goals Addressed:	Partnership and Coordination, Emergency Services

Section 4:
Flood

Jackson County Flood Events

Floods are the most common of all natural hazards and both Oregon and Jackson County have an extensive history of flooding. The frequency of flooding combined with concentrated development along rivers and streams caused millions of dollars in damage to Jackson County over the past several decades. The growing population and development activity in the floodplain can increase the risk of flood-related damages.

In early 1997 Jackson County experienced a serious flood event. The 1997 flood caused 12 million dollars of damage to over 1,000 properties in Jackson County and 1,500 residents were evacuated.

Anticipating and planning for flood events is an important activity for Jackson County. Federal programs provide insurance and funding to communities engaging in flood hazard mitigation. The Federal Emergency Management Agency (FEMA) manages the National Flood Insurance Program (NFIP) and the Hazard Mitigation Grant Program (HMGP). The NFIP provides flood insurance and pays claims to policyholders who have suffered losses from floods. The HMGP provides grants help mitigate flood hazards by elevating structures or relocating or removing them from flood hazard areas. These programs provide grant money to owners of properties who have suffered losses from floods, and in some cases, suffered losses from other natural hazard events.

For information on flood insurance and funding see Current Mitigation Activities on page 4-11.

Flood Impacts in Jackson County

As floodwaters rise and overflow riverbanks, homes and other properties within and near the floodplain are impacted. Most urban and developed areas in Jackson County are on valley floors, along rivers and streams, and many of these structures are in the floodplain.

Fast-moving water in the floodway can cause severe damage and dramatic change. Buildings in the way of fast-moving water can be washed off their foundations and vehicles can float away. Meanwhile, other structures become vulnerable when fast-moving water is combined with debris. Bridge support structures can be battered, destroying the bridge, or leaving it unsafe for use. Power lines and pipelines can also be damaged or lost to the debris carried in fast-moving water.

During the New Year's Day flood in early 1997, swollen Ashland Creek carried trees and debris into the City of Ashland, piling it on bridges near the downtown area. Bridges, roads, and utilities needed significant repairs resulting from this flood.

For definitions of terms related to flooding see page 4-7.

Shallow, slow-moving water is less destructive, but often more costly, and accounts for most of the flooding damage in Jackson County. Saturation damage occurs in basements and ground floors of houses that are inundated by floodwaters, soaking the contents of the houses, as well as the building materials. This type of flooding occurs not only within the floodplain, but also in areas where the land around a building is not able to drain the water faster than it can accumulate. Most of the

losses Jackson County residents suffered in the 1997 flood were due to saturation damage.[1]

Factors That Contribute to Flooding in Jackson County

Image of New Year's Day Flood, Source: Mail Tribune, (1997)

Precipitation

Heavy rainfall is the most common cause of flooding in Jackson County. The rainy season is from October through April, when Pacific storms from the ocean, 60 miles away, bring intense rainfall to the area.[2] Jackson County receives approximately 20 inches of rain on average each year, however about 80% of the precipitation occurs during the seven wettest months of the year, October through April.[3] It is during this "wet season" that flooding is most likely to occur. Snowmelt can also cause flooding, particularly when combined with new rainfall. Rain falling on top of snow causes the snow to quickly melt and river levels to rise rapidly. The two most severe flood events in Jackson County were the result of rain falling on snow pack.

Geography/Geology

The eastern, western, and southern boundaries of Jackson County are mountainous, with a valley in the center of the county. These mountains collect rain and snowfall and deliver it into the Bear Creek and Rogue River valleys. Slopes of the surrounding mountains are relatively steep and have shallow, rocky soils. These types of soils have low absorption properties and quickly transport the rainwater to the river system.

Vegetation Cover

The type and relative amount of vegetation cover dramatically affect how quickly rainwater moves into waterways. Heavy vegetation cover slows the movement of rainwater into the river. When vegetation is removed or reduced, rainwater moves more rapidly into the river system, and contributes to higher water levels. Logging, clearing for development, and agricultural practices can all contribute to rapid water level fluctuations in Jackson County's rivers.

Location of Development

When development is located in the floodplain, it may cause floodwaters to rise higher than before the development was located in the hazard areas. This is particularly true if the development is located within the floodway. When structures or fill are placed in the floodplain, water is displaced. Development raises the base-flood elevation by forcing the river to compensate for the flow space obstructed by the inserted structures. Over time, when structures or materials are added to the floodplain and no fill is removed to compensate, serious problems can arise. The

Jackson County Comprehensive Plan prohibits development in the floodway, but under certain circumstances may allow development in the floodplain.

Floodway development is currently regulated and Jackson County (and FEMA) require engineering ("no-rise") certification that the proposed developments will not cause the base flood (100-year flood) elevation to raise more than 1.0 feet.[4] Displacement of a few inches of water can mean the difference between no structural damage occurring in a given flood event and the inundation of many homes, businesses, and other facilities. Careful attention must be paid to development that occurs within the floodplain and floodway of a river system to ensure that structures are prepared to withstand base flood events.

Surface Permeability

In urbanized areas, increased pavement leads to an increase in volume and velocity of runoff after a rainfall event, exacerbating potential flood hazards. Storm water systems collect and concentrate rainwater and then rapidly deliver it into the local waterway. Traditional storm water systems are a benefit to urban areas, by quickly removing captured rainwater. However, they can be detrimental to areas downstream because they cause increased stream flows due to the rapid influx of captured storm water into the waterway. It is very important to evaluate storm water systems in conjunction with development in the floodplain to prevent unnecessary flooding to downstream properties.

Flood Causes and Characteristics

Many types of flooding occur in Jackson County, including riverine, flash, shallow, and urban flooding. Following are descriptions of each type of flooding and their effects in Jackson County. [5]

Riverine Floods

Riverine floods, or over-bank flooding of rivers and streams, are the most common form of flooding. Most communities in Jackson County have the potential to experience this type of flooding after spring rains, heavy thunderstorms, or snowmelt. These floods can be slow or fast rising, but generally develop over a period of days. The most severe flooding conditions generally occur when direct rainfall is augmented by snowmelt, like the 1964 Christmas Day flood and the 1997 New Year's Day flood.

Flash Floods

Flash floods are a major cause of weather-related deaths in the United States. Flash floods usually result from intense storms dropping large amounts of rain within a brief period. Flash floods occur with little or no warning and rivers can rise in a manner of minutes. Flash floods are most common in arid and semi-arid areas where there is steep topography, little vegetation and intense but short-duration rainfall. Jackson County, located in a semi-arid region, is prone to this type of flooding. Steep topography combined with clearing of vegetation for development and timber production causes rapid runoff of rainwater.

Flash floods occur in both urban and rural settings in Jackson County, principally along smaller rivers and drainage ways. Covering land within cities with non-

permeable surfaces and the construction of storm water drainage systems compound the effects of flash flooding. Storm water systems are designed to move the rainwater quickly out of the city, and into the local drainage way. This additional rapid infusion of water can push rivers over their banks, and literally create a wall of water moving downstream. In flash flood situations, waters rise rapidly, move at high velocities, and often contain large amounts of debris. Occasionally, floating debris or ice can accumulate at a natural or man-made obstruction and restrict the flow of water. Water held back by ice jams or debris dams can cause flooding upstream. Subsequent flash flooding can occur downstream if the obstruction suddenly releases. Additionally, manmade structures like dams that retain water in reservoirs can fail and create flash floods downstream.

In 1918 Jackson County experienced a flash flood that was caused when the Fish Lake dam failed. The earthen dam was washed away by water flowing over the top. It took three hours and ten minutes for the wall of water and debris to reach the town of Medford. No human lives were lost in this flood, but the buildings and infrastructure of the town suffered significant damage.

Dams, or impoundments, can mitigate the effects of some types of flood events by storing runoff from large storms and releasing it slowly. Conversely, dams can cause flooding as well, by failing and releasing a flash flood down the river channel. Jackson County has a large number of impoundments and the Environmental Protection Agency notes that Jackson County has a high volume of impounded water.[6] There are over 100 impoundment dams in Jackson County.[7] The Little Butte Watershed alone contains 69 dams.[8]

Shallow Area Flooding

Shallow area flooding is a special type of riverine flooding. FEMA defines shallow flood hazards as areas that are inundated by the 100-year flood with water depths of one to three feet. Shallow area flooding is generally caused by broad, slow moving water on the floodplain. This type of flooding causes the most damage in Jackson County.

Urban Flooding

As land is converted from fields or woodlands to paved surfaces, it loses its ability to absorb rainfall. This transition from permeable to impermeable surfaces results in more water running off instead of filtering into the ground. Thus, water moves faster to waterways, resulting in flow levels rising above historic, pre-development levels. During periods of urban flooding, streets can become swift moving rivers and basements can fill with water. Storm drains often back up with yard waste causing additional, localized flooding.

Another cause of urban flooding is grading associated with development. Grading may cause changes in drainage direction from one property to another.

History of Past Flood Events

Flooding is a familiar occurrence in Jackson County. Over the past 100 years, the county has experienced major flood events on a regular basis. Figure 4.1 lists some of the major flood events that have occurred in Jackson County and the Pacific Northwest.[9]

Figure 4.1 Major Flood Events in the Pacific Northwest

Date	Location/Basins Affected	Comments
Nov 1909	Rogue, Coquille, Umpqua, Willamette, Santiam & Deschutes	Widespread flooding in Pacific Northwest
Feb 1927	Rogue, Illinois, Umpqua. Klamath & Willamette	Major flood event
Dec 1945	Rogue, Coquille, Santiam & McKenzie	Numerous deaths & homes destroyed
Dec 1955	Rogue, Umpqua & Coquille	Numerous deaths & major property damage
Dec 1964 / Jan 1965	Pacific Northwest	Rain on snow pack; record-setting flood levels; ***landmark flood event***
Jan 1972	Western Oregon	Record flows – coastal rivers
Jan 1974	Western Oregon	$65 million in damages in Oregon
Nov/Dec 1977	Western Oregon	Rain on snow pack; $16.5 million in damages in Oregon
Feb 1996	Nearly Oregon-wide	$280 million in damages in Oregon
Nov 1996	Southwestern Oregon	Flooding, landslides, debris flows; 8 deaths in Douglas County
Dec 1996 / Jan 1997	Southwest & Northeast Oregon	Rain on snow pack; rivaled 1964 flood event; $12 million in damages in Jackson County alone

Source: State of Oregon Natural Hazards Mitigation Plan, p. FL-2, June 2000

Base Floods and Base Flood Elevations

Base Flood is defined by the National Flood Insurance Program (NFIP) regulations (44 CFR 59) as "the flood having a 1 percent chance of being equaled or exceeded in any given year." This flood is referred to as the 100- year flood. Determination of the 100-year flood is based on a statistical analysis of record flood flows, some dating back to the 1860's.

The term ***Base Flood Elevation*** refers to the elevation (normally measured in feet above sea level), which the base flood is expected to reach. Base flood elevations can be set at levels other than the 100-year flood. Some communities choose to use higher frequency flood events as their base flood elevation for certain activities, using lower frequency events for others. For example, for the purpose of storm water management, a 25-year flood event might serve as the base flood elevation, while the 500-year flood event may serve as base flood elevation for the tie down of mobile homes. The regulations of the National Flood Insurance Program focus on development in the 100-year floodplain. For more information on flood designations and flood terminology refer to page 4-24, State and National Resources sections.

The landmark flood event for Jackson County in the last century was the flood of 1964. This flood set most of the record high-water marks for the region. The trigger for this flood was warm rain on a substantial snow pack. The rain quickly melted the snow, and caused the rivers to overrun their banks. All subsequent floods have been compared to this event. The 1964 flood was characterized as a "100-year" flood event. A "100- year" flood has a 1% chance of occurring in any given year, or a 26% chance of occurring during the life of a 30-year home mortgage.[10]

In late December 1996 and early January 1997, Jackson County experienced another devastating flood event, known as the New Years' Day flood. In the weeks preceding the flood, the county received abundant rain and snowfall. A warm and heavily moisture-laden storm front, known as a "Pineapple Express," followed the abundant snowfall. The warm rain quickly melted the snow pack, and county streams and rivers rapidly filled their channels and exceeded their banks. Bear Creek's waters reached 17,600 cubic-feet-per-second. The mean daily flow for January 1st is 262 cubic-feet –per-second. This particular flood event caused over $12 million in damages to Jackson County homes, businesses and infrastructure. More than 1,500 people were evacuated and over 1,000 properties damaged.[11] In January 1997 President Clinton declared fourteen Oregon counties, including Jackson County, eligible for disaster assistance due to damages resulting from these severe winter storms.

Damage and Loss Information

Assessing damage and loss information for a flood event is challenging. Generally, the only data available is from insurance claims. This is misleading, because not all homeowners or renters have flood insurance. Figure 4.2 lists private property damage data for Jackson County from the National Flood Insurance Program since 1981. These losses are for property owners who have sustained flood losses, and qualified for NFIP insurance.[12]

Figure 4.2 Jackson County Flood Insurance Claims, 1981-2001

Year of Damages	Damages
1981	$ 30,002
1982	$ 988
1983	$ 15,049
1990	$ 2,524
1991	$ 1572
1993	$ 511
1995	$ 19,542
Feb. 1996	$ 54,743
1997	$ 1,499,387
1998	$ 9,029
Total Damages	**$ 1,633,347**

Source: Oregon Emergency Management, *Jackson County Cumulative NFIP Loss Data*, (February 2001).

Terms Related To Flooding

Floodplain

A floodplain is land adjacent to a river, stream, lake, estuary or other water body that is subject to flooding. These areas, if left undisturbed, act to store excess floodwater. The floodplain is made up of two areas: the flood fringe and the floodway:

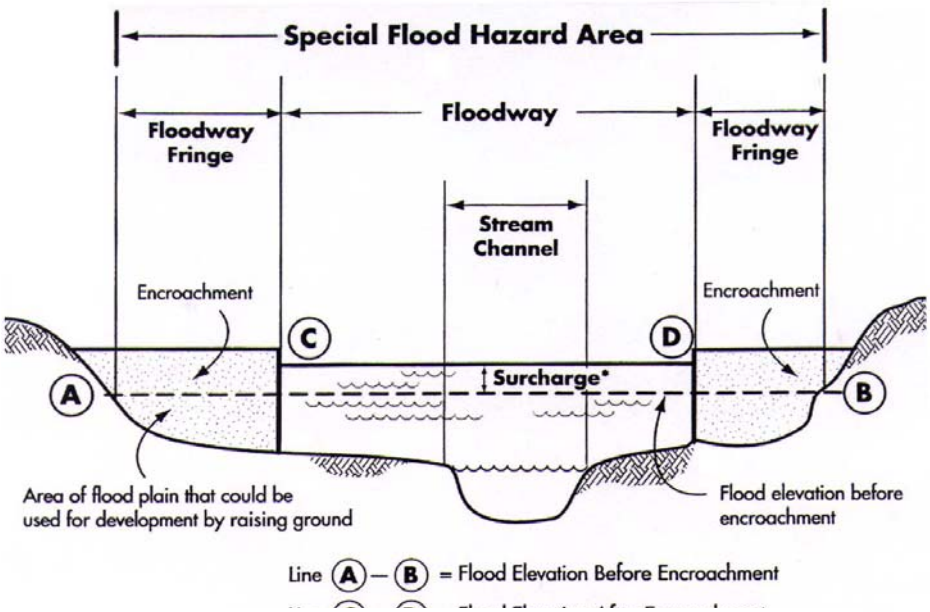
Floodway

The floodway is the portion of the floodplain that is closer to the river or stream. For National Flood Insurance Program (NFIP) and regulatory purposes, floodways are defined as the channel of a river or stream, and the over-bank areas adjacent to the channel. Unlike floodplains, floodways do not reflect a recognizable geologic feature. The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest. NFIP regulations require that the floodway be kept open and free from development or other structures, so that flood flows are not obstructed or diverted onto other properties. The NFIP floodway definition is "the channel of a river or other watercourse and adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot (See Figure 4.1)." Floodways are not mapped for all rivers and streams but are typically mapped in developed areas.

The Flood Fringe

The flood fringe refers to the outer portions of the floodplain, beginning at the edge of the floodway and continuing outward. This is the area where development is most likely to occur, and where precautions to protect life and property need to be taken (See Figure 4.1).

Figure 4.1 Floodplain Schematic



Source: Floodplain Management in Missouri. (March 1999) Missouri State Emergency Management Agency

Community Flood Issues

Human Life

Protection of human life is of primary importance. This issue is tied to several other community issues. Keeping homes safe from floodwaters will also help protect human life.

Critical Facilities/Lifelines

Jackson County is divided by Bear Creek, and the two major regional hospitals are located on the east side of the creek. If Bear Creek floods and blocks access across the valley, people on the west side of the valley will be cut off from the primary medical facilities in the county.[13] Additionally, fire, Emergency Medical Services (EMS), and law enforcement response could be severely limited if roads and bridges were made impassable due to floodwaters.

For further information on Critical Facilities/Lifelines, contact Jackson County Office of Emergency Management (See *County Resources* in the Resource Directory).

Private Property

Homes

Private homes that are built in flood prone areas are of particular concern. In 1996, flood damage to private property totaled one-third of damages statewide.[14] Jackson County had insurance claims that totaled nearly $1.5 million for the 1997 flood event.[15]

Manufactured Homes

Statewide, the 1996 floods destroyed 156 housing units. Of those units, sixty-one percent were mobile homes and trailers.[16] Numerous manufactured home parks are located along Bear Creek in Jackson County. Many older manufactured home parks are located in floodplain areas. Manufactured homes have a lower level of structural stability compared to traditional lumber-built homes. Manufactured homes in floodplain zones should be anchored to provide additional structural stability during flood events. However, because of confusion in the late 1980's resulting from multiple changes in NFIP regulations, there are areas of the county that did not consistently enforce anchoring requirements. Lack of consistent enforcement of manufactured home construction standards in floodplains can contribute to severe damages from flood events.[17]

All new manufactured homes in the County floodplain must be installed using methods and practices to minimize flood damage, as specified in section 254.060 of the Jackson County Land Development Ordinance.

Businesses

The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business. Following the January 1997 flood, businesses in Ashland suffered direct damage from high water, and reduced water service resulting from damage to the public water system.

Public Infrastructure Flood Issues

Buildings and Roads

During the 1997 flood event, statewide, damages to public buildings represented 34% of total public losses.[18] Public buildings such as libraries, schools and government buildings are of concern to the county due to their potential utility in the event of a flood. These buildings can be used as temporary locations for medical and emergency housing services.

Road systems are important to the local economy, and during hazard events, resilient road connections are critical for providing essential and emergency services.

Roads are maintained by multiple jurisdictions. Federal, state, county, and city governments all have a stake in protecting roads from flood damage. Road networks in Jackson County frequently cross floodplain and floodway areas.

Bridges

Bridges are key points of concern during flood events for two primary reasons:

1. Bridges are often important links in road networks, crossing watercourses or other significant natural features.
2. Bridges can be obstructions in the floodway, collecting debris and inhibiting the flow of water during flood events. This can cause water to back up and inundate areas upstream from the bridge that would not otherwise be affected. Also, this build-up of water can suddenly release, causing a flash flood of larger magnitude downstream.

In Ashland, the bridge that crosses Ashland Creek in Lithia Park was at risk during the 1997 flood event. The bridge obstructed the flow of water and began collecting trees and other debris flowing down the stream. During the flood, a piece of heavy equipment was used to catch and remove trees as they floated downstream towards the bridge. After the flood event the bridge required significant repair work, and was upgraded.

Wastewater and Drinking Water Systems

Flood events significantly impact drinking water and waste water systems. When sewer systems are inundated with floodwaters, raw sewage can be flushed into the waterways, posing a significant health hazard. Additionally, drinking water supplies can be contaminated with flushed wastewater or high levels of solids (eroded soil for example), and made unsafe for consumption. Both water and sewage systems often require significant repair and maintenance work following a flood event.

Image of 1997 effort to remove trees from Ashland Creek
Source: Mail Tribune, (1997)

Following the 1997 floods, the City of Ashland was without a functional drinking water system for several weeks while repair and sanitization work was performed. Businesses that depended on the Ashland water supply were unable to operate, and their employees were without work.

Storm Water

Storm water systems collect and concentrate rainwater and rapidly deliver it into the local waterway. This infusion of water causes increased flows downstream. During large rainstorms and flood events, these systems are pushed past their capacity and storm water begins flowing over-ground, causing other infrastructure damage. Traditional storm water systems are a benefit to urban areas by quickly removing captured rainwater, however, they can be detrimental to areas downstream.

Other problems often develop where open ditches enter culverts or go underground into storm water systems. An obstruction at these intersections causes overland water flow. The filling of ditches and swales near buildings can inhibit or prevent the flow of water can compound these problems. Inadequate maintenance, especially following leaf accumulation in the fall, can also contribute to the flood hazard in urban areas.

Parks and Open Space

Public parks and publicly owned open space can provide a buffer between flood hazards and private property. Wetlands in public ownership can reduce flood impacts by absorbing floodwaters and buffering water level fluctuations.

Power Supply

Flooding also significantly impacts electrical supply systems. Floodwaters short-out electrical lines and cause transformers to fail. Additionally, debris transported by floodwaters can knock down power poles and put live, high-voltage lines in the water, posing a serious electrocution hazard to people.

Communications/Phone Lines

Telephone and cable lines are similarly susceptible to floodwaters and floating debris. Underground lines are more resistant to flood damage, but often are exposed and damaged by swift currents.

Current Mitigation Activities

There are numerous programs currently under way in Jackson County designed to mitigate the affects of flooding. These programs range from federally funded national programs to individual projects by landowners. This section outlines the major mitigation activities underway in Jackson County.

Federal Programs

The National Flood Insurance Program (NFIP)

The NFIP is a federal program administered by the Federal Emergency Management Agency (FEMA). The function of the NFIP is to provide flood insurance to homes and businesses located in floodplains at a reasonable cost, and to encourage the location of new development away from the floodplain. The program maps flood risk areas, and requires local implementation to reduce the risk, primarily through restricting new development in floodplains. The maps are known as Flood Insurance Rate Maps (FIRM). Jackson County's FIRM was last updated in September of 1993.[19] Jackson County is a participating community in the NFIP. The total claims from this program in Jackson County since 1981 total over $1.6 million.[20]

Community Rating System (CRS)

Another program under the NFIP is the Community Rating System (CRS). This voluntary program recognizes and rewards efforts that go beyond the minimum standards of the NFIP. This recognition is in the form of reduced flood insurance premiums for communities that adopt such standards. CRS encourages voluntary community activities that reduce flood losses, facilitate accurate insurance rating, and promote flood insurance awareness.

Jackson County participates in the CRS and has a rating of 8, which gives a 10% discount on flood insurance premiums to policyholders in the county. Figure 4.4 below illustrates how the CRS point system is broken down. Jackson County enrolled in the CRS program in 1995 and has engaged in voluntary mitigation activities since then. The county is up for a Community Assistance Visit (CAV)

in June 2001.[21] The CAV is performed by FEMA to assess how well the community is administering its local flood-plain ordinance.

Figure 4.4 Summary of Points and Insurance Rate Discounts Under CRS

Credit Points	Class	Premium Reductions
0-499	10	0
500-999	9	5%
1000-1499	8	10%
1500-1999	7	15%
2000-2499	6	20%
2500-2999	5	25%
3000-3499	4	30%
3500-3999	3	35%
4000-4599	2	40%
4500+	1	45%

Source: NFIP

Hazard Mitigation Grant Program (HMGP)

The HMGP is administered by the Federal Emergency Management Agency (FEMA) and provides grants to state and local governments to implement long-term hazard mitigation measures after a federal disaster declaration. It is important to stress that the HMGP is available only after the president has issued a federal disaster declaration.

Following the flood event of 1997, Jackson County received a presidential disaster declaration and applied to the HMGP program. The funding that Jackson County received was applied to a variety of projects throughout the county. An example of the types of projects already completed or underway are described below:

- **Jackson County** – *Developed a flood warning project for Bear Creek*
- **Rogue Valley Council of Governments** – *Developed education and training programs*
- **City of Talent** – *Acquired properties in the floodplain along Wagner Creek and developed a Storm Water Management and Flood Mitigation Action Plan*
- **City of Ashland** – *Upgraded the Windburn Way Bridge over Ashland Creek*
- **City of Eagle Point** – *Engaged in natural hazard mitigation planning, property acquisition, and home elevation*

State Programs

State Land Use Planning Goals

There are 19 statewide planning goals that guide land use in the State of Oregon. One goal in particular focuses on land use planning and natural hazards:

Goal 7: Areas Subject to Natural Disasters and Hazards, requires local governments to identify hazards and adopt appropriate safeguards for land use and development.[22] This goal is currently under review. In the wake of 1996 flood events, the governor directed state agencies to mitigate natural hazards. The Community Service Center at the University of Oregon conducted a review of Goal 7 and identified gaps in information. New information on hazards needed to be incorporated into local policies and there was no consistent evaluation of risk to people and property being conducted in the state. The Goal 7 revision also updated the list of hazards and terminology. The DLCD conducted 11 workshops across the state to get comments on proposed changes. The passage of Ballot Measure 7 in late 2000 caused the LCDC to table Goal 7 revisions but the LCDC will reconsider revisions in July 2001 after the legislative session ends.[23] Any revisions to Goal 7 would require:

- Identifying natural hazards
- Establishing a process for incorporating new information
- Evaluating risk, and where risk is significant, incorporating at the local level measures to reduce risk.

Goal 7 revisions advocate the continuous incorporation of hazard information in local land use plans and policies.

County Programs

Jackson County Land Development Code - Floodplain Overlay

Community participation in the NFIP requires the adoption and enforcement of a local floodplain management ordinance that controls development in the floodplain. This type of ordinance is currently in effect in Jackson County. The county Floodplain Overlay ordinance was first implemented on September 1, 1973, and was most recently amended in 1995.[24] Jackson County is currently working on another revision of the floodplain ordinance. The Floodplain Overlay ordinance has been accepted by the Land Conservation and Development Commission as sufficient to comply with Statewide Goal 7 for flood hazards, and meets the minimum requirements for NFIP eligibility.

Chapter 254.030 requires that: *"A development permit shall be obtained before construction or development begins within any area of special flood hazard (100-year floodplain) established under Section 254.025."*[25] The methods of reducing flood losses (chapter 254.020) are:

1. Restrict or prohibit uses which are found to be dangerous to health, safety, and property due to water or erosion hazards, or which are found likely to result in damaging increases in erosion or in flood heights or velocities.

2. Require that uses vulnerable to floods, including facilities, which serve such uses, be protected against flood damage at the time of initial construction.
3. Control the alteration of natural floodplains, stream channels, and natural protective barriers, which are found necessary to help accommodate or channel floodwaters
4. Control filling, grading, dredging, and other development that may increase flood damage.
5. Prevent or regulate the construction of flood barriers, which will unnaturally divert floodwaters or may increase flood hazards in other areas.

This ordinance requires mapping and assessment of flood hazard danger for all new construction or reconstruction of buildings or facilities, as part of the permitting process. Development must be at least 1 foot above the base flood level. The ordinance is designed to protect human life, by mitigating structures in the floodplain, and to prevent the construction of other structures in the floodplain that could wash downstream in a flood event and cause further damages.

Bear Creek Greenway Plan

This program strives to create an open-space/natural area along the Bear Creek drainage, in the heart of Jackson County. This open space assures that buildings are not located in the flood plain, and allows floodwaters to expand laterally without causing significant damage to homes and businesses. Jackson County has succeeded in establishing segments of the greenway along Bear Creek. Moreover, acquisition of additional land for the greenway is an ongoing activity.

Flood Hazard Assessment

Hazard Identification

Hazard identification is the first phase of a hazard assessment, and is the process of estimating the geographic extent of the flood hazard, its intensity, and its probability of occurrence.[26]

The flood hazard for Jackson County was identified by FEMA in their Flood Insurance Rate Maps of the county. These maps were first completed in September of 1980, and most recently updated in September 1993.

The maps outline the extent of the 100-year, or base, floodplain. This is an outline of where floodwaters would extend if there were such a flood. These maps are used by FEMA to identify properties that need to purchase flood insurance and, if developed, need to meet floodplain development regulations. See map on following page.

The floodplains begin as very narrow strips adjacent to the upper tributaries of Bear Creek and the Rogue River, and steadily increase in width at lower elevations. The widest floodplains are in the northern portion of the county near

the confluence of Bear Creek and the Rogue River. The map on the following page, "Flood Hazard Areas," shows the 100-year floodplain in Jackson County.

Vulnerability Assessment

Vulnerability assessment is the second phase of a hazard assessment, and combines the information from the hazard identification with an inventory of the existing property exposed to the flood hazard.

Improved Value in the 100-Year Floodplain	
Single-Family	$ 124,868,310
Multi-Family	$ 6,679,110
Mobile Home	$ 10,206,010
Commercial	$ 11,891,640
Industrial	$ 511,810
Other or Unknown	$ 30,295,384
Grand Total	*$ 184,452,264*

Information from the County Assessor's office was combined with the Flood Insurance Rate Maps to estimate the improved property value that is at risk by a 100-year flood event. Only the improved value was cataloged. This is only the value of structures on those properties affected by the 100-year floodplain. Base property values were not considered.

As of spring 2001, there were 1,831 tax lots located within the 100-year flood plain, with an improved value of $184,452,264. Of the 1,831 lots, about 1 percent were manufactured homes, which are very susceptible to flood damage.

Number of Properties in the 100-Year Floodplain	
Single-Family	1,207
Multi-Family	311
Mobile Home	20
Commercial	49
Industrial	2
Other or Unknown	242
Grand Total	*1,831*

Probability

A hundred year flood has a 1% chance of occurring in any particular year. or a 26% chance of occurring during the life of a 30-year home mortgage. The flood of 1964 has been characterized as a 100-year flood in Jackson County. There were over $157 million of losses in the state. Some 600 persons in the Rogue Valley were evacuated.

A five hundred year flood has a .2% chance of occurring each year. In recorded Jackson County history, there is no evidence of a 500-year flood.

Risk Analysis

Risk analysis is the third and most advanced phase of a hazard assessment. It builds upon the hazard identification and vulnerability assessment.

Flood risk analyses include two major components: (1) the amount of loss to both property and life that may result from a flood event (defined through the vulnerability assessment); and (2) the number of flood events expected to occur over time. Within the broad components of a risk analysis, it is possible to predict the

JACKSON COUNTY

FLOODPLAIN

100-Year
500-Year

JACKSON COUNTY
Oregon

2 0 2 4 Miles

4E 3E 2E 1E 1W 2W 3W 4W

30 31 32 33 34 35 36 37 38 39 40 41

UNION CREEK
PROSPECT
TRAIL
SHADY COVE
BUTTE FALLS
WIMER
EAGLE POINT
BROWNSBORO
ROGUE RIVER
GOLD HILL
LAKE CREEK
CENTRAL POINT
MEDFORD
JACKSONVILLE
PHOENIX
APPLEGATE
RUCH
TALENT
ASHLAND
PINEHURST
LINCOLN

Produced by
JACKSON COUNTY G.I.S. SERVICES

severity of damage from a range of events. Flow velocity models can assist in predicting the amount of damage expected from different magnitudes of flood events. The data used to develop these models is based on hydrological analysis of landscape features. Changes in the landscape, often associated with human development, can alter the flow velocity and the severity of damage that can be expected from a flood event.

Using GIS technology and flow velocity models, it is possible to map the damage that can be expected from both flood events over time. See map on following page. It is also possible to pinpoint the effects of certain flood events on individual properties. At the time of publication of this plan, data was insufficient to conduct a risk analysis for flood events in Jackson County.

Flood Goals and Action Items

The mitigation goals and action items were formulated through research of regional and national mitigation plans, natural hazards planning literature, and interviews with local stakeholders. Plan goals and action items were refined through discussions with the mitigation plan steering committee and through public workshops. The goals are broad based to encompass all the identified hazards addressed in this mitigation plan. Plan goals focus on seven categories:

- Property Protection
- Education and Outreach
- Preventative
- Partnership and Coordination
- Structural Projects
- Natural Resource Protection
- Emergency Services

To read the goal statements for each of the seven categories, see *Section 3: Multi-Hazard Goals and Action Items.*

Two public workshops were held during the compilation of the mitigation plan: the first workshop was held on April 26, 2001 and the second one on June 12, 2001. The purpose of these workshops was to inform the public about natural hazards that occur in Jackson County, and identify community priorities, and potential strategies for achieving those priorities.

Through a voting process, Jackson County citizens identified goal statements in the following three categories as community priorities:

1. Emergency Services
2. Education and Outreach
3. Partnership and Coordination

Each of the goal statements and a summary of the workshop outcomes are listed in Section 3: Multi-Hazard Plan Goals and Action Items. A complete listing of public

To read about action item organization, see the *Five-Year Action Plan.*

comment is located in Appendix A: Public Participation Process.

This section lists action items identified to reduce the risk from flood impacts in Jackson County. These action items are designed to meet the mitigation plan goals.

Short-term (ST) Flood Action Items

Short-term flood action items include general mitigation activities that agencies are capable of implementing during the next two years, given their existing resources and authorities.

ST-FL-1: Continue to coordinate with appropriate agencies, and maintain an inventory of all aggregate operations adjacent to or within the floodplain to ensure operations protect streams.

Coordinating Organization: DOGAMI, through County Planning, County Engineering (Code Compliance)
Partner Organizations: County GIS, Watershed Councils, DEQ, ODFW, USACE, DSL
Timeline: Ongoing
Plan Goals Addressed: Preventative, Partnership and Coordination, Natural Resource Protection

ST-FL-2: Coordinate river gauge information.

Notes: Jackson County Emergency Management, National Weather Service, and all watershed councils, including the Little Butte Watershed Council and Applegate River Watershed Council, can benefit from coordinated river gauge information that is tied into National Weather Service flood forecasting activities.

Coordinating Organization: NWS (Medford Office)
Partner Organizations: Watershed Councils, Cities, RVCOG, OSU Extension Service, USGS, WRD, USACE, BOR, private river gauges
Timeline: 1-2 years
Plan Goals Addressed: Partnership and Coordination

ST-FL-3: Maintain an inventory of all permitted dams in Jackson County.

Notes: Update appropriate seismic criteria and procedures for evaluating performance of existing dams (varies within each permitted dam Emergency Action Plan).

- Susceptibility to damage from flood events
- Amount of water impounded
- Type of construction
- Year completed
- Repair work performed

See Jackson County Land Development Ordinance Chapter 254 and 272 for ordinances related to floodplain development and aggregate mining.

Coordinating Organization: County Emergency Management, Water Master
Partner Organizations: Watershed Councils, USACE, BOR, WRD
Timeline: 1-2 years
Plan Goals Addressed: Education and Outreach, Preventative, Structural

ST-FL-4: Conduct workshops for target audiences on National Flood Insurance Programs, mitigation activities, and potential assistance from FEMA's Flood Mitigation Assistance and Hazard Mitigation Grant Programs.

Notes: Include information about the financial aspects of building (and rebuilding) in the floodplain. Present information on how other communities have addressed building in the floodplain. Selected target audiences can include: realtors, lending institutions, surveyors, engineers, and government agencies.

Coordinating Organization:	County Planning, County and City Emergency Management Agencies,
Partner Organizations:	Watershed Councils, DLCD, OEM, FEMA
Timeline:	Ongoing
Plan Goals Addressed:	Property Protection, Education and Outreach, Preventative, Partnership and Coordination

Long-Term (LT) Flood Action Items

Long-term flood action items include general mitigation activities that are likely to take more than two years to implement and may require new or additional resources and/or authorities.

LT-FL-1: Update the Flood Insurance Rate (FIRM) Maps for Jackson County as funding becomes available.

Notes: Work with FEMA on specific areas to update as funding becomes available.

Coordinating Organization:	FEMA, DLCD
Partner Organizations:	County Planning, County GIS
Timeline:	3-5 years
Plan Goals Addressed:	Property Protection, Preventative, Partnership and Coordination

LT-FL-2: Encourage private property owners to restore natural systems within the floodplain, and to manage riparian areas and wetlands for flood abatement.

Notes: In addition to encouraging private property owners, managing publicly owned riparian and floodplain areas for conversion to open space/parkland/greenway is key to restoring natural floodwater absorption capacities (i.e. Bear Creek Greenway program).

Coordinating Organization:	RVCOG, County Emergency Management
Partner Organizations:	County Parks and Planning, FEMA, Watershed Councils, Cities, USACE, DSL
Timeline:	3-5 years
Plan Goals Addressed:	Property Protection, Natural Resource Protection

LT-FL-3: Use federal grant funds to acquire or elevate individual properties adjacent to/within the 100-year floodplain as opportunities arise.

Notes: Investigate Flood Mitigation Assistance or Hazard Mitigation Grant Program funds for potential elevation and acquisition projects. Maintain an inventory of properties that have experienced repetitive flood damage and assess each property for potential mitigation options.

Coordinating Organization: County Emergency Management
Partner Organizations: FEMA, County Planning, County Administrator's Office, OEM, DLCD, OECDD
Timeline: 3-5 years
Plan Goals Addressed: Property Protection, Preventative, Natural Resource Protection

LT-FL-4: Continue to increase Jackson County's CRS (Community Rating System) rating over time through activities outlined by FEMA.

Notes: Communities engaging in these types of activities receive points according to a schedule developed for the CRS [i.e. strengthen building codes (and enforcement of); increase public education activities; dam safety programs; increased elevation standards for homes in the 100-year floodplain; community education programs, etc]. These activities reduce insurance premiums for property owners who have undertaken mitigation activities.

Coordinating Organization: County and City Emergency Management Agencies, County Planning
Partner Organizations: Watershed Councils, OEM, DLCD, OECDD, USACE, FEMA,
Timeline: Ongoing
Plan Goals Addressed: Property Protection, Preventative, Partnership and Coordination

LT-FL-5: Preserve water quality by using storm water best management practices.

Notes: Model standards could be the National Pollution Discharge Elimination System (NPDES).

Coordinating Organization: County Roads, RVCOG, DEQ
Partner Organizations: Watershed Councils, WRD, USACE,
Timeline: 3-5 years
Plan Goals Addressed: Natural Resource Protection

Flood Resource Directory

County Resources

Jackson County Office of Emergency Management

Jackson County Emergency Management helps the community be better prepared for major emergencies and disasters. They work closely with cities, emergency responders, and volunteer agencies to find ways to reduce risks and minimize damages during hazard events. When a disaster occurs, they work with these partners in their Emergency Operations Center to coordinate resources and information. Once the event is over, they help bring assistance to those that have been harmed.

Contact: Jackson County Emergency Program Manager
Address: 10 South Oakdale, Medford, Oregon 97501
Phone: (541) 774-6821
Fax: (541) 774-6455
Website: http://www.co.jackson.or.us

Regional Resources

National Weather Service, Medford, Oregon

The National Weather Service Office in Medford provides weather warnings and forecasts for southern Oregon and northern California.

Contact: National Weather Service
Address: 4003 Cirrus Drive, Medford, OR 97504
Phone: (541) 773-1067
Website: http://www.wrh.noaa.gov/Medford/index.html

American Red Cross, Rogue Valley Chapter

Services provided by the American Red Cross include emergency assistance, disaster relief, and health and safety courses.

Contact: Executive Director
Address: 60 Hawthorne Street, Medford, OR 97504
Phone: (541) 779-3773
Fax: (541) 772-7212
Email: redcross@jeffnet.org
Websites: http://www.redcross.jffnet.org/

State Resources

Department of Land Conservation and Development (DLCD):

DLCD administers the State's Land Use Planning Program. The program is based on 19 Statewide Planning Goals, including Goal 7, related to natural hazards. DLCD also serves as Oregon's federally designated agency to coordinate floodplain management in Oregon. DLCD maintains contact with flood prone communities throughout the state in order to help them meet the requirements of the NFIP and to ensure that they are prepared in case of flood. DLCD offers information on the NFIP, CRS and other FEMA-related programs. They also offer training courses on various flood mitigation programs.

Contact: Department of Land Conservation and Development
Address: 635 Capitol St. NE, Suite 200, Salem, OR 97301-2540
Phone: (503) 373-0050
Fax: (503) 378-6033
Website: http://www.lcd.state.or.us/
Oregon Floodplain Coordinator: (503) 373-0050 ext. 255

State Division of Building Codes, Department of Consumer and Business Services

The Oregon Building Codes Division (BCD) adopts statewide standards for building construction that are administered by the state and local municipalities throughout Oregon. To find out more information about codes that affect development in floodplains contact BCD or your local building department.

Contact: Building Codes Division
Address: 1535 Edgewater Street NW, P.O. Box 14470, Salem, OR 97309-0404
Phone: (503) 378-4133
Fax: (503) 378-2322
Website: http://www.cbs.state.or.us/bed/

Oregon State Police (OSP)-Office of Emergency Management (OEM)

OEM administers FEMA's Hazard Mitigation Grant Program, which provides monies for acquisition, elevation, relocation, and demolition of structures located in the floodplain. OEM also administers FEMA's Flood Mitigation Assistance Program. This program provides assistance for NFIP insured structures only. OEM also helps local jurisdictions to develop local hazard mitigation plans. OEM is heavily involved in flood damage assessment and works mainly with disaster recovery and hazard mitigation programs. OEM provides training for local governments through workshops on recovery and mitigation. OEM also helps implement and manage federal disaster recovery programs.

Contact: Office of Emergency Management
Address: P. O. Box 14370, Salem, OR 97309-5062
Phone: (503) 378-2911
Fax: (503) 588-1378
Website: http://egov.oregon.gov/OOHS/OEM

Oregon Department of Fish and Wildlife (ODFW)

ODFW can provide assistance to local governments in evaluating the effects of floodplain and floodway development on fish and wildlife species and habitat. In particular, your community should contact area Fish and Wildlife staff to help review floodway development permits. To obtain information on area office location, use the following contact information.

Address: 2501 SW First Ave., Portland, OR 97207
Phone: (503) 872-5268
Website: http://www.dfw.state.or.us

State of Oregon Water Resources Department (WRD)

WRD manages the state's Dam Safety Program. Dam failures, though uncommon, can result in catastrophic flooding. WRD can provide technical assistance to local governments on issues of dam safety.

Address: 1158 12th St. NE, Salem, OR 97301-4172
Phone: (503) 378-8455
Fax: (503) 378-2496
Website: http://www.wrd.state.or.us

Oregon Watershed Enhancement Board (OWEB)

OWEB is a potential funding source for communities wanting to do flood mitigation projects and other watershed activities/improvements. The mission of the Oregon Watershed Enhancement Board is to promote and implement programs to restore, maintain and enhance watersheds in the State of Oregon in order to protect the economic and social well being of the state and its citizens. Contact OWEB directly for more information on its grant programs.

Contact: Oregon Watershed Enhancement Board
Address: 255 Capitol St. NE, Salem, Oregon 97310
Phone: (503) 378-3589
Fax: (503) 378-3225
Website: http://www.oweb.state.or.us/index.shtml

USGS Stream Flow Information for Oregon

This website created by the U.S. Geological Survey provides "real time streamflow" maps to track short term changes (over several hours) in rivers and streams. Additional information includes daily, 7-day average, and below normal stream flow. Links include the National Weather Service river conditions, Oregon water resources, and flood information. The Oregon USGS office is responsible for water-re-sources investigations for Oregon and part of southern Washington. Their office cooperates with more than forty local, state, and federal agencies in Oregon. Cooperative activities include water-resources data collection and interpretive water-avail-ability and water-quality studies.

Contact: U.S. Geological Survey, Oregon District
Address: 10615 SE Cherry Blossom Drive, Portland, Oregon, 97216
Phone: (503) 251-3200
Fax: (503) 251-3470
Website: http://water.usgs.gov/cgi-bin/daily_flow

Oregon Department of Geology and Minerals Industries (DOGAMI)

The mission of the Department of Geology and Mineral Industries is to serve a broad public by providing a cost-effective source of geologic information for Oregonians and to use that information in partnership to reduce the future loss of life and property due to potentially devastating earthquakes, tsunami, landslides, floods, and other geologic hazards. The Department has mapped earthquake hazards in most of western Oregon.

Contacts: Deputy State Geologist, Seismic Hazards Team Leader, Tsunami and Coastal Hazards Team Leader
Address: 800 NE Oregon St., Suite 965, Portland, Oregon 97232
Phone: (503) 731-4100

Fax: (503) 731-4066
Website: http://sarvis.dogami.state.or.us

Division of State Lands (DSL)

DSL is a regulatory agency, responsible for administration of Oregon's Removal-Fill Law. This law is intended to protect, conserve and allow the best use of the state's water resources. It generally requires a permit from DSL to remove, fill or alter more than 50 cubic yards of material within the bed or banks of waters of the state. Exceptions are in State Scenic Waterways and areas designated essential salmon habitat, where a permit is required for all in-stream activity, regardless of size. DSL and the U.S. Army Corps of Engineers may issue these permits jointly. Contact the DSL with specific questions regarding this permit process.

Contact: Division of State Lands
Address: 775 Summer Street NE, Suite 100, Salem, OR 97301-1279
Phone: (503) 378-3805
Fax: (503) 378-4844
Website: http://statelands.dsl.state.or.us/
Assistant Director: (503) 378-3805, ext. 279
Western Region Manager: (503) 378-3805, ext. 244

National Resources and Programs

Federal Emergency Management Agency (FEMA)

FEMA provides maps of flood hazard areas, various publications related to flood mitigation, funding for flood mitigation projects, technical assistance, and also operates the National Flood Insurance Program. FEMA's mission is "to reduce loss of life and property and protect our nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of mitigation, preparedness, response and recovery". FEMA Region X serves the northwestern states of Alaska, Idaho, Oregon, and Washington.

Contact: FEMA, Federal Regional Center, Region 10
Address: 130-228th St. SW, Bothell, WA 98021-9796
Phone: (425) 487-4678
Website: http://www.fema.gov
To obtain FEMA publications, Phone: (800) 480-2520
Address: P.O. Box 1038, Jessup, Maryland 20794-1038
Phone: (800) 358-9616
Fax: (800) 358-9620

Army Corps of Engineers

The Army Corps of Engineers administers a permit program to ensure that the nation's waters are used in the public interest. Any person, firm, or agency planning to work in waters of the United States must first obtain a permit from the Army Corps of Engineers. In Oregon, joint permits may be issued with the Division of State Lands. The Corps is responsible for the protection and development of the nation's water resources, including navigation, flood control, energy production through hydropower management, water supply storage and recreation. For more specific information on this permitting program and how it affects your community contact the Portland district office.

Contact: U.S. Army Corps of Engineers, Floodplain Information Branch
Address: P.O. Box 2946, Portland, OR 97208-2946

Phone: (503) 808-4874
Fax: (503) 808-4875
Website: http://www.nwp.usace.army.mil/

National Weather Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce - NOAA

The National Weather Service mission is to provide weather and flood watches and warnings, and public forecasts and advisories primarily for the protection of life and property. The Weather Service collects, interprets and disseminates up-to-date hydrologic data including information of the magnitude and frequency of past and expected water flows. The Weather Service website provides current forecasts and warnings as well as a link to the Emergency Managers Weather Information Network. Oregon has three weather service stations: Portland, Pendleton, and Medford. The Boise station serves southeastern Oregon.

Contact: National Weather Service – Portland
Address: 5241 NE 122nd Avenue, Portland, OR 97230
Phone: (503) 326-2340
Website: http://www.nws.noaa.gov/

Natural Resource Conservation Service (NRCS)

NRCS operates many programs dealing with the protection of floodplain resources. The two most closely related to flooding are the Watershed Surveys and Planning Program and the Flood Risk Reduction Program, administered through the Farm Service Agency. NRCS also provides technical assistance to property owners, including methods to reduce stream bank erosion. NRCS is a federal agency whose mission is to "provide leadership in a partnership effort to help people conserve, improve, and sustain our natural resources and environment."

Contact: Natural Resource Conservation Service, Oregon State Branch
Address: 101 S.W. Main Street, Suite 1300, Port-land, OR 97204-3221
Phone: (503) 414-3200
Fax: (503) 414-3103
Website: http://www.or.nrcs.usda.gov/Welcome.html/

Information for Coping With Floods - North Dakota State University

This site, maintained by the North Dakota extension service, provides a thorough list of what to do before and after a flood. Topics include sandbagging, repairing your home, insurance, financial assistance, and cleaning woodwork.

Contact: NDSU Extension Service
Address: Morrill Hall 314, Box 5562, Fargo, ND 58105-5562
Phone: (701) 231-7881
Fax: (701) 231-7566
Website: http://www.ag.ndsu.nodak.edu/flood/flood.htm/

Surf Your EPA Watershed Site- Information on Watershed Scale:

According to the EPA's surf your watershed site Jackson County crosses 7 watersheds. This site provides information on watershed health and environmental indicators for each watershed. Residents can find which watershed provides their drinking water and examine the health of the watershed, including toxic releases, hazardous wastes and superfund sites.

Contact: Surf Your Watershed, United States Environmental Protection Agency
Address: Mail Code 4503F, 401 M Street SW, Washington, D.C. 20460
Phone: (202) 260-7444
Website: http://cfpub1.epa.gov/surf/county.cfm?fips_code=41029
Website: http://cfpub.epa.gov/surf/locate/index.cfm

FEMA's List of Flood Related Web Sites

This site contains a long list of flood related Internet sites from "American Heritage Rivers" to "The Weather Channel," and is a good starting point for flood information on the Internet.

Website: http://www.fema.gov/nfip/related.htm/

The National Flood Insurance Program

The National Flood Insurance Program (NFIP) Web site is a subsection of the Federal Emergency Management Agency (FEMA) site (http://www.fema.gov). The NFIP information is intended for both the general public and the many organizations and agencies participating in the program. It includes much information about the NFIP and other flood disaster assistance available from the federal government. It also provides access to the newly revised NFIP booklet: Answers to Questions about the National Flood Insurance Program.

Website: http://www.fema.gov/nfip

Office of Hydrology, National Weather Service

The National Weather Service's Office of Hydrology (OH) and its Hydrological Information Center offer information on floods and other aquatic disasters. This site offers current and historical data including an archive of past flood summaries, information on current hydrologic conditions, water supply outlooks, and an Automated Local Flood Warning Systems Handbook, Natural Disaster Survey Reports, and other scientific publications on hydrology and flooding.

Websites: http://www.weather.gov/oh

The Floodplain Management Association

The Floodplain Management Web site was established by the Floodplain Management Association (FMA) to serve the entire floodplain management community. It includes full-text articles, a calendar of upcoming events, a list of positions avail-able, an index of publications available free or at nominal cost, a list of associations, a list of firms and consultants in flood-plain management, an index of newsletters dealing with flood issues (with hypertext links if available), a section on the basics of floodplain management, a list of frequently asked questions (FAQs) about the Web site, and, of course, a copious catalog of Web links.

Website: http://www.floodplain.org

Northwest Regional Floodplain Managers Association (NORFMA)

This site is a resource for floodplains, fisheries and river engineering information for the Northwest. This site provides technical information, articles and Internet links in the field of floodplain and fisheries management.

Website: http://www.norfma.org/

HazLit Database (University of Colorado, Boulder)

The Natural Hazards Research and Applications Information Center at the University of Colorado, Boulder provides this library, which houses one of the most extensive collections of social science hazards literature in the world. This non-lending library is an important resource for practitioners who need information on different aspects of hazards and disasters. The collection includes approximately 22,000 catalogued items, including books, serials, reports, journal articles, videotapes, and compact discs. The database is comprehensive and is an excellent resource for communities looking for information on hazards.

Website: http://www.colorado.edu/hazards/library

Recommended Flood Publications

The following list groups publications into three categories: primary, secondary, and technical. Documents listed as primary are those that every community should have in its resource library. Secondary documents are those that provide useful information to communities, but that may not be as easy to access. Technical documents are those that focus on a specialized aspect of flood hazard mitigation, and may require interpretation by a scientist or engineer.

Primary Resources

These documents represent the principal resources communities can use to better plan for flood hazards. They are key tools for reducing the risks associated with flood prone areas.

NFIP Community Rating System Coordinator's Manual. FEMA/NFIP. Indianapolis, IN: FEMA

This informative brochure explains how the Community Rating System works and what the benefits are to communities. It explains in detail the CRS point system, and what activities communities can do in order to earn points. These points then add up to the "rating" for the community, and flood insurance premium discounts are calculated based upon that "rating". The brochure also provides a table on the percent discount realized for each rating (1-10). Instructions on how to apply to be a CRS community are also included.

To obtain this resource: visit http://www.fema.gov, call 1-(800) 480-2520, or call the CRS office in Indianapolis at (317) 848-2898.

Floodplain Management: A Local Floodplain Administrator's Guide to the NFIP. FEMA-Region 10. Bothell, WA: FEMA

This document discusses floodplain processes and terminology. It contains floodplain management and mitigation strategies, as well as information on the NFIP, CRS, CAVs and floodplain development standards.

To obtain this resource: call FEMA at (800) 480-2520.

Flood Hazard Mitigation Planning: A Community Guide. Massachusetts Department of Environmental Management. (June 1997)

This informative guide offers a ten-step process for successful flood hazard mitigation. Steps include: map hazards, determine potential damage areas, take an inventory of facilities in the flood zone, determine what is or is not being done about flooding, identify gaps in protection, brainstorm alternatives and actions, determine feasible actions, coordinate with others who are doing this, prioritize actions, develop strategies for implementation, and adopt and monitor the plan.

To obtain this resource: You may download an electronic version at http://www.magnet.state.ma.us/dem/pro-grams/mitigate/guide.htm. For a hard copy of this guidebook contact the Massachusetts Flood Hazard Management Program (FHMP) at (617) 626-1250.

Reducing Losses in High Risk Flood Hazard Areas: A Guidebook for Local Officials. FEMA-116. (Feb 1987)

This guidebook offers a table on actions that communities can take to reduce flood losses. It also offers a table with sources for floodplain mapping assistance for the various types of flooding hazards. There is information on various types of flood hazards with regard to existing mitigation efforts and options for action (policy and programs, mapping, regulatory, non-regulatory). Types of flooding which are covered include alluvial fan, areas behind levees, areas below unsafe dams, coastal flooding, flash floods, fluctuating lake level floods, ground failure-triggered by earthquakes areas, ice jam flooding and mudslides.

To obtain this document: call FEMA at 1-800-480-2520.

Oregon Model Flood Damage Prevention Ordinance. FEMA/DLCD. (Jan 1999)

This is an example of how to write an ordinance that complies with NFIP/ FEMA standards. Communities can simply adopt this ordinance, word for word, filling in the blanks specific to their community or jurisdiction.

To obtain this resource: A copy of this ordinance is on the DLCD's website: www.lcd.state.or.us or contact the Oregon DLCD for more information, (503) 373-0050.

Secondary Resources

These documents provide additional information and tools for reducing the risks associated with flood prone areas.

Answers to Questions About Substantially Damaged Buildings. FEMA-213. (May 1991).

Answers to Questions About the National Flood Insurance Program. FIA-2. (March 1992).

Community Flood Mitigation Planning Guidebook. Wisconsin Department of Natural Resources. (Nov 1995).

Cities Under Water. Raymond J. Burby. (1988) University of Colorado Institute of Behavioral Science.

Floodplain Management in Northern Illinois. Illinois Department of Natural Resources. (December 1996).

Homeowners Guide to Retrofitting. FEMA-312. (1998).

How to Use a Flood Map to Protect Your Property. FEMA-258. (May 1995).

Manufactured Home Installation in Flood Hazard Areas. FEMA-85 (September 1985).

Technical Resources

The documents listed here focus on the technical aspects of flood hazard mitigation. They may require interpretation by a technical specialist.

Engineering Principles and Practices for Retrofitting Flood Prone Residential Buildings. (1995)

Managing Floodplain Development in Approximate Zone A Areas- A Guide for Obtaining and Developing Base (100-year) Flood Elevations. FEMA-265. (July 1995)

Endnotes

[1] *Regional Hazard Mitigation Policy and Planning Guide*, Metro, (June 1999).

[2] Interagency Hazard Mitigation Team, *State Hazard Mitigation Plan* (2000) Oregon State Police – Office of Emergency Management.

[3] *Soil Survey of Jackson County Area, Oregon,* p.3, (1993).

[4] Section 60.3 (d) (3) of the *National Flood Insurance Program Regulations*.

[5] *Planning for Natural Hazards: Oregon Technical Resource Guide,* Community Planning Workshop, (July 2000).

[6] Environmental Protection Agency website: http://www.epa.gov

[7] Ludwig, Bill, National Weather Service, Personal Interview, (April 2001).

[8] Anthony, Lu, Little Butte Watershed Council Coordinator, Personal Interview, (March 2001).

[9] Interagency Hazard Mitigation Team, *State Hazard Mitigation Plan* (2000) Oregon State Police – Office of Emergency Management.

[10] *The 100-Year Flood Myth*, FEMA, Region 10.

[11] *Jackson County Emergency Preparedness Plan for Families*, p. 22, (1998).

[12] Dennis Sigrist, Oregon Emergency Management, *Jackson County Cumulative NFIP Loss Data,* (February 2001).

[13] Jackson County Natural Hazards Public Workshop, (April 26, 2001).

[14] *February 1996 Flooding and Landslides and Stream Erosion in the State of Oregon,* The Interagency Hazards Mitigation Team (1996) Oregon State Police – Office of Emergency Management.

[15] Dennis Sigrist, Oregon Emergency Management, *Jackson County Cumulative NFIP Loss Data,* (February 2001).

[16]The Interagency Hazards Mitigation Team *February 1996 Flooding and Landslides and Stream Erosion in the State of Oregon,* (1996).

[17] Ibid.

[18] Ibid.

[19] Mattson, Mike, Jackson County Floodplain Coordinator, Personal Interview, (April 2001).

[20] Dennis Sigrist, Oregon Emergency Management, *Jackson County Cumulative NFIP Loss Data,* (February 2001).

[21] Mattson, Mike, Jackson County Floodplain Coordinator, Personal Interview, (April 2001).

[22] Hazard Mitigation Workshop, Department of Geology and Mineral Industries, Salem, Oregon, (May 1, 2001).

[23] *ibid*

[24] Mattson, Mike, Jackson County Floodplain Coordinator, Personal Interview, (April 2001).

[25] *Jackson County Land Development Ordinance,* (2000).

[26] Burby, R. (Ed.) Cooperating with Nature: Confronting Natural Hazards with Land Use Planning for Sustainable Communities. (1998) Washington D.C.: Joseph Henry Press

Section 5:
Landslide

Community Planning Workshop Researcher:

Matt Mattia, Community and Regional Planning Master's Candidate

Jackson County Landslide Events

Landslides are a serious geologic hazard in almost every state in America. Nationally, landslides cause in excess of $1 billion in damages and 25 to 50 deaths each year. Landslides threaten transportation corridors, fuel and energy conduits, and communications facilities. While not all landslides result in property damage, many landslides impact roads and other infrastructure, and can pose a serious life-safety hazard.[1] Growing population and an increase in housing demand has caused development to occur more frequently in hazard-prone areas. Property damage from landslides throughout Oregon, including Jackson County, continues to rise, in part due to increased development.

Rapidly moving landslides present the greatest risk to human life, and persons living in or traveling through areas prone to rapidly moving landslides are at increased risk for serious injury. Rapidly moving landslides have also caused most of the recent landslide related injuries and deaths in Oregon.[2] Most of the landslides in Jackson County associated with flood events have been rapidly moving debris flows. Identifying and mapping landslide-prone areas and planning for development are essential to help reduce the risks of landslide hazards to life and property in Jackson County.

Landslide Causes and Characteristics

Landslides are defined as any detached mass of soil, rock, or debris that moves down a slope or a stream channel.[3] Seldom if ever, can a landslide be attributed to a single cause. All landslides involve the failure of the earth under stress. Landslides are typically triggered by periods of heavy rainfall and/or rapid snowmelt. Earthquakes, volcanoes, and excavations may also trigger them. Also, an intense wildfire may destroy vegetation and affect organic material so that even normal rainfall may trigger a landslide.[4]

Locations with extremely steep slopes are most susceptible to landslides. Landslides on these slopes tend to move more rapidly and can be more dangerous than other landslides. Landslides are particularly common along stream banks, reservoir shorelines, and large lakes. Although landslides are natural geologic processes, their incidence and impact on people and property can be exacerbated by human activities such as excavation and grading, drainage and groundwater alterations, and changes in vegetation.[5]

Excavation and Grading

Slope excavation is generally needed in order to develop home sites or build roads on sloping terrain. Grading can result in slopes that are steeper than the pre-existing natural slopes. This increase in slope steepness as well as the added weight of fill placed on slopes can increase the potential for landslide hazards. Excavation practices, sometimes aggravated by drainage, can reduce the stability of otherwise stable slopes.[6]

Drainage and Groundwater Alterations

Water flowing through the ground is often the factor that finally triggers many landslides. Any activity that increases the amount of water flowing into landslide-prone slopes can increase landslide hazards. Broken or leaking water or sewer lines can be problematic, as can water retention facilities that direct water onto slopes. Even lawn irrigation and minor alterations to small streams in landslide prone locations can result in damaging landslides. Ineffective storm water management and excess runoff can also cause erosion and increase the likelihood of landslides. Finally, development that results in an increase in impermeable surface will impair the ability of the land to absorb water and increases the risk of flooding as well as landslide hazards.[7]

Changes in Vegetation

Removing vegetation from steep slopes can increase landslide hazards. Areas that have experienced wildfires and land clearing for development can have even longer periods of increased landslide hazards because forest recovery may take considerable time or may never occur. In addition, woody debris (both natural and logging slash) in stream channels may cause impacts from debris flows to be more severe.[8]

Types of Landslides

Landslides vary greatly in the volumes of rock and soil involved, the length, width, and depth of the area affected, frequency of occurrence, and speed of movement. Some characteristics that determine the type of landslide are slope of the hillside, moisture content, and the nature of the underlying materials. Landslides are given different names depending on the type of failure and their composition and characteristics. Types of landslides include slides, rock falls, and flows.

Slides

Slides move in contact with the underlying surface. Slides include rockslides – the down slope movement of a rock mass along a plane surface; and slumps – the sliding of material along a curved or flat surface. Slumps are relatively intact landslides, generally made up of soil, which moves down slope at slow to moderate velocities. Jackson County experienced a number of slumps during the 1997 New Year's Day flood event. However, slumps can occur without soil saturation. Slumps occur when a slope is undercut or when the top of a slope is overloaded with increased weight, such as from buildings or roads.

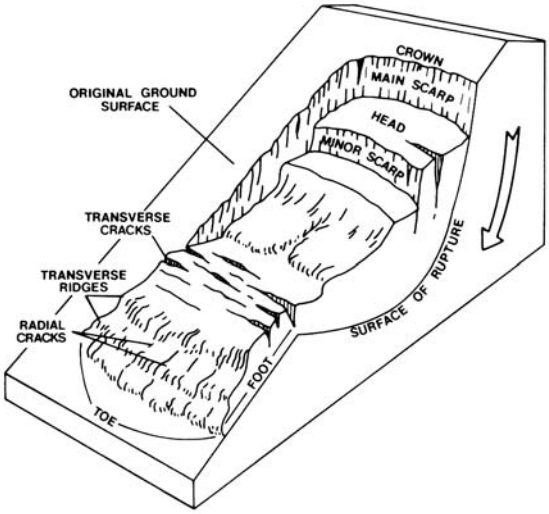
Types of slumps include *rotational* (movement along a curved surface) and *translational* (movement along a flat surface). Rotational slides occur when sliding material moves along a curved surface. Translational slides occur where movement occurs along a flat surface. These slides are generally slow moving and can be deep. Slumps are small rotational slides that are generally shallow (See Figure 5.1). Slow-moving landslides can occur on relatively gentle slopes and can

cause significant property damage, but are far less likely to result in serious injuries than rapidly moving landslides.[9]

Flows

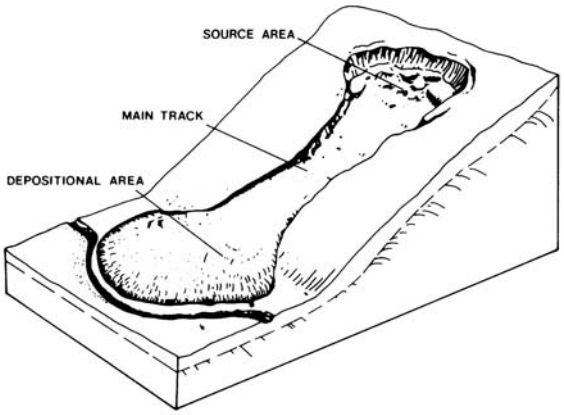
Flows are primarily liquid movements in which mass (e.g., soil and rock) breaks up and flows during movement. It involves individual particles that move separately within a moving mass. They can occur in bedrock (less common) or in soils. Rock flows are generally a slow, deep, or shallow creep. Debris and mudflows tend to have higher water content than other landslides and often occur as a rapid movement. Debris flows usually occur on steep slopes and are often associated with prolonged rainfall, or rapid snowmelt that cause sharp changes in ground water levels.[10] Debris flows were the most common type of landslide in Jackson County during the 1997 flood event. Debris flows typically move rapidly and tend to increase in volume as they scour out a channel. They are complex and usually begin from slides in loose slope deposits on mountainsides. They are commonly composed of rock fragments, boulders, cobbles and gravel set in a matrix of sand with some clay content. Mudflows occur in wet sand or in silty-clays or clays that are so reworked with water or so liquefied by structural collapse that they adopt a flow mode. Figure 5.2 shows elements of a debris flow.

Figure 5.1 Rotational Landslide



Source: Federal Emergency Management Agency 182, Landslide Loss Reduction. (1989)

Figure 5.2 Debris Flow



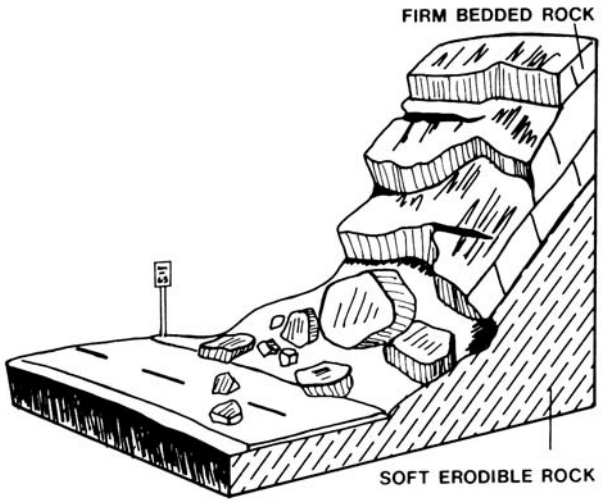
Source: Federal Emergency Management Agency 182, Landslide Loss Reduction. (1989)

Falls and Topples

In falls, material is detached from a steep slope or cliff and descends through the air by free fall or by bouncing or rolling down slope. Falls are generally divided into rock, debris, and soil categories. Rock fall, the

most common type, is a fall of detached rock from an area of intact bedrock. Rock falls are common along Oregon highways where the roads are cut through bedrock. Earthquakes often trigger rock falls. Topples consist of the forward rotation of rocks or other materials about a pivot point on a hill slope. Topples generally create an end-over-end motion of rock down slope. The main step in planning for falls and topples is to produce suitable surveys created by engineering geologists or geomorphologists of likely hazard areas.[11] Figure 5.3 shows the components of a rock fall.

Figure 5.3 Rockfall



Source: Federal Emergency Management Agency 182, Landslide Loss Reduction. (1989)

History of Past Landslide Events in Jackson County

Heavy and prolonged rains associated with major floods have been the most common factor triggering landslides in Jackson County. The 1997 New Year's Day flood resulted in over 200 landslides in the county. The 1955, 1964, and 1974 floods, caused primarily by rain over a heavy snowmelt, also triggered a significant number of landslides throughout the county. This discussion on past landslides in Jackson County focuses primarily on slides associated with the 1997 New Year's Day flood event.

The majority of landslides that occurred during the 1997 flood were fast moving debris flows located on steep, south facing slopes. The heavy rains associated with the flood increased the ground water levels. The soil in the area could not absorb the increases in water fast enough and this excess water eventually forced earth to move into a number of debris flows. There were also a significant number of slides, particularly slumps. Slumps require less saturation than debris flows and often result from roads that undercut steep slopes.

Landslides associated with the 1997 New Year's Day flood caused millions of dollars in damage to property and infrastructure. The

Medford Mail Tribune reported a landslide in Ashland, which caused significant residential property damage.[12] Another landslide during the 1997 flood rendered the Talent Irrigation District unable to generate power for approximately six weeks.[13] Irrigation Districts often generate power in order to supplement their income and to keep water costs down. Finally, a landslide near the Butte Falls/Prospect area resulted in over one million dollars in damages while landslides along Dead Indian Memorial Road resulted in over $300,000 in damages.[14]

Table 5.1 shows the major slides that impacted Jackson County roads during the New Year's Flood of 1997, and the associated costs to repair those roads.[15]

Table 5.1 Major Landslide Damage – 1997 New Year's Day Flood Events

County Roads	Mile Point	Repair Cost
Butte Falls Prospect Road at Middle Fork	MP 19	$1,300,000
Butte Falls Road at Rocky Hill	MP 11	$70,000
Dead Indian Memorial Road	MP 6	$50,000
Dead Indian Memorial Road	MP 7	$320,000
Total		$1,740,000

Source: Jackson County Public Works (2001)

Community Landslide Issues

Acres of property may be damaged and buildings and homes destroyed by landslides. Landslides can cause associated dangers such as broken electrical, water, gas, and sewage lines, and disrupt roadways and railways. Finally, landslides can result in injury and loss of life.

Property Damage

Landslides can cause significant commercial and residential property damage. Landslides occur as "on-site" hazards and "off-site" hazards. On-site hazards occur on or near development areas. In general, slower moving landslides cause most of the property damage in urban areas. Off-site hazards typically begin on steep slopes at a distance from homes or developments, and are often rapidly moving. These rapidly moving landslides have caused most of the property damage in rural areas.[16] A severe landslide can result in financial ruin for affected property owners because landslide insurance (except for debris flow coverage) is unavailable.

Utility Infrastructure Damage

Damage to water, gas, electrical and sewer lines are another important problem resulting from landslides. These damages include not only the costs of replacing and repairing damaged facilities, but also the costs associated with the disruption of the utilities.

Roads and Railway Damage

Much of the economic loss caused by landslides is borne by federal, state and local agencies. Highway construction is an area where mitigation practices could have a dramatic effect on reducing the economic loss associated with landslides. Many of the practices of excavation and grading used in road construction contribute to slope instability.

The majority of slope failures (70%) that occurred in Jackson County during the 1997 flood events were adjacent to road cuts on steep slopes. More than 60 roads in Jackson County were noted as landslide blocked roads. Excavation practices were cited as the main cause for these particular slope failures. In addition, there was no attempt to re-vegetate the slopes after the road cuts were made. An important consideration, however, is that 77% of the slope failures caused by road cuts were located on south facing slopes where it is difficult for vegetation to grow and stabilize the soil.[17]

Death and Injury

Most of the death and injuries caused by landslides occur from rapidly moving landslides. Such landslides are impossible for people to outrun. The most common type of rapidly moving landslide is debris flow.[18]

Current Mitigation Activities

The following activities are currently being carried out by local, regional, state, or national organizations.

Senate Bill 12

The 1997 Legislature passed Senate Bill 12 to address problems caused by landslides and debris flows. Provisions include:

1. Allowing the Oregon State Forester to prevent timber harvest or road construction in or below areas identified by the Department of Forestry as "high risk sites" and where homes or highways are in precarious locations.
2. Allowing road officials to close roads that pose a risk to human life because of landslides.
3. Requiring state agencies to develop, and local officials to distribute information about hazards of construction on sites that are vulnerable to landslides.
4. Establishing a 10-member Task Force on Landslide and Public Safety to assess the problem and develop a solution. It includes legislators and representatives from state natural resource agencies, boards of commission, local government, and the public.[19]

Debris Flow Mapping

Currently, two state agencies are involved in mapping debris flows: (1) the Oregon Department of Forestry and (2) the Department of Geology

and Mineral Industries (DOGAMI). Senate Bill 12 requires that the Department of Geology and Mineral Industries, with cooperation from local governments and the Department of Forestry, identify and map landslide prone areas, or "further review areas." Senate Bill 12 defines a further review area as "an area of land in which further site specific review should occur before land management or building activities begin."[20] Mapping debris flow areas are especially relevant in Jackson County due to the area's topography (steep slopes) and the considerable number of debris flows that have occurred in the past.

Oregon Department of Forestry (ODF)

The Oregon Department of Forestry has provided a preliminary indication of debris flows (rapidly moving landslides) in Western Oregon. Their debris flow maps include locations subject to naturally occurring debris flows and include the initiation sites and locations along the paths of potential debris flows (confined stream channels and locations below steep slopes). These maps neither consider the effects of management-related slope alterations (drainage and excavation) that can increase the hazard, nor do they consider very large landslides that could possibly be triggered by volcanic or earthquake activity. Areas identified in these maps are not to be considered "further review areas" as defined by Senate Bill 12 (1999).[21] Information used to develop the ODF Debris Flow maps include:

- Digital elevation models at 30-meter resolution, based on U.S. Geological Survey data, were used to derive slope steepness and then to develop polygons for assigned hazards. Note that actual slopes are steeper than these digitally elevated models.
- Mapped locations of Tyee soil formation and similar sedimentary geologic units.
- Oregon Dept. of Forestry *Storm Impacts and Landslides of 1996* study; debris flow initiation and path location data.
- Stream channel confinement near steep hill slopes based on U.S. Geological Survey Digital Raster Graphics.
- Historical information on debris flow occurrence in western Oregon (from Oregon Dept. of Forestry, U.S. Forest Service, DOGAMI, Bureau of Land Management, and the Oregon Department of Transportation).
- Fan-shaped land formations below long, steep slopes.
- Areas of highest intensity precipitation do not appear to be correlated with known areas of high and extreme debris flow hazard, so precipitation intensity was ***not*** used to develop risk (hazard) ratings.[22]

Oregon Department of Geology and Mineral Industries (DOGAMI)

The Oregon Department of Geology and Mineral Industries (DOGAMI) conducted field investigations and consolidated data on Oregon landslides associated with three flood events in 1996 and 1997. They

collected evidence of over 9000 landslide and slope failure locations in the state. The generation of a statewide landslide inventory is intended to provide a means for developing and verifying hazard models as well as to facilitate various local efforts aimed at minimizing risk and damage in future storm events. The database includes a digital Geographic Information System file with landslide locations, a digital database with details on each landslide, and an accompanying report.[23] In addition to the slope failures report, DOGAMI is identifying and mapping further review areas. The further review areas identify where landslides have occurred and where landslides are likely to occur.[24]

Prohibition of Certain Forest Operations

As part of the requirements of Senate Bill 12, the Oregon Department of Forestry is currently administering the deferral of certain forest operations on landslide prone sites above homes and roads. The department's policy is that timber harvesting or road construction operations will be prohibited on land where landslides or debris flows pose a significant threat to human safety. Exceptions for salvage or other purposes are considered on an individual basis, but have been infrequent in keeping with the intent of preventing significant risks to human life.[25]

Debris Flow Warning System

The debris flow warning system was initiated in 1997 and involves collaboration between the Department of Forestry, DOGAMI, the Department of Transportation, local law enforcement, and National Oceanic and Atmospheric Administration (NOAA) Weather Radio and other media.

ODF meteorologists are responsible for forecasting storms that may trigger debris flows. Information is broadcast over NOAA Weather Radio, and on the Law Enforcement Data System. DOGAMI provides additional information on debris flows through the media. The Department of Transportation provides warning signs to motorists in landslide prone areas during high-risk periods.[26]

Residential Landslide Damage
Source: Community Planning Workshop

Landslide Brochure

The Department of Geology and Mineral Industries (DOGAMI) developed a landslide public outreach brochure in cooperation with several other state agencies. Forty thousand copies were printed in November 1997 and were distributed widely through building code officials, county planners, local emergency managers, natural resource agency field offices, banks, real estate companies, insurance companies, and other outlets. Landslide brochures are available from DOGAMI, the Office of Emergency Management (OEM),

Oregon Department of Forestry (ODF), and the Department of Land Conservation and Development (DLCD).[27]

Oregon State Building Code Standards

The Oregon Building Codes Division adopts statewide standards for building construction that are administered by the state and local municipalities throughout Oregon. The One- and Two-Family Dwelling Code and the Structural Specialty Code contain provisions for lot grading and site preparation for the construction of building foundations.

Both codes contain requirements for cut, fill and sloping of the lot in relationship to the location of the foundation. There are also building setback requirements from the top and bottom of slopes. The codes specify foundation design requirements to accommodate the type of soils, the soil bearing pressure, and the compaction and lateral loads from soil and ground water on sloped lots. The building official has the authority to require a soils analysis for any project where it appears the site conditions do not meet the requirements of the code, or that special design considerations must be taken. ORS 455.447 and the Structural Code require a seismic site hazard report for projects that include essential facilities such as hospitals, fire and police stations and emergency response facilities, and special occupancy structures, such as large schools and prisons. This report includes consideration of any potentially unstable soils and landslides.[28]

Steep Slope Ordinances

The Cities of Ashland and Medford have both implemented steep slope ordinances to regulate development in hazard-prone areas. Senate Bill 12 also provides for a pilot program, under the guidance of the Department of Land Conservation and Development, to develop model ordinances, regulations and procedures for mitigation of hazards and for allowing the transfer of development rights.[29]

Jackson County Development Standards

Section 05.150 of the Jackson County Design, Development, and Access Standards states that the county may require consideration for road or building development by reasons of geological conditions, excessive surface erosion, expansive soils, steep slopes, unstable subsurface conditions, groundwater ponding and other dangerous conditions.

Section 05.160 states that grading and clearing for road and/or development purposes may be restricted or regulated if such grading can result in erosion or slide damage or other detrimental impacts.

Section 05.160 sets general criteria to minimize storm water runoff and land drainage problems.

Landslide Hazard Assessment

Hazard Identification

Hazard identification is the first phase of a hazard assessment, and is the process of estimating the geographic extent of the hazard, its intensity, and its probability of occurrence.[30] This process usually results in a hazard map, and can provide detailed information in a clear format that provides public information and can assist in making policy and land use decisions. ODF and DOGAMI have been involved in mapping areas prone to rapidly moving landslides. This assessment uses the ODF Debris Flow Hazard maps and the DOGAMI slope failures report as the basis for hazard identification.

The map on the following page illustrates moderate and high-risk areas for landslides, and shows the urban and rural development in proximity to those areas. This landslide map also shows recent landslides, with a concentration occurring throughout the Applegate area, the upper reaches of Elk Creek, and the greatest concentration occurring immediately south of Ashland's Urban Growth Boundary.

Vulnerability Assessment

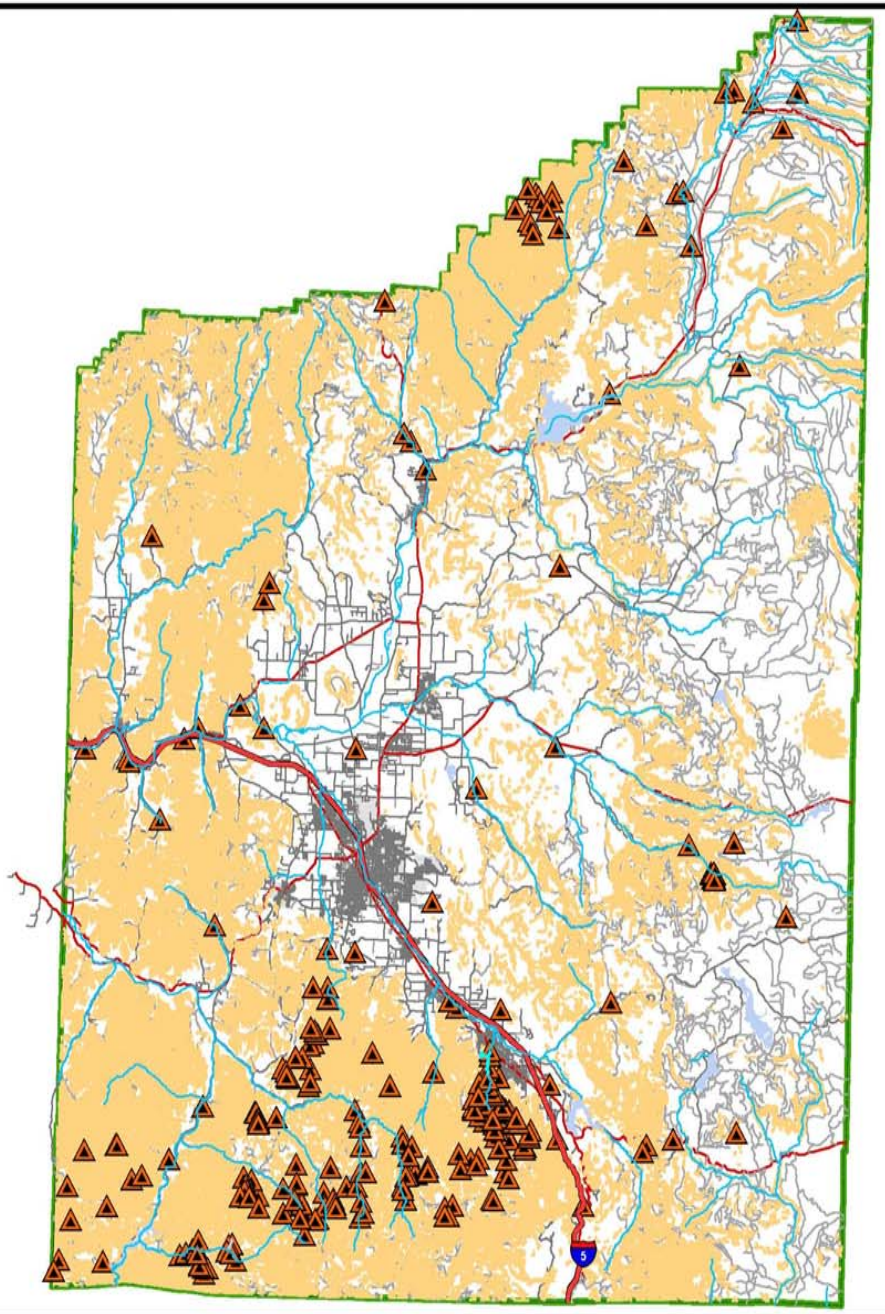
Vulnerability assessment is the second phase of a hazard assessment. It combines the information generated through debris flow identification with an inventory of the existing property and utilities that are exposed to the hazard, helping to predict how different types of property and population groups will be affected by a hazard.[31] While a quantitative vulnerability assessment (an assessment that describes number of lives or amount of property exposed to the hazard) has not yet been conducted for Jackson County landslide events, there are many qualitative factors (issues relating to what is in danger within a community) that point to potential vulnerability. Landslides can impact major transportation arteries, blocking residents from essential services and businesses. While past landslide events have not caused major property damage or significantly impacted county residents, continuing to map county landslide and debris flow areas will aid in preventing future loss.

Probability

Landslides are ranked as the tenth highest natural or man-made hazard in the county's Emergency Operations Plan Hazard Analysis. The probability of occurring is still high, however, being more than one chance per 10 years.

Risk Analysis

Risk analysis is the third, and most advanced phase of a hazard assessment. It builds upon hazard identification and vulnerability assessments. Factors included in assessing landslide risk include population and property distribution in the hazard area, the frequency of landslide or debris flow occurrences, slope steepness, soil



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SMARTMAP

JACKSON COUNTY
GEOGRAPHIC INFORMATION SYSTEM

Jackson County Pre-Disaster Mitigation

Landslide Hazard

Legend

- Debris Flows (ODF)
- Landslides (DOGAMI)

JACKSON COUNTY
oregon

Plot date: 02/15/2005; T:\5015\Disaster Mitigation Maps - Flood Hazard.mxd

characteristics, and precipitation intensity. This type of analysis could generate estimates of the damages to the county due to a landslide or debris flow event in a specific location. At the time of publication of this plan, data was insufficient to conduct a risk analysis and the software needed to conduct this type of analysis was not available.

Landslide Goals and Action Items

The mitigation goals and action items were formulated through research of regional and national mitigation plans, natural hazards planning literature, and interviews with local stakeholders. Plan goals and action items were refined through discussions with the mitigation plan steering committee and through public workshops. The goals are broad based to encompass all the identified hazards addressed in this mitigation plan. Plan goals focus on seven categories:

1. Property Protection
2. Education and Outreach
3. Preventative
4. Partnership and Coordination
5. Structural Projects
6. Natural Resource Protection
7. Emergency Services

To read the goal statements for each of the seven categories, see *Section 3: Multi-Hazard Goals and Action Items.*

Two public workshops were held during the compilation of the mitigation plan: the first workshop was held on April 26, 2001 and the second one on June 12, 2001. The purpose of these workshops was to inform the public about natural hazards that occur in Jackson County, and identify community priorities, and potential strategies for achieving those priorities.

Through a voting process, Jackson County citizens identified goal statements in the following three categories as community priorities:

1. Emergency Services
2. Education and Outreach
3. Partnership and Coordination

Each of the goal statements and a summary of the workshop outcomes are listed in Section 3: Multi-Hazard Goals and Action Items. A complete listing of public comment is located in Appendix A: Public Process.

This section lists action items identified to reduce the risk from landslide impacts in Jackson County. These action items are designed to meet the mitigation plan goals.

Short-term (ST) Landslide Action Items

Short-term landslide action items include general mitigation activities that agencies are capable of implementing during the next two years, given their existing resources and authorities.

To read about action item organization, see the *Five-Year Action Plan.*

ST-LS-1: Compile Relative Landslide Risk maps for Jackson County.

Notes: DOGAMI has produced maps of potential debris flow areas in the county. However, field investigations must be undertaken to verify the actual flow hazard. The county may combine historic information on landslides in the county with the DOGAMI model data to inform planning and development processes.

Coordinating Organization:	DOGAMI, County GIS
Partner Organization:	County Planning, County Emergency Management, ODF, SOU
Timeline:	Ongoing
Plan Goals Addressed:	Education and Outreach, Preventative, Partnership and Coordination

ST-LS-2: Increase public education related to landslide hazards by distributing landslide informational brochures.

Notes: Local governments in Jackson County can easily distribute brochures. Target departments include emergency management and land use planning.

Coordinating Organization:	County Emergency Management
Partner Organization:	County Planning, City Emergency Managers, DOGAMI, OEM, ODF, DLCD
Timeline:	1-2 years
Plan Goals Addressed:	Education and Outreach, Partnership and Coordination

Long-Term (LT) Landslide Action Items

Long-term landslide action items include general mitigation activities that are likely to take more than two years to implement and will require additional resources and/or authorities.

LT-LS-1: Investigate the development and implementation of a county landslide ordinance.

Notes: This ordinance is currently being developed and its purpose will be to review development applications for properties within identified "further review areas" and excessive slope areas to assess the risk before allowing proposed land use activities. The ordinance can also use financial incentives or disincentives to promote development outside identified risk areas. The Salem Steep Slope / Landslide Ordinance can be an example of key components.

Coordinating Organization:	County Planning
Partner Organization:	County Emergency Management, County GIS, DOGAMI, ODF, County Roads
Timeline:	3-5 years
Plan Goals Addressed:	Preventative

Jackson County
Landslide Resource Directory

County Resources

Jackson County Emergency Management

Jackson County Emergency Management helps the community be better prepared for major emergencies and disasters. They work closely with cities, emergency responders, and volunteer agencies to find ways to reduce risks and minimize damages during hazard events. When a disaster occurs, they work with these partners in their Emergency Operations Center to coordinate resources and information. Once the event is over, they help bring assistance to those that have been harmed.

Contact: Jackson County Emergency Program Manager
Address: 10 South Oakdale, Medford, Oregon 97501
Phone: (541) 774-6821
Fax: (541) 774-6455
Website: http://www.co.jackson.or.us

Regional Resources

Department of Geology, Portland State University

Portland State University conducts research and prepares inventories and reports for communities throughout Oregon. Research and projects conducted through the Department of Geology at Portland State University includes an inventory of landslides for the Portland metropolitan region after the 1996 and 1997 floods and a subsequent susceptibility report and planning document for Metro in Portland.

Contact: Portland State University, Department of Geology
Address: 17 Cramer Hall; 1721 SW Broadway, Portland, OR 97207
Phone: (503) 725-3389
Website: http://www.geol.pdx.edu

Southern Oregon University

The Geology and Environmental Studies programs at Southern Oregon University are involved in research related to the physical landscape in the region around Jackson County.

Contact: Southern Oregon University Geology Department
Address: 1250 Siskiyou Blvd, Ashland, OR 97520
Phone: (541) 552-6477
Website: http://www.sou.edu/Geology/index.htm

State Resources

Salem Ordinance- Landslide hazard

The development of the Salem Landslide ordinances began with updated inventory information, which included landslide mapping and characterization of the project area.

Contact: City of Salem
Address: 555 Liberty St. SE/Room 305, Salem, OR 97301-3503
Phone: (503) 588-6211
Fax: (503) 588-6005
Website: http://www.open.org/~naturalr/Landslides/landslide_Ord.htm

Oregon Department of Forestry

In addition to its other functions, ODF regulates forest operations to reduce the risk of serious bodily injury or death from rapidly moving landslides directly related to forest operations, and assists local governments in the siting review of permanent dwellings on and adjacent to forestlands in further review areas.

Contact: Oregon Department of Forestry
Address: 5286 Table Rock Rd. Central Point, OR 97502
Phone: (541) 664-3328
Website: http://www.odf.state.or.us/

Oregon Department of Geology and Mineral Industries (DOGAMI) Landslide Inventory Project

DOGAMI is an important agency for landslide mitigation activities in Oregon. Some key functions of DOGAMI are development of geologic data for Oregon, producing maps, and acting as lead regulator for mining and drilling for geological resources. The agency also provides technical resources for communities and provides public education on geologic hazards. DOGAMI provides data and geologic information to local, state and federal natural resource agencies, industry and other private groups.

Contact: DOGAMI
Address: 800 NE Oregon Street, Suite 965, Portland, Oregon 97232
Phone: (503) 731-4100
Fax: (503) 731-4066
Website: http://sarvis.dogami.state.or.us/landslide/inventory/project.htm
Email: info@naturenw.org
Document: Hofmeister, R. J., 2000, "Slope Failures in Oregon: GIS Inventory for Three 1996/97 Storm Events": Oregon Department of Geology and Mineral Industries Special Paper 34, 20 p., 1 compact disc.

Nature of the Northwest, landslides

The Nature of the Northwest Information Center is operated jointly by Oregon Department of Geology and Mineral Industries and the USDA Forest Service. It offers a selection of maps and publications from state, federal and private agencies.

Contact: The Nature of the Northwest Information Center
Address: 800 NE Oregon Street #5, Suite 177**,** Portland, Oregon 97232
Phone: (503) 872- 2750
Fax: (503) 731-4066
Website: http://www.naturenw.org/geo-landslides.htm
Email: Nature.of.Northwest@state.or.us

Department of Land Conservation and Development (DLCD)

Oregon's Department of Land Conservation and Development administers a natural hazards program to assist local governments in meeting Statewide Planning Goal 7: Areas Subject to Natural Disasters and Hazards. Activities relating to landslide mitigation include:

- Distribution of model ordinances through which hazards can be mitigated. DLCD advises local governments on which ordinance best meets their needs;
- Reviewing local land use plan amendments for consistency with state landslide programs and regulations and providing direct technical assistance;
- Providing a liaison between pertinent local, state, and federal agencies. DLCD representatives serve on a variety of commissions and ad hoc committees which deal with natural hazards;
- Adopting and amending Statewide Planning Goals and Administrative rules relating to natural hazards.

Contact: Natural Hazards Program Manager
Address: 635 Capitol Street NE, Suite 150
Phone: (503) 373-0050
Fax: (503) 378-6033
Website: http://www.lcd.state.or.us/hazards.html

Oregon State Police (OSP)-Office of Emergency Management (OEM)

In relation to Senate Bill 12 and rapidly moving landslide hazards, OEM coordinates state resources for rapid and effective response to landslide-related emergencies. The Oregon Emergency Response System (OERS) of OEM is a key player in the dissemination of debris flow advisories and warnings. OEM chairs a group that develops and measures landslide hazard mitigation strategies. OEM administers the FEMA Hazard Mitigation Grant Program, which provides a source of funding for implementing hazard mitigation projects. OEM also works with other state agencies to develop information for local governments and the public on landslide hazards.

Contact: Oregon State Police – Office of Emergency Management
Address: 595 Cottage Street NE
Phone: (503) 378-2911
Fax: (503) 588-1378
Website: http://www.osp.state.or.us/oem

Oregon Department of Consumer & Business Services – Building Codes Division

The Building Codes Division (BCD) sets statewide standards for design, construction, and alteration of buildings that include resistance to seismic forces. BCD is active on several earthquake committees and funds construction related continuing education programs. BCD registers persons qualified to inspect buildings as safe or unsafe to

occupy following an earthquake and works with OEM to assign inspection teams where they are needed.

Contact: Building Codes Division
Address: 1535 Edgewater St. NW, P.O. Box 14470, Salem, Oregon 97309
Phone: (503) 378-4133
Fax: (503) 378-2322
Website: http://www.cbs.state.or.us/external/

Oregon Department of Transportation (ODOT)

ODOT constructs and maintains road transportation networks across the state. For further information on state roads and landslides in Jackson County, contact the ODOT Region 3 office in Roseburg.

Contact: ODOT Main Office
Address: 355 Capitol St. NE Room 135, Salem OR 97301-3871
Phone: (541) 957-3656
Website: http://www.odot.state.or.us/region3public/

National Resources and Programs

National Landslide Information Center; US Geological Survey

Their website provides good information on the programs and resources regarding landslides. The page includes information on the National Landslide Hazards Program, Information Center, a bibliography, publications and current projects. USGS scientists are working to reduce long-term losses and casualties from landslide hazards through better understanding of the causes and mechanisms of ground failure both nationally and worldwide.

Contact: National Landslide Information Center
Phone: (800) 654-4966
Website: http://landslide.usgs.gov

Federal Emergency Management Agency, landslide and mudflow fact sheet

Landslide and mudflows usually strike without warning. The force of rocks, soil, or other debris moving down a slope can devastate anything in its path. The websites focus on strategies to reduce risk and prevent loss from landslides and debris flows.

Contact: Federal Regional Center, Region 10
Address: 130-228th St. SW, Bothell, WA 98021-9796
Phone: (425) 487-4678
Website: http://www.fema.gov/library/landslif.htm

American Planning Association, landslides page

The APA's research department embarked on a program to bring together solutions from multiple disciplines into a single source. It will help serve local planning efforts in identifying landslide hazards early in the planning process so as to minimize exposure to landslide risks. The website highlights planning efforts to reduce risk and loss from landslides. You can sign up on their mailing list to receive updates on the research.

Contact: Principal Investigator, Landslides Project
Address: Research Department, American Planning Association
122 S. Michigan Ave., Suite 1600, Chicago, Illinois 60603-6107
Phone: (312) 431-9100
Fax: (312) 431-9985
Website: http://www.planning.org/landslides
Email: landslides@planning.org

Natural Resource Conservation Service (NRCS)

The NRCS produces soil surveys. These may be useful to local governments who are assessing areas with potential development limitations including steep slopes and soil types. They operate many programs dealing with the protection of natural resources.

Contact: NRCS, Oregon Branch
Address: 101 S.W. Main Street, Suite 1300
Phone: (503) 414-3200
Fax: (503) 414-3103
Website: http://www.or.nrcs.usda.gov

Recommended Publications

Planning for Natural Hazards: The Oregon Technical Resource Guide

Produced by the Community and Planning Workshop, this is a natural hazards planning and mitigation resource specifically for Oregon cities and counties. It provides resource guides and plan evaluation tools written for local staff and officials. The guide includes a natural hazards comprehensive plan review, hazard mitigation legal issues guide, and hazard-specific technical resource guide, including the following natural hazards: flooding, wildfires, landslides, coastal hazards and earthquakes. This document is available online. You can also write, call or fax to obtain this document:

Contact: Natural Hazards Program Manager, DLCD
Address: 635 Capitol St. NE, Suite 200, Salem, OR 97301-2540
Phone: (503) 373-0050
Fax: (503) 378-6033
Website: http://www.lcd.state.or.us/hazards.html

Disasters by Design: A Reassessment of Natural Hazards in the United States, Mileti, Dennis. (1999).

This book offers a way to view, study, and manage hazards in the United States that will help foster disaster-resilient communities, higher environmental quality, inter- and intragenerational equity, economic sustainability, and an improved quality of life. The volume provides an overview of what is known about natural hazards, disasters, recovery, and mitigation; reveals how research findings have been translated into policies and programs; and advances a sustainable hazard mitigation research agenda. The book summarizes and sets the stage for other more detailed and topic specific volumes in the series.

To obtain this resource: Contact your local library

Planning for Hillside Development, Olshansky, Robert B. (1996) American Planning Association Planning Advisory Service Report #466

This document describes the history, purpose and functions of hillside development and regulation, the role of planning, and provides excerpts from hillside plans, ordinances and guidelines from communities throughout the U.S.

To obtain this resource: Contact your local library or contact the American Planning Association at (312) 431-9100.

Unstable Ground: Landslide Policy in the United States. Olshansky, Robert B. and Rogers, J. David. (1987) Ecology Law Quarterly page 939

This article is about the history and policy of landslide mitigation in the United States. **To obtain this resource:** Contact your local library

USGS Landslide Program Brochure. National Landslide Information Center (NLIC), United States Geologic Survey

The brochure provides good, general information in simple terminology. Information on the importance of landslide studies and a list of databases, outreach and exhibits maintained by the NLIC. The brochure also includes information on types and causes of landslides, falls, and flows.

Contact:	USGS- MS 966, Box 25046, Federal Center, Denver, CO 80225
Phone:	(800) 654-4966
Email:	highland@gldvxa.cr.usgs.gov
Website:	http://geohazards.cr.usgs.gov/

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[19] *Landslides in Oregon Brochure*. ODF, DOGAMI, Department of Consumer and Business Services, Oregon Emergency Management.

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[21] *Western Oregon Debris Flow Hazard Maps: Methodology and Guidance for Map Use.* (1999).

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[25] Ibid.

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Section 6:
Severe Winter Storm and Windstorm

Jackson County Severe Winter Storm and Windstorm Event

Jackson County is threatened by hazards generated from weather conditions almost every year. Storms bring heavy rains, strong winds, and occasionally ice and snow. Flooding and landslides can also accompany severe storms. Damaging storms are most common from October through April. Severe storms can create conditions that disrupt essential regional systems such as public utilities, telecommunications, and transportation routes. Wind, snow, and ice associated with winter storms can knock down or otherwise damage trees, power lines, and utility services. Freezing winter temperatures can damage agricultural crops and utilities. Lightning poses a risk to life and can result in property damage. Weather hazards cause damage to private property and public infrastructure, and occasionally cause injury or death.

Causes and Characteristics

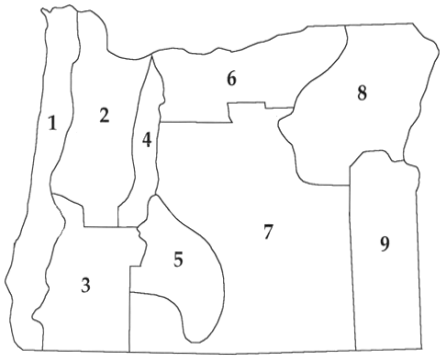
Storms affect all parts of Jackson County. However, the varied elevations and topography of the County mean that the impact of a storm is variable depending on the location. The Cascade Mountains along the eastern border of the County, and the Siskiyou and Klamath Mountains to the south, regularly receive the highest amounts of rainfall and snowfall, and the strongest wind gusts in the County. The mountains to the south and west often bear the brunt of storms and provide some shelter to the lower, more populated valleys.

The most frequent weather related hazards in the Rogue Valley and other low-elevation areas of Jackson County are rain, wind, and freezing temperatures. Occasionally, freezing temperatures combine with moisture to produce snow and ice.

Climate

Figure 6.1 shows the nine climate zones in Oregon. Jackson County coincides with the southern half of Climate Zone 3 – Southwestern Interior, which also includes small portions of Josephine and Douglas Counties. [1] This discussion of Jackson County's climate is based in part on data for Zone 3, as well as weather data from local weather stations.

Figure 6.1 Oregon Climate Zones

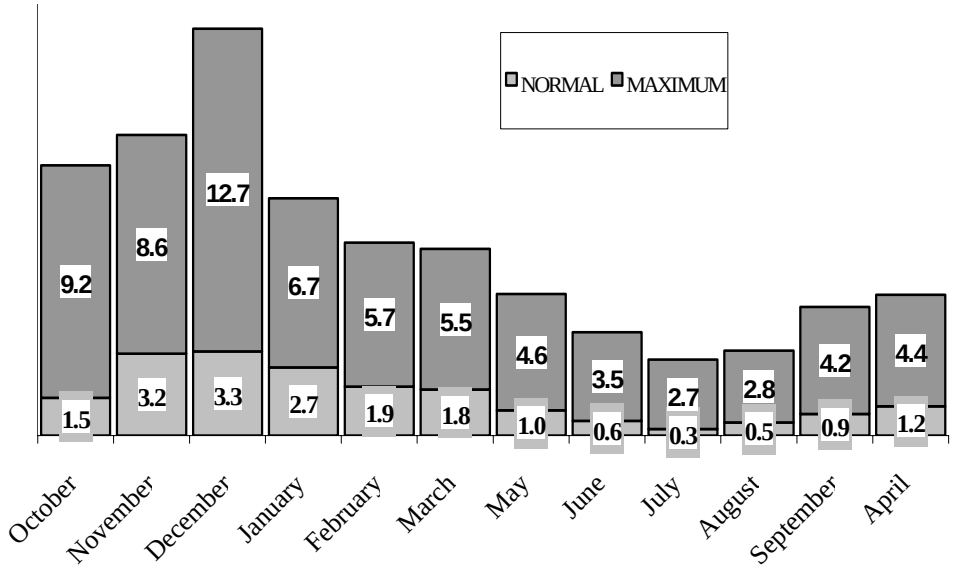


Zone 1: Coastal Area
Zone 2: Willamette Valley
Zone 3: Southwestern Interior
Zone 4: Northern Cascades
Zone 5: High Plateau
Zone 6: North Central Area
Zone 7: South Central Area
Zone 8: Northeast Area
Zone 9: Southeast Area

Source: National Climatic Data Center

Jackson County's rugged topography and its distance from the Pacific Ocean are the principal factors influencing the nature of its weather.[2] Generally, the populated valleys of the County lie in the "rain shadow" of the Coast Range to the west. The Coast Range effectively separates the region from the most severe impacts of the storm systems moving east from the Pacific. While annual rainfall in the bottom of Bear Creek Valley averages less than twenty inches, Mt. Ashland receives more than fifty inches in an average year. Unofficial data from the Klamath Mountain regions along the southwestern edge of the county indicate highly localized averages in excess of 120 inches per year. [3]

Figure 6.2 Normal and Maximum Monthly Precipitation, Medford



Medford's average annual precipitation is 18.85 inches, with about three-quarters of that precipitation in the county falling between November and March. This pattern generally holds true, though in 1962, a massive rainstorm soaked the county for several days in October.[4] Figure 6.2 shows normal precipitation averages.

Despite lower rainfall amounts than in the Willamette Valley, snowfall averages in Jackson County's valleys are much greater. The county's drier climate and higher altitudes result in colder winter temperatures, and annual snowfall totals are typically between twenty and thirty inches, though snow does not usually last long in the valleys.[5] Mountain locations receive far more snow than the valleys. Valley locations average around three storms annually that yield at least an inch of snow, while mountain locations may average thirty such storms per year.[6] The following map shows the average annual precipitation in Jackson County and illustrates the influence that elevation has on precipitation levels.

Weather Patterns

Marine Air Masses

Most of western Oregon is dominated by moist marine air masses that move east up the coastal valleys. However, the coastal mountains protect Jackson County from all but the most powerful movements of marine air.

Subtropical Air Masses

Subtropical air masses from the far southwest regions of the Pacific are associated with the wettest storms and with relatively warm temperatures. Most of Jackson County's major flood events occur after these storms, especially if the rain melts snow from previous storms. The New Year's Day flood of 1997 and the Christmas flood of 1964 are examples of this phenomenon. The unusually high incidence of El Nino events during the 1980's and 1990's meant that subtropical air was a part of Pacific storms more often than in the past.

Gulf of Alaska Air Masses

When Pacific low-pressure systems form at high latitudes, they may bring air that is moist and cold enough to cause snowstorms. Medford's elevation of approximately 1,400 feet is particularly susceptible to snow generated by these air masses. These air masses can also be involved in certain kinds of fierce windstorms.

California Air Masses

South winds pass over California before coming into Oregon. These may arrive during the winter in advance of a storm system, when they bring warm, dry air from the Great Basin by way of California. During the summer, California air masses produce thunderstorms in the county when they bring moist Pacific air.[7]

Severe Winter Storms

Each year the State of Oregon receives many "mid-latitude synoptic-scale cyclones."[8] Figure 6.3 shows typical winter storm system. These systems approach from the Pacific, rotating counter-clockwise around a low-pressure zone. Oregon's big winter storms share the following characteristics:

- They move in a general west-to-east direction, with occasional detours to the north or south.
- They form over the north Pacific.
- They produce both wind and rain. Much of Jackson County's annual precipitation comes from these storms.
- They occur almost exclusively during the cool season, from October to March.
- They move fairly rapidly, affecting an area for a day or less.
- Pacific storm systems generate predictable wind patterns.

Winds generally originate from the south-southeast. As the leading edge of the storm passes over the county, wind direction changes to blow from the south-southwest. These are the destructive winds, which constitute the storm's main wind hazard. A cold front defines the trailing edge of the storm, and winds shift once again to bring cold air from the west-northwest. Cold winds arriving at the end of a Pacific storm can cause violent windstorms affecting small areas in mountain valleys along the west side of Jackson County.

Rain

In the Rogue and Bear Creek Valleys, rain is the most common form of precipitation associated with severe winter storms. Depending on the type of air mass and temperature, a winter storm can result in rain in the valleys and rain or snow in higher elevations. In 1964, the "Christmas" floods were the result of warm winter storms dropping rain in valleys and mountains. In 1997, warm rain in the mountains melted snow pack increasing the amount of water flowing in County creeks and rivers.

Snow

Freezing temperatures and sufficiently moist air are required to produce a snowstorm.[9] Between 1911 and 1996, Medford experienced a 24-hour snowfall total greater than five inches only fourteen times.[10] Western Oregon valleys are not often cold enough for snow, but when a Pacific storm is associated with an air mass from the Gulf of Alaska, a major snowstorm may ensue. Jackson County often receives heavier snowfall than the rest of western Oregon under these conditions because of its lower temperatures and higher altitudes.[11] Crater Lake, at the county's northeast border, holds many state records for snowfall.

Windstorms

A majority of the destructive surface winds in Oregon come out of the southwest. Under certain conditions, very strong east winds may occur, but these are usually limited to small areas in the vicinity of the mountain passes.

The more frequent and widespread strong winds from the southwest are associated with storms moving onto the coast from the Pacific Ocean. If the winds are from the west, they are often stronger on the coast than in the interior valleys due to the north-south orientation of the Coast Range and Cascades. The Coast Range shelters the populated valleys of Jackson County from the full force of Pacific windstorms.[12] In Medford the official record one-minute wind speed is only 55 mph, set on March 14, 1952, which is substantially below the hurricane-force threshold of 74 mph.[13] The most destructive winds are those which blow from the south, parallel to the major mountain ranges. The Columbus Day Storm of 1962 was a classic example of a south wind storm. The storm developed off the coast of California, moved to the northeast, and then turned north and paralleled the Oregon coast.

High winds are common in the mountains of both the Coast Range and the Cascade Range. Cold air from the northwest arriving behind Pacific storm fronts filters through mountain canyons into the basins and valleys of southwest Oregon. If the cold air is deep enough, it can spill over the mountain ridge. As the air funnels through canyons and over ridges, wind speeds may exceed 100 mph. Official wind observations in Oregon are all made at valley locations, but unofficial observations indicate that gusts over 100 mph occur several times a year across the higher ridges of Jackson County.[14] These very localized winds are unique to mountainous terrain. They are often intense, but of short duration and affect relatively small areas.[15] High wind events in mountainous regions are probably under-reported because of the lack of official weather stations there.[16]

Thunderstorms

County residents are familiar with the phenomenon of summer thunderstorms. Summer thunderstorms may cause very high winds in localized areas. They are complex, and may contain many weather elements. Wind almost always accompanies a thunderstorm, but lightning, hail and rain are also common elements.[17] While unusual relative to their occurrence in other parts of the country, thunderstorms occur most summers in Jackson County, with potentially serious consequences for the people, property and environment.

History of Past Severe Winter Storm & Windstorm Events

Jackson County's unique location adjacent to high coastal mountains generates severe weather significantly different from other places in western Oregon. For example, a Pacific storm in November of 1996 set 24-hour rainfall records from Portland to Roseburg,[18] but was only the third wettest storm in Medford at that point in time.[19] With few exceptions, Pacific storms must be powerful enough to affect most of the state to be considered major storms in Jackson County. A notable exception occurred on December 2, 1962, when a winter storm dropped a record 3.3 inches of rain in Medford and caused serious flooding there.[20] Yet this storm did not have serious impacts outside of southwestern Oregon.[21] More recently, the New Year's Day storm of 1997 caused major flooding in Jackson County, but was not a record-setting storm elsewhere in Oregon.

Major Rainstorms

Twice in its history Medford experienced 24-hour periods of rainfall amounts greater than three inches. On December 2 of 1962, Medford received 3.3 inches in 24-hours.[22] December 22 1964 brought 3.2 inches, and the resulting flood is known as the Christmas Flood of 1964.[23] Five other storms brought intense December rains, including two storms during the La Nina years of 1950 and 1955, each depositing two inches of rain in twenty-four hours.[24] Between October 28th and 29th of 1950, Medford received almost five inches of rain. October 1950 became the second wettest on record, with a total of 9.16 inches. The Columbus Day Storm of 1962 brought high winds throughout Oregon on

Winter driving in 1998
Source: Medford Mail Tribune

Table 6-1. Medford Snowfall Totals 1988-1998

Year	Date	Amount
1988	Jan. 31	4 inches
1988	Dec. 24	1 inch
1988	Dec. 30	1 inch
1989	Jan. 8	2 inches
1989	Feb. 2	1 inch
1989	Mar. 2	1 inch
1990	Jan. 30	1 inch
1990	Feb. 6	1 inch
1990	Feb. 15	1 inch
1990	Dec. 22	1 inch
1992	Dec. 29	1 inch
1993	Jan. 5	1 inch
1993	Feb. 2	1 inch
1994	Nov. 26	1 inch
1998	Dec. 6	2 inches

October 12th. The days leading up to the windstorm, however, brought large amounts of rain.[25] Medford received an inch or more on the 8th and 9th of that month, with almost two inches on the 11th.[26]

Snowstorms

Snowstorms vary in character. Some are accompanied by strong winds, such as those of March 1988 and February 1989. Others are accompanied by freezing rain and ice, such as the storm of January 1980. A series of snowstorms occurred during the week of January 9th in 1950 that closed all highways west of the Cascades.[27] The storm of November 1989 was unusual in that it did not result from a powerful Pacific storm, but was driven mainly by local climatic effects. Thus, Jackson County received heavy snow that did not occur in other areas in western Oregon. Major snowstorms have been less common in Jackson County during the 1990's, though significant amounts of snow fell during the winter of 1998-99.[28] In December 1998, Medford received two inches of snow. The winter weather persisted throughout the month, culminating in a four-day period of sub-freezing temperatures just before Christmas.

Snowstorm damage information is not systematically collected in Jackson County. The National Climatic Data Center (NCDC) maintains a database of past storm events throughout the country, organized by microclimate regions. A record is made of each storm reported to NCDC, including injury and property damage assessments. Unfortunately, winter storm damage assessments have not been reported for Oregon Climate Zone 3, and the list of winter storms for the region is far from complete. Table 6-1 illustrates snowfall in Medford between 1988 and 1998.

Windstorms

Damaging winds in Oregon are most often generated by Pacific windstorms. Records of major Pacific windstorms are documented by state agencies and weather stations throughout Oregon, including several official weather stations in Jackson County's lower valleys. However, because of the county's sheltered location, the most severe statewide windstorms only occasionally match up with local wind speed records. Jackson County experienced record-setting Pacific windstorms in January and February 1958. Wind speeds in November 1958 were

not surpassed until 1981.[29] During this storm, every major highway in Oregon was at some point blocked by fallen trees.[30]

Oregon's second most powerful windstorm occurred in December of 1995.[31] This storm caused massive damage throughout the state. The 113 mph gusts measured in Portland illustrate the force of the 1995 storm. [32] However, in Medford the sustained one-minute wind speeds from this storm did not reach 44 mph, which was the local record for the month of December, set thirty years earlier in 1965.[33] The Columbus Day Storm of 1962 did register on Medford's official records, though winds reached only 40 mph.

Thunderstorms

The National Climatic Data Center (NCDC) database for Jackson County thunderstorms goes back to 1993, and lists twenty thunderstorms. Unfortunately, few of these listings include details, but 60-knot winds are recorded for three of the thunderstorms.

Lightning is almost always an element of summer thunderstorms in Jackson County, and is a direct hazard to human safety. The Oregon State Climatologist has recorded several tragic accounts of lightning strikes during thunderstorms in Ashland, Grants Pass, and Rogue River, all of which resulted in injury or death.[34] More commonly, lightning damages property, primarily when it causes wildfires. Forested and grasslands are particularly vulnerable to thunderstorm lightning strikes during drought years.

Wind is a factor in most thunderstorms, and thunderstorm winds are sometimes very strong. During a thunderstorm in 1970, high winds caused extensive damage in the Medford area, notably to the Sheriff's radio communications system. A May 1987 storm caused 60 to 70-mph winds in Eagle Point, removing a number of roofs.

On July 8, 1995 a thunderstorm hit Wimer in northern Jackson County and caused approximately $70,000 of wind damage. On July 29, 1996, a thunderstorm at the Medford airport was reported to have 60-knot winds. This storm reportedly caused $3.5 million in wind damage. On August 23, 1999 a thunderstorm in Central Point also reportedly achieved 60-knot winds.[35]

Lightning Strikes

In 1967 and 1970 lightning from thunderstorms caused hundreds of forest fires. In May of 1987 strong thunderstorms brought 60- to 70-mph winds to Jackson County, damaging buildings in Eagle Point and fanning multiple fires. For more information on lightning-induced wildfires, see *Section 7: Wildfire*.

Community Severe Winter Storm & Windstorm Issues

Jackson County residents face a number of difficult issues when dealing with storms and their aftermath. Residents are primarily concerned with protecting life, property, infrastructure, utilities, and transportation systems from storm damages.

Property Protection

Severe Winter Storm Damages

Storm water drainage problems are one cause of property damage from severe winter storms. Insufficient or improperly maintained culverts or other elements of storm drainage systems cause localized flooding, and can lead to saturated soils and structural subsidence. Structural damage from subsidence can be very costly.

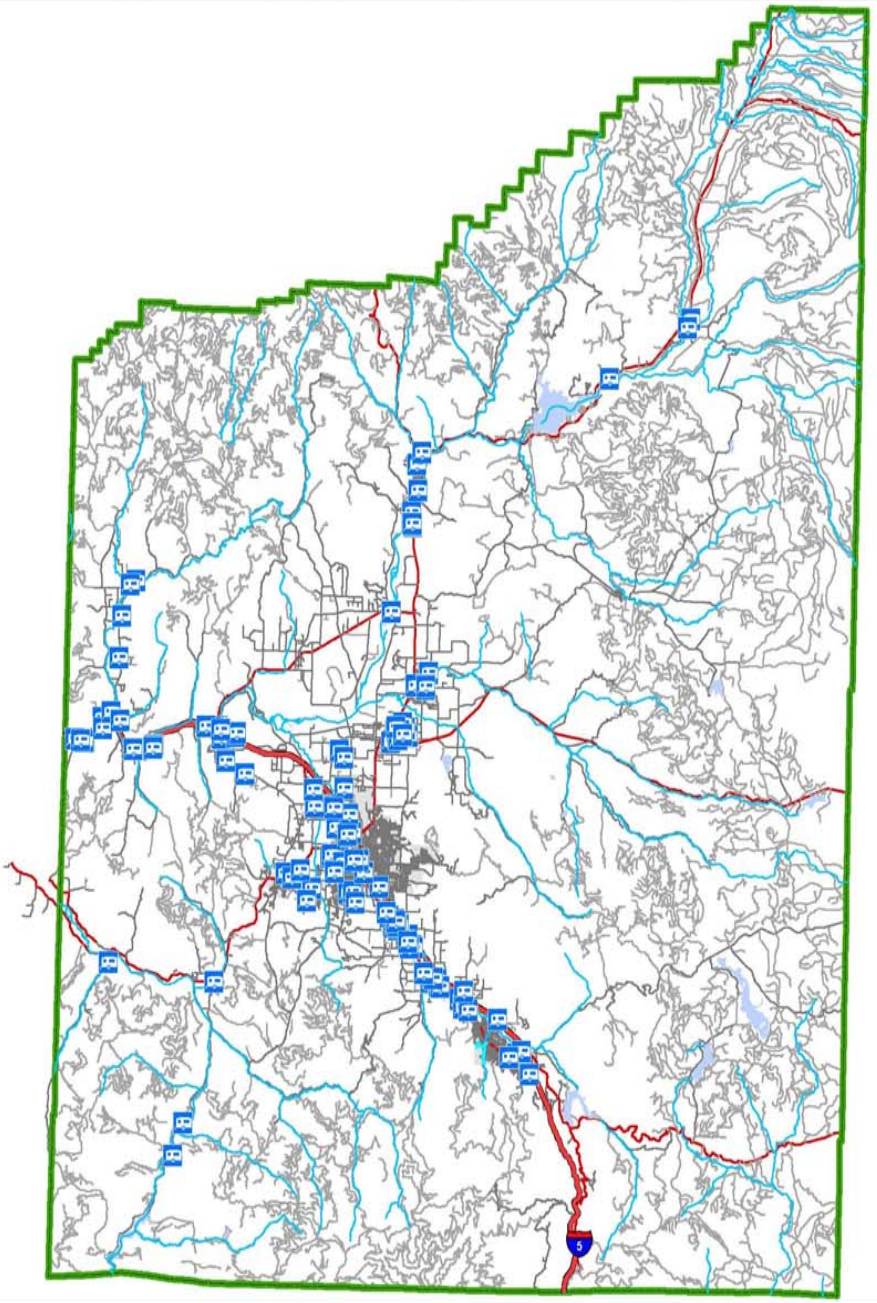
Property is also at risk due to flooding (see section 4) and landslides (see section 5) resulting from heavy rainfall and snow melt. Trees, power lines, telephone lines, and television and radio antennas can be impacted by ice, wind, snow, and falling trees and limbs. Soil that is saturated can cause trees to lose there ability to stand and can be uprooted falling on houses, cars, utilities and other property. Similarly, if streets are icy, it is difficult for emergency personnel to travel and may pose a secondary threat to life if police, fire, and medical personnel cannot respond to calls.[36]

Winter storms are deceptive killers. Many of the deaths that occur are indirectly related to the actual storm, including deaths resulting from traffic accidents on icy roads, heart attacks while shoveling snow, and hypothermia from prolonged exposure to the cold.

Windstorm Damages

Windstorms have the ability to cause damage over 100 miles from the center of storm activity. Isolated wind phenomena in the mountainous regions have more localized effects. Winds near the earth's surface and associated pressure effects on walls, doors, windows, and roofs, may cause structural components, the elements that provide the buildings structure, to fail. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift and suction forces that act to pull building components and surfaces outward. The effects of winds are magnified in the upper levels of multi-story structures. As positive and negative forces impact the buildings protective envelope (doors, windows, and walls), the result can be roof or building component failures and considerable structural damage.

Debris carried along by extreme winds can directly contribute to loss of life and indirectly to the failure of protective building envelope, siding or walls of the building. When severe windstorms strike a community, downed trees, power lines, and damaged property can be major hindrances to emergency response and disaster recovery. Effects of wind speed are shown in Table 6.2.



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SMARTMAP

JACKSON COUNTY
GEOGRAPHIC INFORMATION SYSTEM

Jackson County
Pre-Disaster Mitigation

Special Populations

Legend

Mobile Home Parks

JACKSON COUNTY
oregon

Plot date: 02/15/2005; T:\5015\Disaster Mitigation Maps - Flood Hazard.mxd

Table 6.2. The Effect of Wind Speed

WIND SPEED (MPH)	WIND EFFECTS
25-31	Large branches will be in motion.
32-38	Whole trees in motion; inconvenience felt walking against the wind.
39-54	Twigs and small branches may break off of trees; wind generally impedes progress when walking; high profile vehicles such as trucks and motor homes may be difficult to control.
55-74	Potential damage to TV antennas; may push over shallow rooted trees especially if the soil is saturated.
74-95	Potential for minimal structural damage, particularly to unanchored mobile homes; power lines, signs, and tree branches may be blown down.
96-110	Moderate structural damage to walls, roofs and windows; large signs and tree branches blown down; moving vehicles pushed off roads.
111-130	Extensive structural damage to walls, roofs, and windows; trees blown down; mobile homes may be destroyed.
131-155	Extreme damage to structures and roofs; trees uprooted or snapped.
Greater than 155	Catastrophic damage; structures destroyed.

Source: Washington County Office of Consolidated Emergency Management, website: http://www.co.washington.or.us/ocem/wind.htm#windeffect

Agricultural Damages

Strong winds can damage agricultural products. Following the Columbus Day Storm of 1962 pear producers in the Rogue and Bear Creek valleys reported severe crop damage. The strong winds knocked the some fruit from the trees and caused bruises and punctures to the remaining hanging fruit.[37] Severe storms in October will consistently threaten late season agricultural products.

Freezing temperatures can also have a severe impact on agricultural producers. In 1997, Jackson County produced approximately $60 million in agricultural products.[38] Jackson County ranks fourth in the state just behind Washington and Polk Counties in the number of acres planted in wine grapes.[39] In December of 1998 low temperatures dropped below five degrees Fahrenheit on three successive nights. The low temperatures damaged several wine grape varieties. As a result, in the spring many vines failed to emerge at all from dormancy or just produced a few very small leaves and quit growing. Jackson County Extension Service estimated that 40% of newly planted grapevines were lost at a cost of $648,000.[40] Crop damage from hail or ice storms may be costly to individual growers and to the community as a whole, which could suffer from a loss of agricultural service jobs. Agricultural damages caused by weather events are extremely difficult to mitigate community wide. However, individual property owners may be able to protect themselves from losses by purchasing insurance.

Utilities

Severe Winter Storm

Soil saturation as a result of heavy rainfall can destabilize tree root systems. When heavy rainfall is accompanied by high winds, trees can be easily blown down, potentially causing damage to power lines and other utility infrastructure. Saturated soils are also much more subject to landslides, as evidenced by the high number of landslides that occurred in Jackson County during the 1997 New Year's Day storm.

Windstorm

High winds near ground level can be very destructive. Storm winds indirectly damage buildings, power lines, the environment, and infrastructure by falling trees and branches. Historically, falling trees have been the major cause of power outages. According to Pacific Power & Light (PP&L), even 20 mph winds create a risk of falling trees. While the PP&L's tree hazard mitigation program has been successful, it only addresses trees that potentially threaten PP&L power lines.[41] PP&L identified other areas besides power line easements that are at risk for tree-falls, including stands of trees left as visual screens adjacent to new timber cuts, and trees at the edges of new developments on the rural-urban fringe. Trees in these kinds of locations are much more vulnerable to strong winds than are trees in areas of contiguous forest. Harrington suggests that developers and foresters can coordinate their plans with utility companies and hazard planners to reduce risk from wind-induced tree-falls, and improve the effectiveness of tree hazard mitigation activities.

Transportation

Severe Winter Storm

Utility repairs on Rogue River Highway, winter 2001, Source: Medford Mail Tribune

Road closures from snow and ice can have severe consequences for commerce and public safety. Some roads in Jackson County are regularly closed due to snow and ice hazards. Commerce and industry are especially dependent on the Interstate Route 5 corridor, which may be subject to closure during storms. Many smaller roads are subject to flash flood damage at creek crossings, and to localized flooding from overwhelmed drainage systems.

Windstorm

Roads blocked by fallen trees during a windstorm isolate people by cutting them off from their homes, jobs and essential services. Blocked roads also disrupt business services by preventing the transportation of goods. Falling trees often bring electric power lines down to the pavement, creating the possibility of lethal electric shock. Utility lines brought down by summer thunderstorms have also been known to cause wildfires, which can start in dry roadside vegetation.[42]

Economic Impacts

Closed transportation corridors impacts many Jackson County industries, which engage in product exports, services for tourists, and other transportation-dependent activities. Additionally, power outages can have significant indirect impacts on commerce and industry through business closures and lost work time.

Current Mitigation Activities

The following activities are currently being carried out by local, regional, state, and national organizations.

Farm Service Agency crop insurance

The Non-insured Crop Disaster Assistance Program (NAP) insures crops when other crop insurance is not available. It provides assistance for farmers who grow such crops, limiting their losses from natural disaster and helping to manage their overall business risk. Eligible crops include agricultural commodities that are: grown for food, planted and grown for livestock consumption, (including but not limited to grain and seeded and native forage crops), crops grown for fiber, except for trees; and specialty crops, such as aquaculture, floriculture, ornamental nursery, Christmas trees, turf for sod, industrial crops, and seed crops used to produce crops that are eligible for NAP.[43]

Oregon Department of Transportation

The Oregon Department of Transportation (ODOT) has well-established programs to reduce the incidence of road closures from rain, snow, and ice, and windstorms. These include engineering standards for road construction as well as a tree removal program.

County and State Planning

Transformer substations are another aspect of public infrastructure subject to natural hazards. Jackson County requires that all proposed transmission lines over 115 Kilowatts undergo a site review process. The process may include an evaluation of the risks that natural hazards pose to new power infrastructure. Statewide building and codes are in place to reduce vulnerability to windstorm hazards. The State Building Code already requires that buildings in Jackson County be designed to resist wind speeds of 80 miles per hour. All utility facilities constructed on forestlands must submit to a conditional use process.

Outreach and Education

PP&L distributes numerous brochures from the International Society of Arboriculture on subjects such as Recognizing Tree Hazards, Avoiding Tree & Utility Conflicts, and many others on proper tree selection and care, especially in utility easements. PP&L's in-house forestry department has also put out their own publication on these subjects. PP&L distributes information from the U.S. Forest Service and the Washington State Department of Resources on landscaping for wildfire defense. For information about how to obtain these publications, contact PP&L.

Pacific Power and Light tree mitigation

Pacific Power and Light (PP&L) spends $4 million per year in Jackson County on mitigating trees that are potentially hazardous to power lines during windstorms. The program involves pruning and tree removal, and the company has a fairly extensive outreach program. PP&L also operates a program through which the company subsidizes property owners to replace trees inappropriate for their location in or adjacent to utility easements. Power lines in high-wind zones are constructed according to different standards than areas with a lower wind hazard. These standards include stronger support wires, stronger connections, and different standards for poles and towers.

National Weather Service

The Portland Office of the National Weather Service issues severe winter storm watches and warnings when appropriate to alert government agencies and the public of possible or impending weather events. The watches and warnings are broadcast over NOAA weather radio and are forwarded to the local media for retransmission using the Emergency Alert System.

Winter Storm & Windstorm Hazard Assessment

Hazard identification is the first phase of a hazard assessment, and is the process of estimating the geographic extent of the hazard, its intensity, and its probability of occurrence.[44]

Severe Winter Storm Identification

There is not currently a map of extreme weather occurrences in Jackson County. Though severe weather can be highly localized, the geographic extent of winter storm hazards includes all of Jackson County. The nature of the hazard varies by location, with snow and ice creating more hazards at higher elevations, localized flooding more hazardous on the valley floors, and flash floods on the steep valley slopes. Identifying severe winter storm hazards requires a historical review and mechanisms to systematically gather data on storm events. The nature of winter storm hazards is very dependent on land use. Changes in vegetation, soil grading, storm water systems, the amount of impermeable surface, etc. can impact the likelihood and degree of winter storm hazards.

Windstorm Identification

The geographic extent of windstorm hazards covers every area in the county where there are trees. The lower wind speeds typical in the lower valleys are still high enough to knock down trees, bring down power lines, and cause other property damage. Despite a lack of wind speed data for higher elevations, it is clear that the mountainous portions of the county experience much higher winds, under more varied conditions. Because of the local nature of wind hazards in the mountains, a fairly high resolution wind speed map (i.e. a G.I.S. overlay of wind speed data on a topographic map) would be required to accurately identify the degree of wind hazard throughout the county. Such a map could identify wind hazards other than tree-falls, such as winds sufficiently high to cause structural damage. Lacking such a map, a basic level of wind hazard can be assumed for every location in the county where trees can be found.

1962 Columbus Day Windstorm, Source: National Weather Service

Vulnerability Assessment

Vulnerability assessment is the second phase of a hazard assessment. It combines the information generated through hazard identification with an inventory of the existing property and utilities that are exposed to the hazard, helping to predict how different types of property and population groups will be affected by a hazard.[45]

While a quantitative vulnerability assessment (an assessment that describes number of lives or amount of property exposed to the hazard) has not yet been conducted for Jackson County windstorm and winter storm events, there are many qualitative factors (issues relating to what is in danger within a community) that point to potential vulnerability. Windstorms and winter storm events can cause power outages, transportation and economic disruptions, significant property damage, and pose a high risk for injuries and loss of life. The event can also be typified by a need to shelter and care for individuals impacted by the event. Several destructive windstorms and winter storms have brought economic hardship and affected the life safety of county residents. Future windstorms may carry similar impacts countywide. Wind storms can be very destructive to mobile homes. In Jackson County, there are several mobile home parks, throughout the county. The map on the following page shows the dispersion of these parks.

Severe Winter Storms

Jackson County's higher elevations have greater exposure to snow and ice, but may be less economically vulnerable, because they are sparsely populated. Roads may be closed longer in more isolated areas, and extreme snowfall or flash flood events may simply be more dangerous in the mountains. Outreach programs, emergency communications systems, and special emergency response plans may be the most effective ways to reduce vulnerability in outlying areas of the County.

Windstorms

Every location in the county is exposed to some level of windstorm-related hazards, and each location is vulnerable to the extent that trees are in close proximity to a structure, road, or power line. However, since development in Jackson County is highly concentrated in its lower valleys, most properties in the county are rarely if ever exposed to the most intense wind hazards found in the mountains and along ridges. Certain properties or facilities are vulnerable because of an inherent susceptibility to wind damage, perhaps at certain critical times. In 1996 sixty-knot winds were sufficient to cause millions of dollars of damage at the Medford airport. This is related to the susceptibility of small aircraft to wind when they are parked on the ground. A similar example is the vulnerability of orchard crops during the period when they are blossoming. A wind occurring at this critical time can cause major economic losses, both to individual owners and to the community. As with severe winter storms, Jackson County's higher elevations have greater exposure to high winds, but may be less economically vulnerable than the river valleys.

Probability

According to the Hazard Analysis in the county's Emergency Operations Plan, severe weather, including the various types of storms identified above, has a high probability of occurring. Indeed, it ranks as the first natural or man-made hazard in that analysis. The probability of severe weather occurring is more than one chance per 10 years.

Risk Analysis

Risk analysis is the third, and most advanced phase of a hazard assessment. It is conducted by use of mathematical models and relies on information compiled during hazard identification and vulnerability assessments. Factors included in windstorm and winter storm risk analysis include population and property distribution in the hazard area, the frequency of windstorm and winter storm events and other relevant community variables. When sufficient data is collected for hazard identification and vulnerability assessment, the County can complete a risk analysis.

Severe Winter Storm and Windstorm Goals and Action Items

The mitigation goals and action items were formulated through research of regional and national mitigation plans, natural hazards planning literature, and interviews with local stakeholders. The goals and action items were refined through discussions with the mitigation plan steering committee and through public workshops. The goals are broad based to encompass all the identified hazards addressed in this mitigation plan. Plan goals focus on seven categories:

- Property Protection
- Education and Outreach
- Preventative
- Partnership and Coordination
- Structural Projects
- Natural Resource Protection
- Emergency Services

To read the goal statements for each of the seven categories, see *Section 3: Multi-Hazard Goals and Action Items.*

Two public workshops were held during compilation of the mitigation plan: the first workshop was held on April 26, 2001 and the second one on June 12, 2001. The purpose of these workshops was to inform the public about natural hazards that occur in Jackson County, and identify community priorities, and potential strategies for achieving those priorities.

Through a voting process, Jackson County citizens identified goal statements in the following three categories as community priorities:

1. Emergency Services
2. Education and Outreach
3. Partnership and Coordination

Each of the goal statements and a summary of the workshop outcomes are listed in Section 3: Multi-Hazard Goals and Action Items. A complete listing of public comment is located in Appendix A: Public Process. This section lists action items identified to reduce the risk

from severe winter storm and windstorm impacts in Jackson County. These action items are designed to meet the mitigation plan goals.

Short-term (ST) Severe Winter Storm/Windstorm Action Items

To read about action item organization, see the *Five-Year Action Plan.*

Short-term severe winter storm/windstorm action (S) items include general mitigation activities that agencies are capable of implementing during the next two years, given their existing resources and authorities.

ST-SWS/W -1: Map areas where extreme weather, such as road icing or wind damage occurs.

Notes: Hazardous areas can be identified for the public so precautions can be taken at appropriate times. Extreme weather should be reported to the National Climatic Data Center. Information about county road icing or county road closures due to snow or other severe winter storm events may already exist within county offices but it can be mapped and disseminated countywide to make residents knowledgeable about severe winter and windstorm events.

Coordinating Organization:	County GIS
Partner Organization:	County Planning, NWS, ODOT, NOAA
Timeline:	1-2 years
Plan Goals Addressed:	Education and Outreach, Partnerships and Coordination

Long-Term (LT) Severe Winter Storm/Windstorm Action Items

Long-term severe winter storm/windstorm action items include general mitigation activities that are likely to take more than two years to implement and may require new or additional resources and/or authorities.

LT-SWS/W-1: Promote the benefits of tree-trimming and tree replacement programs and help to coordinate local efforts by public and private agencies.

Notes: Pacific Power and Light's (PP&L) tree-trimming and tree replacement programs provide tree maintenance benefits to local communities. PP&L could benefit in turn from cooperation with Forest Service and BLM foresters in harvest plans that are adjacent to roads and/or power line easements.

Coordinating Organization:	County Roads, Vegetation Management
Partner Organizations:	Utility and Telecommunications Companies, ODOT, City Public Works, USFS, BLM
Timeline:	3-5 years
Plan Goals Addressed:	Education and Outreach, Preventative, Partnership and Coordination

Jackson County

Winter Storm & Windstorm Resource Directory

County Resources

Jackson County Emergency Management

Jackson County Emergency Management helps the community be better prepared for major emergencies and disasters. They work closely with cities, emergency responders, and volunteer agencies to find ways to reduce risks and minimize damages during hazard events. When a disaster occurs, they work with partners in their Emergency Operations Center to coordinate resources and information. Once the event is over, they help bring assistance to those that have been harmed.

Contact: Jackson County Emergency Management Coordinator
Address: 10 South Oakdale, Medford, Oregon 97501
Phone: (541) 774-6821
Fax: (541) 774-6455
Website: http://www.co.jackson.or.us

Regional Resources

National Weather Service, Medford, Oregon

The National Weather Service Office in Medford provides weather warnings and forecasts for southern Oregon and northern California.

Contact: National Weather Service
Address: 4003 Cirrus Drive, Medford, OR 97504
Phone: (541) 773-1067
Website: http://www.wrh.noaa.gov/Medford/index.html

State Resources

Department of Land Conservation and Development (DLCD)

DLCD administers the state's Land Use Planning Program. The program is based on 19 Statewide Planning Goals, including Goal 7, related to natural hazards, with flood as its major focus. In order to help local governments address natural hazards effectively, DLCD provides technical assistance such as conducting workshops, reviewing local land use plan amendments, and working interactively with other agencies.

Contact: Natural Hazards Program Manager, DLCD
Address: 635 Capitol St. NE, Suite 200, Salem, OR 97301-2540
Phone: (503) 373-0050
Fax: (503) 378-6033
Website: http://www.lcd.state.or.us/hazards.html

Oregon Climate Service

The Oregon Climate Service collects, manages, and maintains Oregon weather and climate data. OCS provides weather and climate information to those within and outside the state of Oregon and educates the citizens of Oregon on current and emerging climate issues. OCS also performs independent research related to weather and climate issues.

Contact: Oregon Climate Service
Address: Oregon Climate Service, Oregon State University
Strand Ag Hall Room 316, Corvallis, OR 97331-2209
Phone: (541) 737-5705
Website: http://www.ocs.orst.edu
Email: oregon@oce.orst.edu

Oregon State Police (OSP)-Office of Emergency Management (OEM)

The purpose of OEM is to execute the Governor's responsibilities to maintain an emergency services system as prescribed in Oregon Revised Statutes Chapter 401 by planning, preparing, and providing for the prevention, mitigation, and management of emergencies or disasters that present a threat to the lives and property of citizens of and visitors to the state of Oregon.

Contact: Office of Emergency Management
Address: 595 Cottage Street NE, Salem, OR 97310
Phone: (503) 378-2911
Fax: (503) 588-1378
Website: http://www.osp.state.or.us/oem/

Oregon Department of Consumer and Business Services

The Building Codes Division of Oregon's Department of Consumer and Business Services is responsible for administering statewide building codes. Its responsibilities include adoption of statewide construction standards that help create disaster-resistant buildings, particularly for flood, wildfire, wind, foundation stability, and seismic hazards.

Contact: Building Codes Division
Address: 1535 Edgewater St. NW, P.O. Box 14470, Salem, OR 97309
Phone: (503) 373-4133
Fax: (503) 378-2322
Website: http://www.cbs.state.or.us/external/bcd

National Resources and Programs

National Oceanic and Atmospheric Administration (NOAA)

NOAA's historical role has been to predict environmental changes, protect life and property, provide decision makers with reliable scientific information, and foster global environmental stewardship.

Contact: National Oceanic and Atmospheric Administration
Address: 14th St. & Constitution Ave., NW, Washington, DC 20230
Phone: (202) 482-6090
Fax: (202) 482-3154
Website: http://www.noaa.gov
Email: answers@noaa.gov

National Weather Service

The National Weather Service (NWS) provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure, which can be used by other governmental agencies, the private sector, the public, and the global community.

Contact: National Weather Service
Address: 5241 NE 122nd Ave, Portland, Oregon 97230
Phone: (503) 326-2340
Website: http://nimbo.wrh.noaa.gov/Portland

Additional Resources

American Red Cross, Rogue Valley Chapter

Services provided by the American Red Cross include emergency assistance, disaster relief, and health and safety courses.

Contact: Executive Director
Address: 60 Hawthorne Street, Medford, OR 97504
Phone: (541) 779-3773
Fax: (541) 772-7212
Email: redcross@jeffnet.org
Websites: http://www.redcross.jffnet.org/

Institute for Business & Home Safety (IBHS)

IBHS was created as an initiative of the insurance industry to reduce damage and losses caused by natural disasters. This website provides educational resources and on-line publications for insurers, businesses, and homeowners who are interested in taking the initiative to minimize future damages and losses.

Contact: Institute for Business and Home Safety
Address: 1408 North Westshore Boulevard - Suite 208 - Tampa, FL 33607
Phone: (813) 286-3400
Fax: (813) 286-9960
E-mail: info@ibhs.org
Website: http://www.ibhs.org/ibhs2/

Endnotes

[1] Taylor, George H. & Chris Hannan, *The Climate of Oregon* OSU Press, 1999.

[2] Ibid.

[3] Ibid.

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[5] Taylor, George H. & Chris Hannan, *The Climate of Oregon* OSU Press, 1999.

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[7] Taylor, George H. & Chris Hannan, *The Climate of Oregon* OSU Press, 1999.

[8] Taylor, George H. *The Oregon Weather Book*. Corvallis, OR, OSU Press, 1999.

[9] Taylor, George H. *The Oregon Weather Book*. Corvallis, OR, OSU Press, 1999.

[10] *City of Medford weather data book*, Table 20.

[11] Taylor, George H. & Chris Hannan, *The Climate of Oregon* OSU Press, 1999.

[12] Taylor, George H. & Chris Hannan, *The Climate of Oregon* OSU Press, 1999.

[13] *City of Medford weather data book*, Table 28.

[14] Oregon Climate Service website: http://www.ocs.orst.edu. April 2001.

[15] Christopherson, Robert W. *Elemental Geosystems: a Foundation in Physical Geography*. Upper Saddle River, NJ: Prentice Hall, 1995. 164.

[16] Taylor, George H. *The Oregon Weather Book*. Corvallis, OR, OSU Press, 1999.

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[20] Ibid.

[21] Taylor, George H. *The Oregon Weather Book*. Corvallis, OR, OSU Press, 1999.

[22] *City of Medford weather data book*, Table 31.

[23] Taylor, George H. *The Oregon Weather Book*. Corvallis, OR, OSU Press, 1999.

[24] *City of Medford weather data book*, Table 31.

[25] Oregon Climate Service website: http://www.ocs.orst.edu. April 2001.

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[30] Taylor, George H. *The Oregon Weather Book*. Corvallis, OR, OSU Press, 1999.

[31] Oregon Climate Service website: http://www.ocs.orst.edu. April 2001.

[32] Ibid.

[33] *City of Medford weather data book*, Table 28.

[34] Taylor, George H. *The Oregon Weather Book*. Corvallis, OR, OSU Press, 1999.

[35] NCDC web page for windstorms in Jackson County, OR. http:// www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms, April 2001.

[36] Robert Olson Associates, *Metro Regional Hazard Mitigation Policy and Planning Guide*, Metro, (June 1999).

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[38] 1997 Census of Agriculture County Profile, US Department of Agriculture.

[39] National Agriculture Statistics Service, USDA, Website: http://www.oda.state.or.us/oass/vinyd000.htm, April 2001.

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[45] Ibid.

Section 7:
Wildfire

Community Planning Workshop Researcher:

Jim Ekins, Community and Regional Planning Master's Candidate

Jackson County Wildfire Events

In the forested mountains of Jackson County, where the hills are timbered and can be steep, there is a high susceptibility to wildfires. In recent years, lower than normal levels of precipitation have contributed to the wildfire risk as vegetation dries out. Forested areas throughout Jackson County are becoming increasingly populated, and wildfires pose a risk to people and their property. Choices in landscaping, site location, and building materials can elevate the risk of fire.

Wildfires threaten valued forest and agricultural lands and individual home sites. State or federal firefighters provide the only formal wildfire suppression service in some areas, and they do not protect structures as a matter of policy. As a result, many rural dwellings have no form of fire protection. The potential for serious damage and loss of life from wildfire is second in magnitude only to flooding in the County. Once a fire has started, homes and development in wildland settings complicate firefighting activities and stretch available human and equipment resources. The loss of property and life, however, can be minimized through cooperation, preparedness, and mitigation activities.

Wildfire Characteristics

Several physical factors affect the amount of damage resulting from wildfires, and the ability of firefighters to suppress a fire. These include: topography, weather, fuel loading, vehicle access, fire breaks, proximity of water sources, distance from fire stations, and available firefighting personnel and equipment.[1] Areas where annual precipitation is less than 30 inches per year are extremely susceptible to fire. Jackson County's valley floors, with an annual precipitation of 18 to 20 inches, are especially susceptible to fires. Many rural residential areas lack large water storage or pumping facilities, and are long distances from fire stations.

In Jackson County, the long open valleys increase wind velocity. The wind can exacerbate a fire that is otherwise controllable. Wind and hilly terrain combine to form a dangerous natural wildfire accelerant.

Types of Wildfires

Wildfire can be divided into four categories: interface fires, wildland fires, firestorms, and prescribed fires.[2] The most prevalent category in Jackson County is the interface fire. Interface fire, as described below, is the primary fire hazard discussed in this plan. Additional types of fire are also described in this section, as they potentially play roles in interface fire.

Wildland/Urban Interface

The interface is an intermingling of homes and structures with natural cover or forestlands combining to provide fuel. It is not an identifiable line like the ocean meeting the beaches. It is virtually everywhere, from the pine forests of Eastern Oregon to the fir stands of the Coast Range, and even within the city limits of Ashland.

State of Oregon Natural Hazards Mitigation Plan

Interface

Three categories of wildland/urban interface exist:[3]

1. *The classic wildland/urban interface* exists where well-defined development presses up against open expanses of wildland areas.
2. *The mixed wildland/urban interface* exists where isolated homes, subdivisions, and small communities are situated predominantly in wildland settings. The hills above Ashland fit this description.
3. *The occluded wildland/urban interface*, exists where islands of wildland vegetation occur inside a largely urbanized area. Some of the Bear Creek area fits this characteristic.[4]

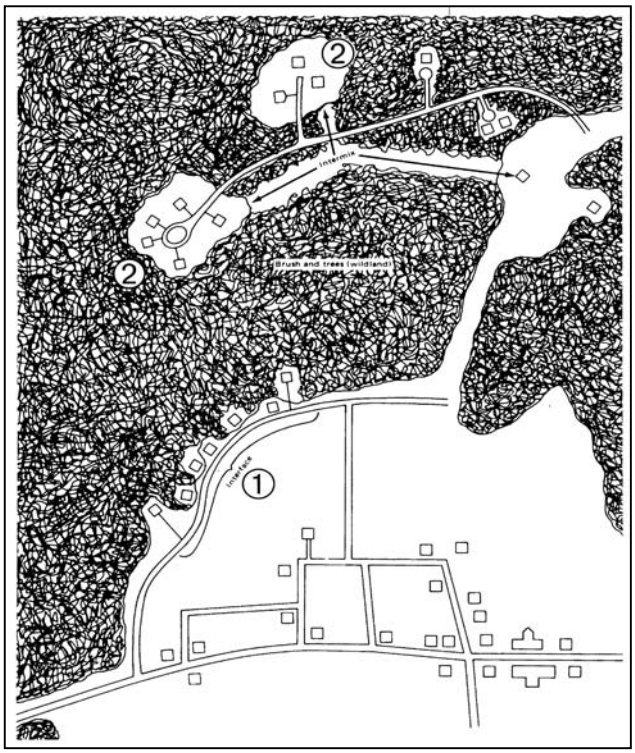
Wildland Fires

A wildland fire's main source of fuel is vegetation. These fires primarily occur in national forests and parks, rangeland, and privately owned timberland. A wildland fire may become an interface fire if it encroaches on developed areas. Fire in dry land farming areas may similarly affect development. Both of these scenarios happened in Jackson County over the last ten years.

Firestorms

Firestorms are events of such extreme intensity that suppression is virtually impossible. Firestorms occur during dry, windy weather and generally burn until conditions change or the fuel is exhausted. The disastrous 1991 East Bay Fire in Oakland, California is an example of an interface fire that developed into a firestorm. In 1987, widespread dry lightning in late August ignited fires throughout northern California and southwest Oregon. Two of these were over 10,000 acres, and according to the Oregon Department of Forestry, this series of events fits the definition of a firestorm. Resources were brought in from other states and Canada to fight them.[5]

Figure 7.1 Interface and Intermix Diagram



Source: National Wildland/Urban Interface fire Protection Program. Fire Protection in the Wildland/Urban Interface. Boise, Idaho: National Interagency p. 3.

Prescribed Fires

Prescribed fires are intentionally set or are select natural fires that are allowed to burn for beneficial purposes. Before humans suppressed forest fires, small, low intensity fires cleaned the underbrush and fallen plant material from the forest floor while allowing the larger plants and trees to live through the blaze. These fires were only a few inches to two feet tall and burned slowly. Forest managers now realize that a hundred years of prevention has contributed to the unnatural buildup of plant material that can

flare up into tall, fast moving wildfires. These can be impossible to control and can leave a homeowner little time to react.

Wildfire Causes

Several conditions contribute to wildfires. Ignition of a wildfire may come from a lightning strike or, more frequently in Jackson County, one of many possible human sources (most often arson or debris burns).[6] Once a fire starts, four main conditions influence its behavior: fuel, topography, weather, and development.

Fuel

Fuel is the material that feeds a fire, and is a key factor in wildfire behavior. Fuel is classified by volume and type. Volume is described in terms of "fuel loading," the amount of available vegetative fuel. If fuel-loading doubles, the energy released can also be expected to double.[7] The type of fuel also influences wildfire. Jackson County is located far enough south in Oregon that even though it is west of the Cascades, it is dry enough to support the prevalent conifer, brush, and rangeland fuel types. Thus, Jackson County is subject to more frequent wildfires than other regions of western Oregon.[8] Another important element of fuel is its continuity. A house surrounded by brushy growth rather than cleared space allows for greater continuity of fuel and increases the fire's ability to spread.

Topography

Topography influences the movement of air, directing a fire's course. Slope is a key topographic feature in fire behavior. If the percentage of uphill slope doubles, the rate of spread in wildfire will likely double.[9] Gulches and canyons can funnel air and act as chimneys, which intensify fire behavior and cause the fire to spread faster. Similarly, saddle-shaped lands on ridge tops lower resistance to the passage of air and draw fires. Solar heating of drier, south-facing slopes produces upslope drafts that can complicate fire behavior.[10] Ironically, the most desirable residential areas are typically hillsides with hazardous topographic characteristics.

Weather

Weather is the most variable factor affecting wildfire behavior, with some geographic locations having a favorable overall climate for wildfire activity. High-risk areas in Oregon, including Jackson County, share a hot, dry season in late summer and early fall when high temperatures and low humidity favor fire activity. Predominant wind directions may guide a fire's path, as demonstrated by New Mexico's wind driven Los Alamos fire in 2000.[11] It is often a change in the weather that marks the end of a wildfire's growth.[12]

Fire Magnitude

The magnitude of past fires within Jackson County is the result of two primary factors:

1. Severe drought, accompanied by dry-lightning storms, and
2. Long-term effects of almost a century of suppressing wildfires leading to buildup of brush and small diameter trees in forests and rangelands.

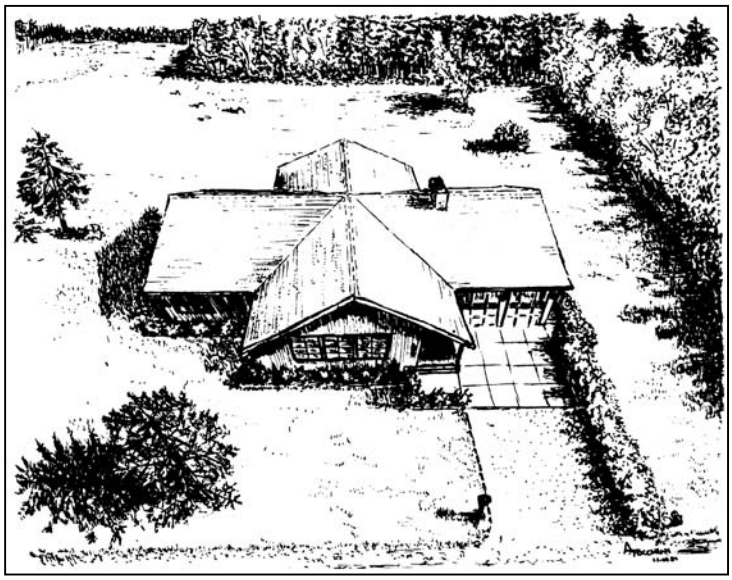
National Interagency Fire Center, National Register of Urban Wildland Interface.

Development

The amount of development in wildland/urban interface areas is increasing in Jackson County. Fire is a natural wildland element and can sweep through vegetation that is adjacent to homes in wildland areas made of combustible materials. Wildfires can rapidly grow to sizes that require formal fire services. New residents in remote locations are often surprised to find that in escaping urban areas, they left behind readily available fire services for structure protection.[13]

Development can influence the number of wildfire events and the behavior of fires. Owners often prefer homes that are private, have scenic views, are nestled in vegetation, and use natural materials (wood shake roofing, for example). More people living in forested settings make for more eyes watching for wildfire, but an increase in opportunities for fires to start may also arise.[14] A house far from public roads, or hidden behind a narrow, curving driveway, makes evacuation and firefighting difficult. Natural vegetation contributes to scenic beauty, but it may also provide a ready trail of fuel leading a fire directly to the combustible fuels of the home itself.[15] Conversely, a burning structure, such as a chimney, can introduce fire into wildlands.[16]

Figure 7.2 Diagram of Defensible Space



Source: Northwest Interagency Fire Prevention Group. Fire Safety Considerations for Developments in Forested Areas. Salem, OR: Oregon Department of Forestry (1997) p. 15.

While reducing fuel loads in Jackson County communities may reduce wildfire risk, some risk is inherent to those living in wildfire-prone areas. Private landowners can help reduce this risk though the creation of defensible space around their homes and businesses and by using fire-resistant materials in building those structures.[17]

History of Past Wildfire Events

Wildfires cause tremendous destruction in Oregon communities. The severe fire season of 1987 resulted in a record setting mobilization of resources in the state.[18] That year, tens of thousands of acres in Jackson County were blackened, and 218,000 acres burned throughout Oregon.[19]

Often, accurate records of wildfire history do not exist. For instance, before the early 1960's, only those fires that were especially damaging were recorded. Table 7.1 shows some of the historic fires in Oregon over the past 150 years.[20] Only the general location and number of acres affected were recorded.

Table 7.1 Historic Oregon Fires

Year	Fire Location	Acres Burned
1848	Nestucca	290,000
1849	Siletz	800,000
1853	Yaquina	482,000
1865	Silverton	988,000
1868	Coos Bay	296,000
1933	Tillamook	240,000
1936	Bandon	143,000
1939	Saddle Mountain	190,000
1945	Wilson River/ Salmonberry	180,000
1951	North Fork/ Elkhorn	33,000
1966	Oxbow	44,000

Source: "Atlas of Oregon," by William G. Loy, et al, University of Oregon Books, 1976, ODF, "Tillamook Burn to Tillamook State Forest."

Jackson County Wildfires

In May of 1987 strong thunderstorms brought 60 to 70-mph winds to Jackson County, damaging buildings in Eagle Point and fanning multiple fires. In July of that same summer, intense thunderstorms brought hail, lightning, and rain.[21] Lightning started numerous fires in the Umpqua and Rogue River National Forests. One fire lasted for five days. A third round of thunderstorms struck in late August of that summer. Over 900 fires were reported in the Siskiyou and Cascade Mountains, which destroyed more than 130,000 acres of forest and continued to burn well into September. This was Oregon's second worst fire in history, and the worst since the Tillamook Burn in the 1930's.[22] Each year, about 350 fires are sparked in Jackson and Josephine Counties alone.

Damage and Loss Information

Table 7.2 is a summary of the more costly fires experienced in Jackson County since the early 1960's. This is not an exhaustive list, and the most complete information as of Spring 2001 is located in the County Emergency Management Office. The suppression cost is a summary of the costs to the local ODF division, private entities, emergency funds, and other agencies.

Table 7.2 Partial Summary, Jackson County Wildfire Damage 1970-2000

Time Period	Number of Fires	Acres Burned	Suppression Costs	Estimated Damage
1970-1979	14	8079	$924,698	$910,506
1980-1989	19	31530	$9,431,263	$5,887,958
1990-2000*	16	24041	$22,232,504	$212,500
Total	49	63650	$32,588,465	$7,010,964

* 11-year period
Source: Jim Wolf, Oregon Department of Forestry, Jackson County Office.

Community Wildfire Issues

Threat to Life and Property

Since the 1970's, Jackson County's growing population expanded into traditional forest and range resource lands. The interface between urban and suburban areas and these resource lands are producing increased exposure to life and property from wildfire. In many cases, existing fire protection services cannot adequately protect new development.[23] Wildfires that also involve structures present complex and dangerous situations to firefighters. See map on the following page.

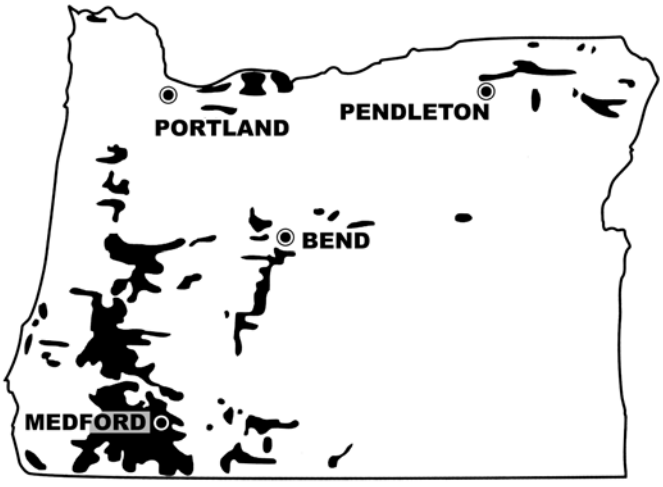
Personal Choices

Many interface areas, found at lower elevations and drier sites, are also desirable real estate. More people in Oregon are becoming vulnerable to wildfire by choosing to live in wildfire-prone areas.[24] Map 7.1 illustrates the areas of highest risk in Oregon; most surrounding the Medford area. In 1990, there were about 200,000 Oregon homes built in interface areas.[25]

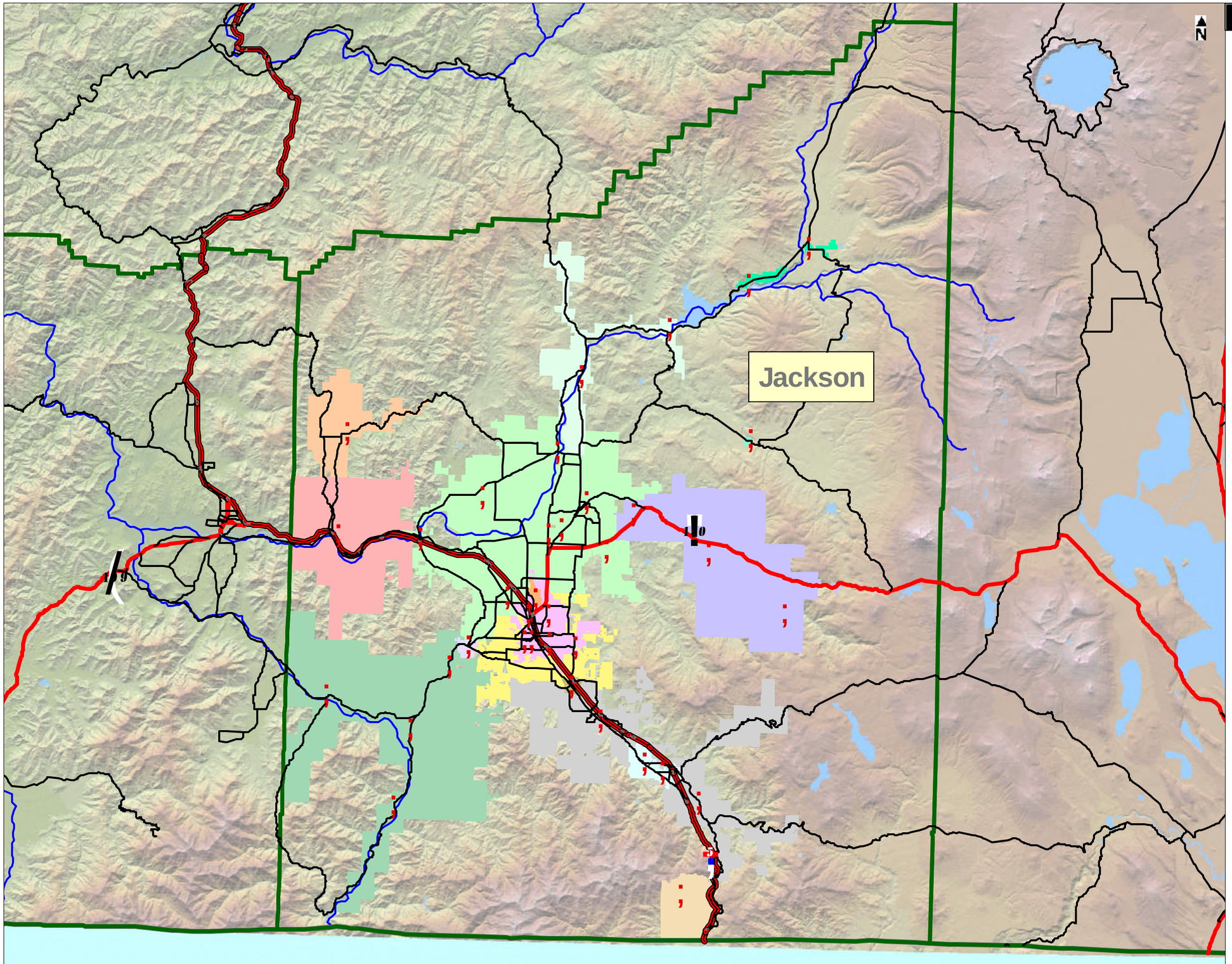
Community Firefighting

There is development in Jackson County located outside of rural fire districts where structural fire protection is not provided. In certain areas fire trucks cannot negotiate steep grades, poor road surfaces, narrow roads, flammable or inadequately designed bridges, or traffic attempting to evacuate the area. Development occurring in the small valleys and gulches extending up from the valley floors tend to have access via a single dead-end road. Little water during the fire season, and severe fuel loading problems add to the problem. In some areas, current protection resources are stretched thin, thus both property in the interface and traditionally protected property in the forests and cities are at greater risk from fire. Finally, many property owners in the interface are not aware of the problems and threats that they face, and owners in some areas have done little

Map 7.1 High Risk Wildfire Areas in Oregon



Source: ODF, Disaster in the Making



S M A R T M A P

JACKSON COUNTY
GEOGRAPHIC INFORMATION SYSTEM

Jackson County Fire Districts & Fire Stations

Wildland Fire
Resource / Inventory Study
Map #5 -- June 2003

Fire Stations

Jackson Fire Districts
- Fire District #1
- Fire District #2
- Fire District #3
- Fire District #4
- Fire District #5
- Fire District #6
- Fire District #9
- Airport
- Ashland
- Butte Falls
- Colestin
- Jacksonville
- Lake Creek
- Medford
- Phoenix
- Prospect
- VA Domiciliary

0 3 6 9 12 Miles

JACKSON COUNTY Oregon

Plot date: May 22, 2003; t:\22144\finalmaps\map5_jackson_county_fire_depts.apr

to manage or offset fire hazards or risks on their own property.

Drought

Recent concerns about the effects of climate change, particularly drought, are contributing to concerns about wildfire vulnerability. Unusually dry winters and hot summers increase the likelihood of a wildfire event, and place importance on mitigating the impacts of wildfire before an event takes place.

Current Mitigation Activities

Some mitigation activities are, or will soon be, occurring in Jackson County, and in Oregon. Following is a list of many of these activities:

Local Fire Crews

Fire crews can be called upon to meet with landowners at their house to provide recommendations to create a defensible space.[26]

County Fire Chief's Associations

Jackson and Josephine Counties have a strong fire chief's association. Mutual aid agreements and combined task forces are results of cooperation among different agencies that previously would not cross each other's jurisdictional lines.[27]

Local Fire Hazard Reduction Standards

Jackson County has worked with the local fire districts and other agencies to formulate fire hazard reduction standards. Standards now include requirements for road development, incline of driveways, width of roads, and building standards, as well as pumps and a water supply for houses outside the fire protection district.[28]

Local Working Committees

A working committee consisting of Rogue and Siskiyou National Forests, Bureau of Land Management (BLM), and Oregon Department of Forestry (ODF) meets monthly to focus on common fuel-related issues, suppression issues, and the combination and sharing of resources such as teams, flights, engines, dispatch capabilities, etc. [29]

Community Emergency Response Teams

The CERT, or Community Emergency Response Team, is a citizen-based program that teaches communities to be self-reliant for 72 hours without the assistance of local government. In addition, a team of about 15 people in each neighborhood can provide a structural survey to the Emergency Operations Center after an event, will put out small fires, and will provide assistance to residents. It started just prior to Y-2K and is modeled after programs around the nation and in Medford, Portland, Ashland, and Klamath Falls.[30]

Medford Mail Tribune

Oregon Revised Statute, Chapter 478: Rural Fire Protection Districts

ORS 478 provides authority for a district, city, municipal corporation or other governmental agency, to contract with any person for the purpose of affording fire fighting, protection or prevention facilities. When a contract is entered into (pursuant to ORS 190.003 to 190.620) to provide fire protection service, the district, city, municipal corporation or governmental agency providing such service will have authority over open burning and the issuance of fire permits in the area served, and may make reasonable rules and regulations allowed in ORS 478.[31]

Senate Bill 360

ODF has been working on the implementation of Senate Bill 360. Passed in 1997, the primary purpose of the bill is to encourage landowners in the interface to reduce hazardous vegetative buildup around structures. It encourages government at various levels and the private sector to work together to accomplish mitigation tasks. Jackson and Deschutes Counties are the highest priorities and have already implemented the bill.[32]

Oregon Department of Forestry

ODF is involved with local fire chiefs and local fire departments to provide training. Local firefighters can get a range of experience from exposure to wildland firefighting. Local firefighters can also obtain their red card (wildland fire training documentation), and attend extensive workshops combining elements of structural and wildland firefighting, defending homes, and operations experience.[33] For years, ODF has worked with industrial partners (big timber companies) to share equipment in the case of extremely large fires.[34]

U.S. Forest Service

The U.S. Forest Service (USFS) is involved in a fuel-loading program implemented to assess fuels and reduce hazardous buildup on U.S. forestlands. The USFS is a cooperating agency and, while it has little to no jurisdiction in the lower valleys of Jackson County, it has an interest in preventing fires in the interface, as fires often burn up the hills and into the higher elevation U.S. forestlands.[35]

Federal Fire Grants

In 2001, the ODF received a $750,000 federal grant for cost share programs to help fund fuel reduction around individual homes.[36]

Firewise

Firewise, a national program is in the process of holding workshops with professionals throughout the region working in a wide array of fields dealing with land ownership and the effects of land use on wildfire cycles. By bringing people together and working through a series of exercises, solutions to urban/wildland interface fires are made. Soon, this program will be broken down into local workshops within Jackson County.[37]

Wildfire Hazard Assessment

Hazard Identification

Hazard identification is the first phase of a hazard assessment, and is the process of estimating the geographic extent of the hazard, its intensity, and its probability of occurrence.[38] This process usually results in a hazard map, and can provide detailed information in a clear format that provides public information and can assist in making policy and land use decisions.

The location and source of ignition for some past wildfires in the county is available in GIS, as are High Risk Wildfire Areas identified in 1990 by the Oregon Department of Forestry (ODF). These data show the geographic extent of high-risk wildfire areas based on density of development, fuel loading, slope and weather. Though not true wildland-urban interface areas, the ODF data helps identify areas of greater risk to wildfire.

Not all high-risk areas are in the woods. Grasslands are susceptible to wildfires year-round. Any prolonged dry spell can increase the chances of range fires, and a house in the way of a grass fire will be difficult to defend.

The following map, "Wildfire Hazard Areas," shows high-risk wildfire areas in Jackson County and the location of fire starts between 1992 and 1998. These high-risk areas generally lie in a perimeter around Medford. The perimeter consists of steeper and forested terrain that is more susceptible to wildfires.

Fire starts in this wildfire map are identified based on the number of acres involved. It's important to note that most large fires occurred in high-risk wildfire areas near development.

Vulnerability Assessment

Vulnerability assessment is the second phase of a hazard assessment. It combines the information generated through wildfire risk area identification with an inventory of the existing land use and infrastructure that are exposed to the hazard, helping predict how different types of property and population groups will be affected by the hazard.[39]

While a quantitative vulnerability assessment (an assessment that describes number of lives or amount of property exposed to the hazard) has not yet been conducted for Jackson County wildfire events, there are many qualitative factors (issues relating to what is in danger within a community) that point to potential vulnerability. Using the ODF High Risk Wildfire Areas, it is possible to show the relationships between high-risk areas and development areas, roads, utilities, and other infrastructure.

As of May 2001, within Ashland's City Limits alone, 733 acres of woodland contained 428 homes, all under the jurisdiction of a single fire department.[40] These structures are vulnerable because of their location in vegetated and sloped areas, and though some owners have taken steps to mitigate the danger, all face some threat of fire. But through mitigation efforts, millions of dollars worth of losses can be potentially eliminated, strengthening the community's economy and making it more disaster resilient.

Probability

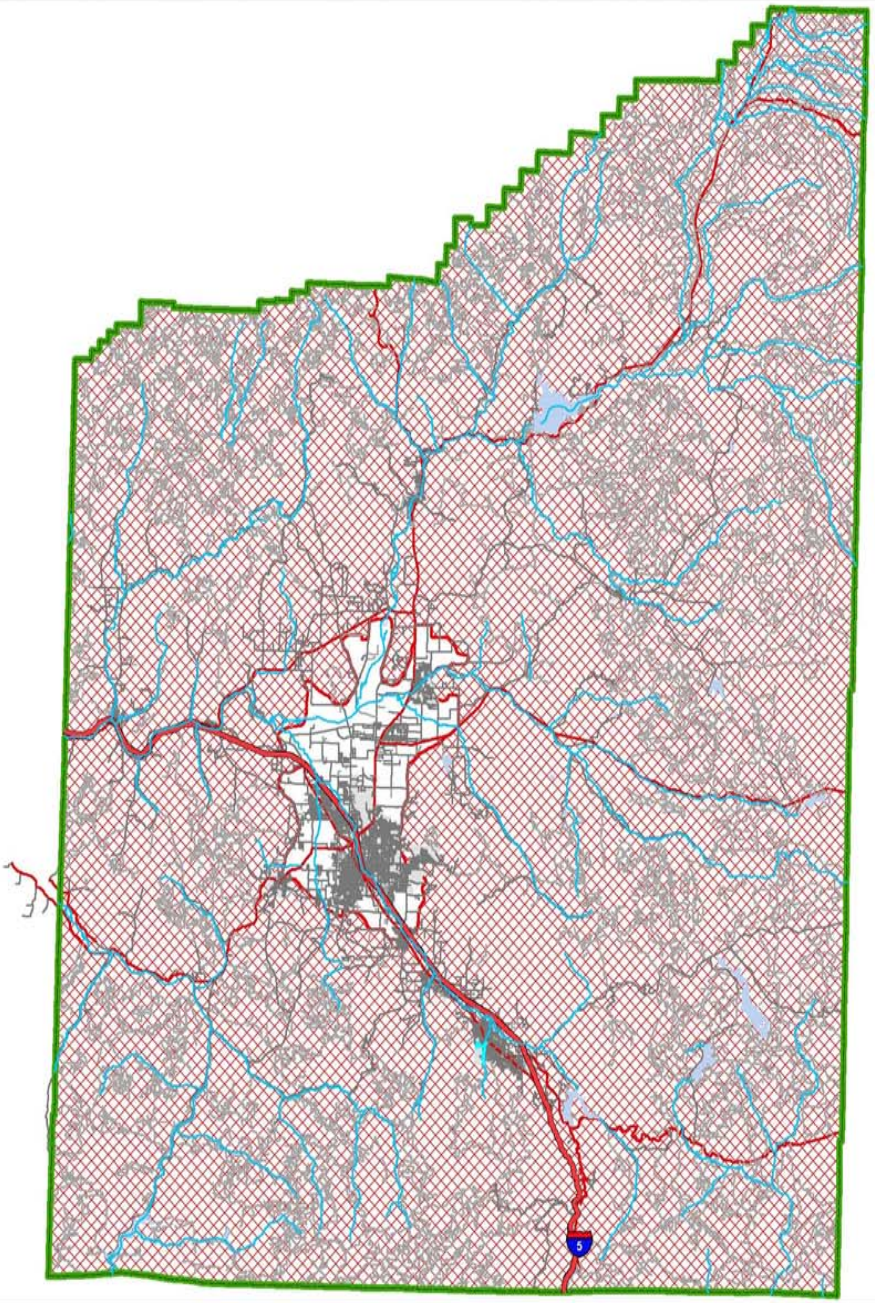
According to the Natural and Man-made Hazard Analysis in the county's Emergency Operations Plan, the probability of wildfire is high. There is more than one chance per 10 years of wildfire occurring. Wildfire ranks as the seventh highest ranked hazard of the thirteen identified hazards.

Risk Analysis

Risk analysis is the third, and most advanced phase of a hazard assessment. It builds upon hazard identification and vulnerability assessments.

Key factors included in assessing wildfire risk include ignition sources, building materials and design, community design, structural density, slope, vegetative fuel, fire occurrence, and weather, as well as occurrences of drought. At the time of publication of this plan, data was insufficient to conduct a risk analysis and the software needed to conduct this type of analysis was not available.

The National Wildland/Urban Fire Protection Program has developed a Wildland/Urban Fire Hazard Assessment Methodology tool for communities to assess their risk to wildfire. For more information on wildfire hazard assessment refer to www.Firewise.org. The map on the following page displays how the majority of Jackson County is located within a fire hazard area.



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SMARTMAP

JACKSON COUNTY
GEOGRAPHIC INFORMATION SYSTEM

Jackson County
Pre-Disaster Mitigation

Wildfire Hazard

Legend

Within Hazard Area

JACKSON COUNTY
oregon

Plot date: 02/15/2005; T:\5015\Disaster Mitigation Maps - Flood Hazard.mxd

Wildfire Goals and Action Items

The mitigation goals and action items were formulated through research of regional and national mitigation plans, natural hazards planning literature, and interviews with local stakeholders. Plan goals and action items were refined through discussions with the mitigation plan steering committee and through public workshops. The goals are broad based to encompass all the identified hazards addressed in this mitigation plan. Plan goals focus on seven categories:

1. Property Protection
2. Education and Outreach
3. Preventative
4. Partnership and Coordination
5. Structural Projects
6. Natural Resource Protection
7. Emergency Services

To read the goal statements for each of the seven categories, see *Section 3: Multi-Hazard Goals and Action Items.*

Two public workshops were held during the compilation of the mitigation plan: the first workshop was held on April 26, 2001 and the second one on June 12, 2001. The purpose of these workshops was to inform the public about natural hazards that occur in Jackson County, and identify community priorities, and potential strategies for achieving those priorities.

Through a voting process, Jackson County citizens identified goal statements in the following three categories as community priorities:

1. Emergency Services
2. Education and Outreach
3. Partnership and Coordination

Each of the goal statements and a summary of the workshop outcomes are listed in Section 3: Multi-Hazard Goals and Action Items. A complete listing of public comment is located in Appendix A: Public Process.

This section lists action items identified to reduce the risk from wildfire impacts in Jackson County. These action items are designed to meet the mitigation plan goals.

To read about action item organization, see the *Five-Year Action Plan.*

Short-term (ST) Wildfire Action Items

Short-term wildfire action items include general mitigation activities that agencies are capable of implementing during the next two years, given their existing resources and authorities.

ST-WF-1: Continue working with the Rogue Valley Fire Prevention Cooperative in the review of plans and inspection of structures for fire code compliance.

Notes: Currently, construction plans for commercial and industrial structures are reviewed, but not residential plans. Identification of areas with lack of experienced fire staff to review plans may be necessary.

Coordinating Organization:	County Building
Partner Organization:	Rogue Valley Fire Prevention Cooperative, State Fire Marshal
Timeline:	Ongoing
Plan Goals Addressed:	Preventative, Partnership and Coordination

ST-WF-2: Advocate water storage facilities with fire-resistant electrical pump systems in development that is not connected to a community water/hydrant system.

Notes: Such storage facilities should be accessible by standard firefighting equipment and adequate for the needs of the structure(s) built. Fire-resistant electrical pump systems should be used so water can be replenished during use. Presently, recommendations for storage facilities exist in development plan rules but are not mandatory or advocated.

Coordinating Organization:	RVFCA, Rural Fire Districts, State Fire Marshal
Partner Organization:	County Planning, ODF
Timeline:	Ongoing
Plan Goals Addressed:	Property Protection, Preventative

ST-WF-3: Continue to promote public awareness campaigns for individual property owners living in interface areas.

Notes: Focus on individual community outreach efforts through:

- Working demonstrations of risk reduction measures (i.e. survivable space around structures; driveway, road and bridge specifications; and landscaping);
- Voluntary site visits by fire crews to consult with landowners about specific ways to reduce risk to their property and to identify properties that would not be saved if a wildfire event occurred;
- Mailings;

- Public service announcements in the media;
- Warn prospective buyers to ask about the level of fire protection available and fire insurance rating for properties in Jackson County; and
- Noxious weed abatement.

Coordinating Organization: RVFCA, RVCOG, Rural Fire Districts, ODF, County and City Emergency Management Agencies
Partner Organization: Media, County Planning, OEM, FEMA,
Timeline: Ongoing
Plan Goals Addressed: Property Protection, Education and Outreach, Preventative, Partnership and Coordination

Long-Term (LT) Wildfire Action Items

Long-term wildfire action items include general mitigation activities that are likely to take more than two years to implement and may require new or additional resources and/or authorities.

LT-WF-1: Promote the expansion of rural fire districts.

Coordinating Organization: Rural Fire Districts, County Assessor
Partner Organization: Rogue Valley Fire Training Association
Timeline: 3-5 years
Plan Goals Addressed: Property Protection, Preventative, Partnership and Coordination, Emergency Services

LT-WF-2: Reduce wildfire fuels.

Notes: Identify methods of disposal or utilization of fire fuels removed from individual properties (i.e. prescribed fire application, fuel reduction through grass/timber/brush removal, small diameter forest product based industries, chipping etc.). The Firefree spring-cleaning program in Bend is an example.

Coordinating Organization: Rogue Recycling, BioMass
Partner Organization: County Planning, Rural Fire Districts, ODF, State Fire Marshal, BLM, USFS, Co-generation facilities, Applegate Community Partnerships
Timeline: 3-5 years
Plan Goals Addressed: Property Protection, Education and Outreach, Preventative

Jackson County
Wildfire Resource Directory

County Resources

Jackson County Emergency Management

Jackson County Emergency Management helps the community be better prepared for major emergencies and disasters. They work closely with cities, emergency responders, and volunteer agencies to find ways to reduce risks and minimize damages during hazard events. When a disaster occurs, they work with these partners in their Emergency Operations Center to coordinate resources and information. Once the event is over, they help bring assistance to those that have been harmed.

Contact: Jackson County Emergency Management
Address: 10 South Oakdale, Medford, Oregon 97501
Phone: (541) 774-6821
Fax: (541) 774-6455
Website: http://www.co.jackson.or.us

Fire Protection Districts

Jackson County

Applegate Valley FD #9 (8500)

Address: 1095 Upper Applegate Road, Jacksonville, OR 97530
Phone: 541/899-1050 (D)
Fax: 899-9314

Ashland Fire and Rescue

Address: 455 Siskiyou Blvd., Ashland, OR 97520
Phone: 541/482-2770
Fax: 541/488-5318
Email: keith@ashland.or.us

Butte Falls Fire Department

Address: POB 268, Butte Falls, OR 97522
Phone: 541/865-3262
Fax: 541/865-3777
E-mail: buttefallspd@cji.net

Colestine Rural Fire District

Address: 1701 Colestine Road, Ashland, OR 97520
Phone: 541/488-1768; 541/482-4889
Fax: 541/488-3515
Email: tastas@aol.com

Eagle Point Fire Department

Address: POB 779, Eagle Point, OR 97524
Phone: 541/826-4212
Fax: 541/826-6155

Evans Valley F.D. #6

Address: 8677 East Evans Rd., Rogue River, OR 97537
Phone: 541/582-0678
Fax: 541/582-0696
Email: evfd@internetcds.com

Jackson County Fire District #3

Address: 8333 Agate Road, White City, OR 97503
Phone: 541/826-7100
Fax: 541/826-4566
Email: jcfd3@cdsnet.net

Jackson County Fire District #4

Address: POB 996, Shady Cove. OR 97539
Phone: 541/878-2666
Fax: 541/878-3172

Jackson County Fire District #5

Address: 716 South Pacific Highway, Talent, OR 97540
Phone: 541/535-4222
Fax: 541/535-4226

Jacksonville Fire Department

Address: POB 7, Jacksonville, OR 97530
Phone: 541/899-7246
Fax: 541/899-7882

Lake Creek Rural

Address: 1892 South Obenchain Road, Eagle Point, OR 97524
Phone: 541/944-4573

Medford City/Rural

Address: 200 South Ivy Street, Room 257, Medford, OR 97501
Phone: 541/774-2301
Fax: 541/774-2514

Phoenix Fire Department

Address: POB 666, Phoenix, OR 97535
Phone: 541/535-2883
Fax: 541/535-5769

Rogue River Rural

Address: POB 1137, Rogue River, OR 97537
Phone: 541/582-4411
Fax: 541/582-3456

RVI—Medford Airport Fire

Address: 3650 Biddle Road, Medford, OR 97504
Phone: 541/776-2830
Fax: 541/776-0964
Email: fireone@mail.mind.net

Jackson County Roads and Parks Services

Address: 200 Antelope Road, White City, OR 97503
Phone: 541/774-6238
Fax: 541/774-6971

Regional Fire Protection Districts

California Department of Forestry and Fire Protection

Contact: Ranger Unit Chief
Address: POB 128, Yreka, CA 96097
Phone: 530/842-3516
Fax: 530/842-7952

Two Rivers Fire Zone

Contact: Fire Management Officer
Phone: 541/471-6732
Fax: 541/471-6514

Regional Resources

American Red Cross, Rogue Valley Chapter

Services provided by the American Red Cross include emergency assistance, disaster relief, and health and safety courses.

Contact: Executive Director
Address: 60 Hawthorne Street, Medford, OR 97504
Phone: (541) 779-3773
Fax: (541) 772-7212
Email: redcross@jeffnet.org
Websites: http://www.ccountry.net/~arces1/

State Resources

Oregon Department of Forestry (ODF) ODF's fire prevention Unit is involved in interface wildfire mitigation, providing information about Oregon's Wildfire Hazard Zones. ODF has maps and information services relevant to wildfire hazard mitigation. The protection from Fire section of the ODF website includes Oregon specific fire protection resources, including wildfire condition reports. The GIS section of the site includes state maps of the

following: slope, fire weather zones, precipitation, forest protection districts, potential natural vegetation, GAP vegetation, Northwest Oregon fire History, Southwest Oregon vegetation, lightning frequency, major watersheds, and general land ownership. ODF's Graphics Department can produce mapping at the local level, but data availability may limit the usefulness of this resource.

Contact: Fire Prevention Unit
Address: 2600 State Street, Salem, OR 97310
Phone: 503/945-7440
Fax: 503/945-7454
Website: www.odf.state.or.us

Oregon Department of Consumer and Business Services

The Building Codes Division of Oregon's Department of Consumer and Business Services is responsible for administering statewide building codes. Its responsibilities include adoption of statewide construction standards that help create disaster-resistant buildings, particularly for flood, wildfire, wind, foundation stability, and seismic hazards. Information about wildfire related codes are found through this department.

Contact: Building Codes Division
Address: 1535 Edgewater St. NW, P.O. Box 14470, Salem, OR 97309
Phone: 503/373-4133
Fax: 503/378-2322
Website: www.cbs.state.or.us/external/bcd

Office of the State Fire Marshal (OSFM)

The Prevention Unit of Oregon's Office of the State Fire Marshal includes 19 Deputy State Fire Marshals located in various regions. The responsibilities of these deputies include public education for local fire districts and inspection of businesses, public assemblies, schools, daycare centers, and adult foster homes.

Contact: Prevention Unit
Address: 4760 Portland Rd. NW, Salem, OR 97305-1760
Phone: 503/378-3473
Fax: 503/373-1825
Website: www.sfm.state.or.us

National Resources

Federal Emergency Management Agency (FEMA)

FEMA Region 10 serves the northwestern states of Alaska, Idaho, Oregon, and Washington. The Federal Regional Center (FRC) for Region 10 is located in Bothell, Washington. FEMA is an agency of the federal government whose purpose is to reduce risks, strengthen support systems, and help people and their communities prepare for and cope with disasters regardless of cause. FEMA's mission is to "reduce loss of life and property and protect our nation's critical infrastructure from all types of hazards through a comprehensive, risk-

based emergency management program of mitigation, preparedness, response, and recovery."

Contact: Federal Regional Center, Region 10
Address: 130-228th ST. SW, Bothell, WA 98021-9796
Phone: 425/487-4678
Website: www.fema.gov

National Fire Protection Association (NFPA)

NFPA is the principal federal agency involved in the National Wildland/Urban Interface Fire Protection Initiative. NFPA has information on the initiative's programs and documents. Other members of the initiative include: the National Association of State Foresters, the U.S. Department of Agriculture: Forest Service, the U.S. Department of the Interior: Bureau of Land Management, Bureau of Indian Affairs, Fish and Wildlife Service, and the National Park Service, and the United States Fire Administration.

Contact: Public Fire Protection Division
Address: 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101
Phone: 617/770-3000
Website: www.nfpa.org

Klamath National Forest

Contact: Forest Supervisor
Address: 1312 Fairlane Road, Yreka, CA 96097
Phone: 530/842-6131
Fax: 530/841-4571

Rogue River National Forest

Contact: Fire Staff Officer
Address: POB 520 Medford, OR 97501
Phone: 541/858-2200
Fax: 541/858-8220

Tanker Base

Contact: Forest Supervisor
Address: 600 Nebula Drive, Medford, OR 97504
Phone: 541/858-2210
Fax: 541-858-8220

Medford Fire Center

Contact: Asst. Fire Staff Officer
Address: 600 Nebula Way, Medford, OR 97504
Phone: 541/858-2343
Fax: 541/858-2346

Applegate Ranger District

Contact: District Ranger
Address: 694 Upper Applegate Road, Jacksonville, OR 97530
Phone: 541/899-1812
Fax: 541/858-2401

Ashland Ranger District

Contact: Linda Duffy, District Ranger

Address: 645 Washington Street, Ashland, OR 97520
Phone: 541/482-3333
Fax: 541/858-2402

Butte Falls Ranger District

Contact: District Ranger
Address: POB 227, Butte Falls, OR 97522
Phone: 541/865-2710
Fax: 541/865-2795

Prospect Ranger District

Contact: District Ranger
Address: Highway 62, Prospect, OR 97536
Phone: 541/560-3400, 858-3406
Fax: 541/560-3444

Siskiyou National Forest

Contact: Supervisor
Address: POB 440 Grants Pass, OR 97526
Phone: 541/571-6507
Fax: 541/471-6514

Tiller Ranger Station

Contact: District Ranger
Address: 27812 Tiller Trail Highway, Tiller, OR 97484
Phone: 541/825-3201
Fax: 541/625-3259

Crater Lake National Park

Contact: George Buckingham, Chief Ranger
Address: POB 7, Crater Lake National Park, OR 97604
Phone: 541/594-2211

Endnotes

[1] Northwest Interagency Fire Prevention Group, *Fire Safety Considerations for Developments in Forested Areas*, (1978).

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[19] *Planning for Natural Hazards: Oregon Technical Resource Guide*, Community Planning Workshop, (July 2000), Page 7-3.

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[22] Ibid.

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[25] Oregon Department of Forestry, *Disaster in the Making: Awbrey Hall Fire* (brochure). Salem, OR, (1991).

[26] Jim Wolf, ODF, Personal Interview, (February 28, 2001).

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[29] M.J. Harvey, USFS, Personal Interview, (March 1, 2001).

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[36] Ibid.

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Section 8:
Earthquake

Community Planning Workshop Researcher:

Skye Seiber, Community and Regional Planning Master's Candidate

Jackson County Earthquake Events

Earthquakes occur in Oregon everyday; every few years an earthquake is large enough for people to feel; and every few decades there is an earthquake that causes damage. Each year, the Pacific Northwest Seismic Network locates more than 1000 earthquakes greater than magnitude 1.0 in Washington and Oregon. Of these, approximately two dozen are large enough to feel. These noticeable events offer a subtle reminder that the Pacific Northwest is an earthquake-prone region.

Seismic hazards pose a real and serious threat to many communities in Oregon, including Jackson County, requiring local governments, planners, and engineers to consider their community's safety. Currently, no reliable scientific means exists to predict earthquakes. Identifying seismic-prone locations, adopting strong policies and implementing measures, and using other mitigation techniques are essential to reducing risk from seismic hazards in Jackson County.[1]

Earthquake Causes and Characteristics

Earthquakes from three different sources threaten Jackson County and other communities in western Oregon. These are shallow crustal fault slippage, subduction zone movement, and deep intraplate earthquakes.[2]

Earthquakes Occurring on Crustal Faults

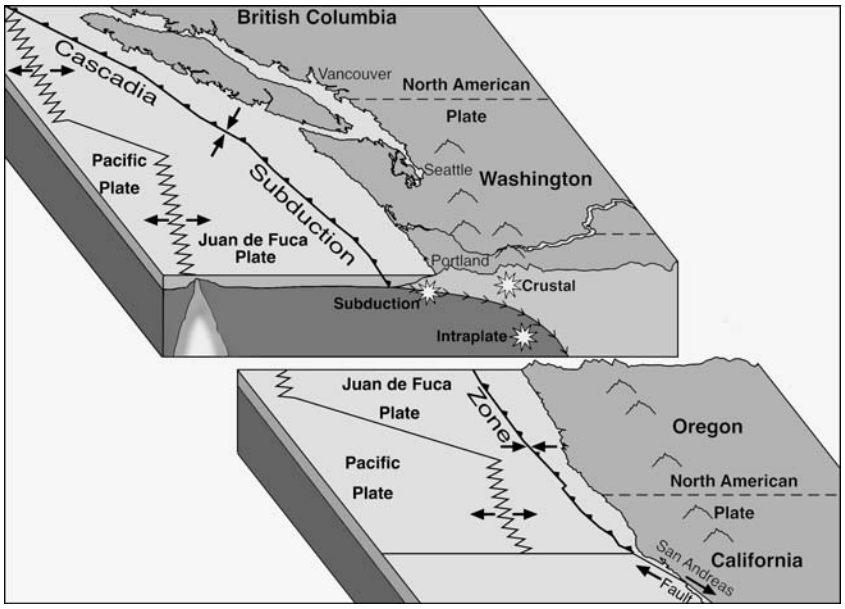
These are the most common earthquakes and occur at relatively shallow depths of 6-12 miles below the surface.[3] When crustal faults slip, they can produce earthquakes of magnitudes up to 7.0. Although most crustal fault earthquakes are smaller than 4.0 and generally create little or no damage, some of them can cause extensive damage. Known active faults in the region include the Wallula, Hite, Mount Angel, and Lake of the Woods fault zones.[4] Of the three earthquake types, crustal earthquakes are the greatest threat to Jackson County.

Subduction Zone Earthquakes[5]

The Pacific Northwest is located at a convergent continental boundary, where the Juan de Fuca and North American tectonic plates meet. This boundary is called the Cascadia Subduction Zone and extends from British Columbia to northern California. The two plates are converging at a rate of about 1-2 inches/year. Earthquakes are caused by the abrupt release of this slowly accumulated stress. Although there have been no large recorded earthquakes along the offshore Cascadia Subduction Zone, similar subduction zones worldwide do produce "great" earthquakes with magnitudes of 8 or larger. They occur because the oceanic crust "sticks" as it is being pushed beneath the continent, rather than sliding smoothly. Over hundreds of years, large stresses build which are released suddenly in great earthquakes. Such earthquakes typically have a minute or more of strong ground shaking, and are quickly followed by numerous large aftershocks.

Geologic evidence shows that the Cascadia Subduction Zone has also generated great earthquakes, and that the most recent one was about 300 years ago. Large earthquakes also occur at the southern end of the Cascadia Subduction Zone (in northern California near the Oregon border) where it meets the San Andreas Fault system.

Figure 8.1 Cascadia Subduction Zone



Source: Shoreland Solutions. Chronic Coastal Natural Hazards Model Overlay Zone. Salem, OR: Oregon Department of Land Conservation and Development (1998) Technical Guide-3.

Deep Intraplate Earthquakes

Intraplate earthquakes occur at depths between 18 to 60 miles below the earth's surface. These earthquakes are a result of subducting oceanic crust and can be up to 7.5 in magnitude. The February 28, 2001 earthquake in Nisqually, Washington was a deep intraplate earthquake. It produced a rolling motion which was felt from Vancouver, British Columbia to Coos Bay, and Astoria to Salt Lake City.[6]

Earthquake Hazards

Ground shaking, amplification, liquefaction, and landslides are the specific hazards associated with an earthquake. The severity of these hazards depends on several factors, including soil and slope conditions, proximity to the fault, earthquake magnitude, and the type of earthquake.[7]

Ground Shaking

Ground shaking is the motion felt on the earth's surface caused by seismic waves generated by the earthquake. Ground shaking is the primary cause of earthquake damage. The strength of ground shaking depends on the magnitude of the earthquake, the type of fault that is slipping, and distance from the epicenter (where the earthquake originates). Buildings on poorly consolidated and thick soils will typically see more damage than buildings on consolidated soils and bedrock.

Amplification

Soils and soft sedimentary rocks near the surface can modify ground shaking caused by an earthquake. This modification may amplify or decrease the strength of shaking, or it may change the frequency of the shaking. The thickness of the geologic materials and their physical properties determine how much amplification will occur. Ground

motion amplification increases the risk for buildings and structures built on soft and unconsolidated soils.

Liquefaction and Subsidence

Liquefaction occurs when ground shaking causes wet, granular soils to change from a solid state into a liquid state. This results in the loss of soil strength and the soil's ability to support weight. When the ground can no longer support buildings and structures (subsidence), buildings and their occupants are at risk.

Landslides and Rockfalls

Earthquake-induced landslides are secondary hazards that occur from ground shaking and can destroy roads, buildings, utilities and critical facilities necessary to recovery efforts after an earthquake. Some Jackson County communities are built in areas with steep slopes. These areas often have a higher risk of landslides and rockfalls triggered by earthquakes.

> "Due to the amount of faulting in the area, [the 1999 Klamath Falls earthquake] is just business as usual for such a geologically active region. Historic evidence, combined with geologic evidence for large numbers of earthquakes in the prehistoric past, suggests that one or more earthquakes capable of damage (magnitude 4-6) hit south-central Oregon every few decades, so it pays to be prepared."
>
> *James Roddey, DOGAMI*

History of Past Earthquake Events

All of Oregon west of the Cascades is at risk from the three earthquake types and associated hazards. The amount of earthquake damage at any place will depend on its distance from the epicenter, local soil conditions, and types of construction. Due to Oregon's relatively short written history and the infrequent occurrence of severe earthquakes, few Oregon earthquakes have been recorded in writing. Moreover, in the past century, there have been no *reported* damage or injuries in Jackson County due to earthquakes. However, several significant earthquake events have occurred in southwestern Oregon in the past 150 years. Details concerning these events are highlighted below.

November 23, 1873, Magnitude 6.75

The largest recorded earthquake in Oregon's history occurred near the California border at the coast. Property damage was reported in Crescent City, Port Orford, Grants Pass and Jacksonville and motion was felt in Portland and San Francisco. The earthquake is speculated to have originated from Cascadia Subduction Zone movement.

Image of damage from the 2001 Nisqually earthquake near Seattle

April 14, 1920

Three shocks were felt at Crater Lake. Despite an unrecorded magnitude or damage report, one of the earthquakes was rated "5" on the 1-10 Modified Mercalli intensity scale, indicating it was felt by nearly everyone; fragile objects and windows broke; plaster cracked; unstable objects overturned; disturbances to trees, poles, and other objects were noticeable.

September 20, 1993, Magnitude 5.9 and 6.0

Two earthquakes hit north-northwest of Klamath Falls, causing two fatalities and $7.5 million in damages in the nearby region, including extensive damage to the Klamath County Courthouse. Hundreds of small aftershocks were felt immediately afterwards and during the next three months, including a 5.1 quake on December 4, 1993.

Klamath Falls is located in the south-central part of Oregon, just north of the Oregon-California border. The city is situated in an earthquake-prone area between the High Cascades volcanic region and the Basin and Range system of faulting. Klamath Falls has experienced several minor earthquakes since the 1950's. The September 1993 earthquakes were felt over a 200-mile radius and caused extensive damage in Klamath Falls resulting in the deaths of two people.

Public facilities sustained damages of over $1.6 million, while 940 residences suffered at least minor damages involving cracked walls, broken windows, collapsed chimneys, and damaged plumbing. Businesses reported damages exceeding $2 million, while other non-residential structures estimated damages around $260,000. Two miles north of Klamath Falls, the Oregon Institute of Technology (OIT) experienced non-structural damage, including toppled bookcases and filing cabinets, and collapsed storage shelves. Most of the structural damage was limited to buildings with brick walls. [8]

November 28, 1999, Magnitude 3.4

This earthquake's epicenter was located 13.9 miles west-northwest of Klamath Falls, almost precisely where two quakes originated six years prior. Ground motion was felt in Medford, 45 miles away, and there were no reported injuries or damages.

Community Earthquake Issues

Earthquake damage occurs because humans have built structures that cannot withstand severe shaking. Buildings, airports, schools, and lifelines (highways, phone lines, gas, water, etc.) suffer damage in earthquakes and can ultimately result in death or injury to humans.

Death and Injury

Death and injury can occur both inside and outside of buildings due to falling equipment, furniture, debris, and structural materials. Likewise, downed power lines or broken water and gas lines endanger human life. Death and injury are highest in the afternoon when

damage occurs to commercial and residential buildings and during the evening hours in residential settings.[9]

Building and Home Damage

Wood structures tend to withstand earthquakes better than structures made of brick or unreinforced masonry buildings.[10] Building construction and design play a vital role in the survival of a structure during earthquakes. Damage can be quite severe if structures are not designed with seismic reinforcements or if structures are located atop soils that liquefy or amplify shaking. Whole buildings can collapse or be displaced.

2001 Nisqually Earthquake

A 6.8 magnitude earthquake centered southwest of Seattle struck on February 28, 2001, followed by a mild aftershock the next morning, and caused more than $1 billion worth of damage. Despite this significant loss, the region escaped with relatively little damage for two reasons: the depth of the quake center and preparations by its residents. Washington initiated a retrofitting program in 1990 to strengthen bridges, while regional building codes mandated new structures withstand certain amounts of movement. Likewise, historic buildings have been voluntarily retrofitted with earthquake-protection reinforcements.

Source: "Luck and planning reduced Seattle quake damage", CNN Report, March 1, 2001

Bridge Damage

All bridges can sustain damage during earthquakes, leaving them unsafe for use. More rarely, some bridges have failed completely due to strong ground motion. Bridges are a vital transportation link – damage to them can make some areas inaccessible. Because bridges vary in size, materials, siting, and design, earthquakes will affect each bridge differently. Bridges built before the mid 1970's often do not have proper seismic reinforcements. These bridges have a significantly higher risk of suffering structural damage during a moderate to large earthquake. Bridges built in the 1980's and 1990's are more likely to have the structural components necessary to withstand a large earthquake. [11]

Damage to Lifelines

Lifelines are the connections between communities and critical services. They include water and gas lines, transportation systems, electricity, and communication networks. Ground shaking and amplification can cause pipes to break open, power lines to fall, roads and railways to crack or move, and radio or telephone communication to cease. Disruption to transportation makes it especially difficult to bring in supplies or services. All lifelines need to be usable after an earthquake to allow for rescue, recovery, and rebuilding efforts and to relay important information to the public.

Disruption of Critical Facilities

Critical facilities are police stations, fire stations, hospitals, and shelters. These are facilities that provide services to the community and need to be functional after an earthquake event. The earthquake effects outlined above can all cause emergency response to be disrupted after a significant event.[12] See map on following page.

Economic Loss: Equipment and Inventory Damage, Lost Income

Seismic activity can cause great loss to businesses, either a large-scale corporation or a small retail shop. Losses not only result in rebuilding cost, but fragile inventory and equipment can be destroyed. When a company is forced to stop production for just a day, business loss can be tremendous. Residents, businesses, and industry all suffer temporary loss of income when their source of finances are damaged or disrupted.

Fire

Downed power lines or broken gas mains can trigger fires. When fire stations suffer building or lifeline damage, quick response to quench fires is less likely.

Debris

After damage occurs to a variety of structures, much time is spent cleaning up brick, glass, wood, steel or concrete building elements, office and home contents, and other materials.

Current Mitigation Activities

Mitigation through either regulatory or non-regulatory, voluntary strategies allow communities to gain cooperation, educate the public and provide solutions to ensure safety in the event of an earthquake.[13]

Individual Preparedness

At an individual level, preparedness for an earthquake is minimal as perception and awareness of earthquake hazards are low.[14] Strapping down heavy furniture, water heaters and expensive personal property as well as having earthquake insurance, is a step towards earthquake mitigation.

Earthquake Awareness Month

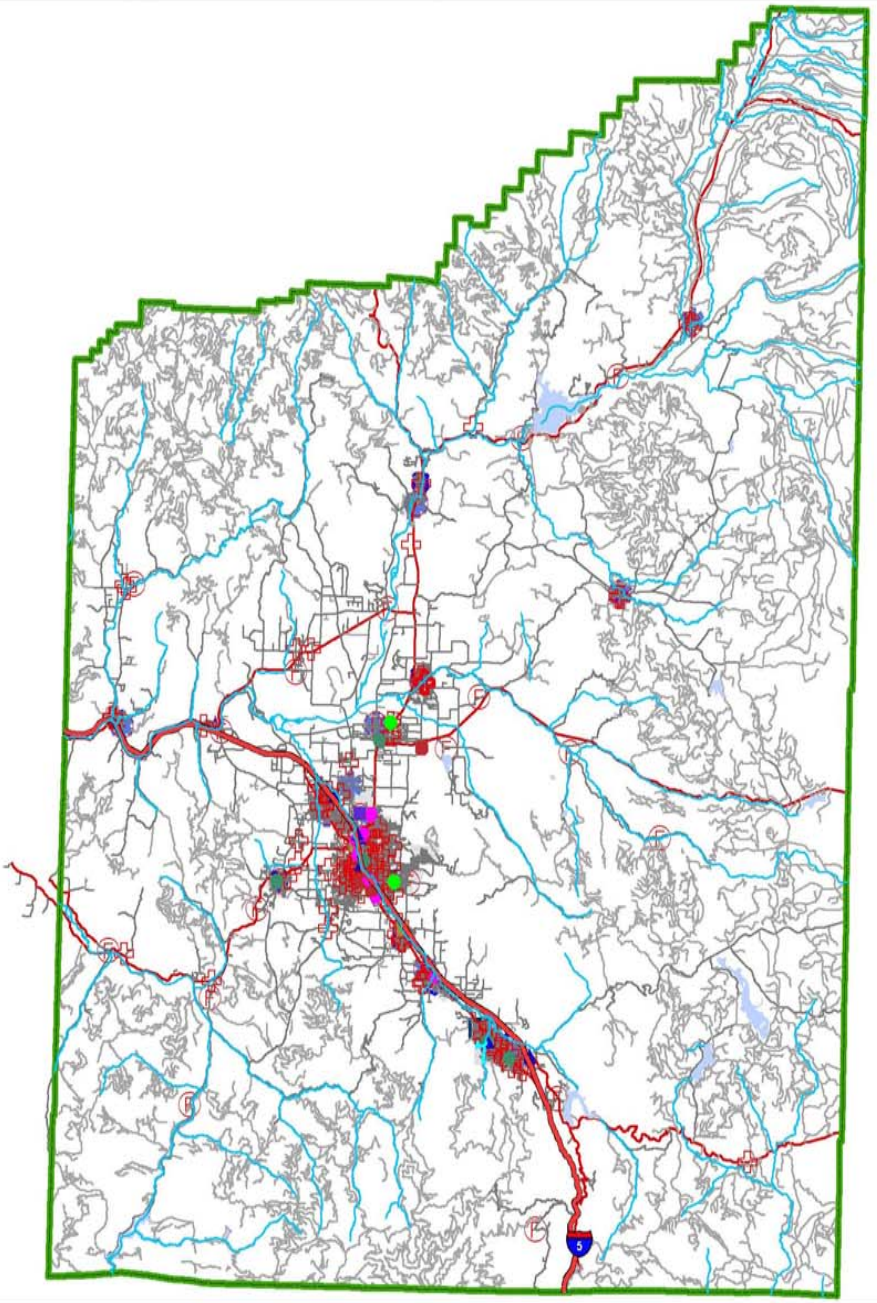
April is Earthquake Awareness Month. Oregon Emergency Management coordinates activities such as earthquake drills and encourages individuals to strap down computers, heavy furniture and bookshelves in homes and offices.

School Education

Schools conduct earthquake drills regularly throughout Oregon and teach students how to respond when an earthquake event occurs.

Oregon Showcase State Initiative

The Institute for Business and Home Safety (IBHS), a national non-profit organization is actively providing natural hazards information to the public, through interviews with the media and through public meetings and workshops. Insurance Information Service of Oregon and Idaho (IISOI) has a speaker's bureau that visits local communities to discuss loss prevention, insurance information, and effects from other natural hazard events.



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SMARTMAP

JACKSON COUNTY
GEOGRAPHIC INFORMATION SYSTEM

Jackson County
Pre-Disaster Mitigation

Critical Facilities

Legend

- Convention Center
- Hospital
- Mall
- Sports Venue
- Store
- Theater
- Travel
- Red Cross Shelters
- City Police
- Sheriff Outpost
- Sheriff / Jail
- Medical Services
- Hospitals
- Fire Stations
- City Hall / Courthouse

JACKSON COUNTY
oregon

Plot date: 02/15/2005; T:\5015\Disaster Mitigation Maps - Flood Hazard.mxd

Prioritization of Oregon Bridges for Seismic Retrofit

In January 1997, the Oregon Department of Transportation (ODOT), Oregon Local Agencies Seismic Committee, and CH2M HILL consultants completed a 4-year long study of seismic vulnerability for Oregon's bridge inventory. From this assessment, Jackson County was able to prioritize bridges for seismic retrofit within the county. Bridges that are considered structurally unsafe will be retrofitted or rebuilt to withstand high water flows, landslides and other natural hazards in addition to seismic events. ODOT can be contacted for more information on this bridge inventory.

State Building Codes

The Oregon State Building Codes Division adopts statewide standards for building construction that are administered by the state, cities and counties throughout Oregon. The codes apply to new construction and to the alteration of, or addition to, existing structures. Within these standards are six levels of design and engineering specifications that are applied to areas according to the expected degree of ground motion and site conditions that a given area could experience during an earthquake. The Structural Code requires a site-specific seismic hazard report for projects including critical facilities such as hospitals, fire and police stations, emergency response facilities, and special occupancy structures, such as large schools and prisons.[15]

The seismic hazard report required by the Structural Code for essential facilities and special occupancy structures considers factors such as the seismic zone, soil characteristics including amplification and liquefaction potential, any known faults, and potential landslides. The findings of the seismic hazard report must be considered in the design of the building. The Dwelling Code incorporates prescriptive requirements for foundation reinforcement and framing connections based on the applicable seismic zone for the area. The cost of these requirements is rarely more than a small percentage of the overall cost for a new building.

Requirements for existing buildings vary depending on the type and size of the alteration and whether there is a change in the use of the building that is considered more hazardous. Oregon State Building Codes recognize the difficulty of meeting new construction standards in existing buildings and allow some exception to the general seismic standards. Upgrading existing buildings to resist earthquake forces is more expensive than meeting code requirements for new construction. The state code only requires seismic upgrades when there is significant structural alteration to the building or where there is a change in use that puts building occupants and the community at a greater risk. Local building officials are responsible for enforcing these codes. Although there is no statewide building code for substandard structures, local communities have the option of adopting a local building code to mitigate hazards in existing buildings. Oregon State Statutes allow municipalities to create local programs to require seismic retrofitting of existing buildings within their communities.

The building codes do not regulate public utilities or facilities constructed in public right-of-ways, such as bridges.

Coordination Among Building Code Officials

Larger incorporated areas in Jackson County, such as Medford, Ashland, and Eagle Point, have a city building code official, while smaller jurisdictions work directly with the County building code official. Together, city and county building code officials enforce building codes and coordinate efficient inspection routines in the event of an earthquake. The Jackson County GIS Office has also mapped critical facilities and major public buildings so that inspections of these places can be assigned quickly when an earthquake occurs.

Community Programs

Currently, the city of Medford is remodeling and retrofitting buildings for earthquakes.

Implementing Local Ordinances

As a result of the destructive 1993 earthquake, Klamath Falls adopted an ordinance for dangerous buildings. At the time of this guide's production, the city is considering three additions to their ordinance based on Portland's ordinance. *Contact City of Klamath Falls at (541) 883-5316 for more information on the ordinance and these additions.*

Earthquake Hazard Assessment

Hazard Identification

The Oregon Department of Geology and Mineral Industries (DOGAMI), in partnership with other state and federal agencies, has undertaken a rigorous program in Oregon to identify seismic hazards, including active fault identification, bedrock shaking, tsunami inundation zones, ground motion amplification, liquefaction, and earthquake induced landslides. DOGAMI has published a number of seismic hazard maps that are available for Oregon communities to use. At the present time, the only hazard map that exists for Jackson County is one for the Ashland Urban Area. Due to the large extent of associated hazards, earthquakes can affect all parts of the county to varying degrees. Following is a map DOGAMI produced that illustrates the relative earthquake hazard across Oregon. There are high hazard areas located in the southwestern region of the state.

In response to growing earthquake awareness statewide, the Oregon Building Codes Division (BCD) revised construction standards for new buildings to make them resistant to seismic events. Oregon State Building Codes reflect three seismic zones as depicted in Figure 8.2. An increase in zone number reflects increased seismic activity. Zones are based on predicted ground motion and potential risk from large earthquakes within 50 years. New structures must be built to standards capable of resisting the forces caused by ground shaking applicable to the various seismic zones. For example, a structure in Zone 4 must be 33 percent stronger or more seismically resistant than a structure built in Zone 3.[16] Jackson County lies in Zone 3.

Vulnerability Assessment

FEMA has developed a computer-based estimation methodology called HAZUS that uses mathematical formulas and information about building stock, local geology and the location and size of potential earthquakes, economic data, and other information to estimate losses from a potential earthquake. Earthquake loss estimates forecast damage, and human and economic impacts that may result from future earthquakes. They are not precise predictions, but rather estimates based on scientific and engineering knowledge.[17]

HAZUS is capable of using PC-based Geographic Information Systems (GIS) software to map and display ground shaking, the pattern of building damage, and demographic information about a community. Once the location and size of a hypothetical earthquake is identified, HAZUS estimates the

Figure 8.2 Current Seismic Zones in Oregon

Source: Shoreland Solutions. Chronic Coastal Natural Hazards Model Overlay Zone., DLCD (1998).

violence of ground shaking, the number of casualties, damaged buildings, the amount of disruption to transportation systems, electrical and water utilities, population displaced from homes, and the estimated cost of repairing the projected damage. Earthquake damage for all 36 Oregon counties has been estimated recently using FEMA's HAZUS program and is based on years of research into Oregon's geology.[18] Since the HAZUS program was run statewide, estimates at the county level are less accurate. Therefore, DOGAMI cautions these figures and estimates should be used only for general planning purposes. Table 8.1 below depicts predicted loss and damage for an 8.5 Cascadia zone event and 500-year model in Jackson County. Due to the county's relatively large economic base and potentially high economic loss in either event, Jackson County was included among nine counties at highest risk from earthquakes in Oregon.

Table 8.1 Estimated Earthquake Damage Summary for Jackson County

Loss	8.5 Cascadia Subduction Zone Event	500-year Model
Injuries	428	930
Deaths	8	18
Displaced households	650	1,458
Short term shelter needs	489	1,080
Economic losses for buildings	$538 million	$1.2 billion
Operational day after quake:		
Fire stations	75%	NA
Police stations	62%	NA
Schools	70%	NA
Bridges	84%	NA
Communication	81%	NA
Economic losses to:		
Highways	$10 million	$34 million
Airports	$2 million	$8 million
Communication	$2 million	$9 million
Debris generated (thousands of tons)	434	889

Source: Wang, Yumei and J.L. Clark, "Earthquake damage in Oregon: Preliminary estimates of future earthquake losses", Special Paper 29, DOGAMI, 1999, p. 38.

Probability

Earthquake is ranked as the second highest natural hazard in the county's Hazard Analysis. It is estimated that there is more than one chance of an earthquake occurring in 10 years.

Risk Analysis

Risk analysis is the third phase of a hazard assessment. Risk analysis involves estimating the damage and costs likely to be experienced in a geographic area over a period of time.[19] Factors included in assessing earthquake risk include population and property distribution in the hazard area, the frequency of earthquake events, landslide

susceptibility, buildings, infrastructure, and disaster preparedness of the region. At the time of publication of this plan, data was insufficient to conduct a risk analysis and the software needed to conduct this type of analysis was not available. DOGAMI is leading state initiatives in producing relative earthquake maps and conducting risk analyses of various regions in the state.

Earthquake Goals and Action Items

The mitigation goals and action items were formulated through research of regional and national mitigation plans, natural hazards planning literature, and interviews with local stakeholders. Plan goals and action items were refined through discussions with the mitigation plan steering committee and through public workshops. The goals are broad based to encompass all the identified hazards addressed in this mitigation plan. Plan goals focus on seven categories:

- Property Protection
- Education and Outreach
- Preventative
- Partnership and Coordination
- Structural Projects
- Natural Resource Protection
- Emergency Services

To read the goal statements for each of the seven categories, see *Section 3: Multi-Hazard Goals and Action Items.*

Two public workshops were held during the compilation of the mitigation plan: the first workshop was held on April 26, 2001 and the second one on June 12, 2001. The purpose of these workshops was to inform the public about natural hazards that occur in Jackson County, and identify community priorities, and potential strategies for achieving those priorities.

Through a voting process, Jackson County citizens identified goal statements in the following three categories as community priorities:

1. Emergency Services
2. Education and Outreach
3. Partnership and Coordination

To read about action item organization, see the *Five-Year Action Plan.*

Each of the goal statements and a summary of the workshop outcomes are listed in Section 3: Multi-Hazard Goals and Action Items. A complete listing of public comment is located in Appendix A: Public Process.

This section lists action items identified to reduce the risk from earthquake impacts in Jackson County. These action items are designed to meet the mitigation plan goals.

Short-term (ST) Earthquake Action Items

Short-term earthquake action items include general mitigation activities that agencies are capable of implementing during the next two years, given their existing resources and authorities.

ST-EQ-1: Promote building safety through nonstructural improvements.

Notes: Publicize information on securing bookcases, filing cabinets, light fixtures, and other items that can cause injuries and block exits. Work with local building supply outlets to feature checklists/retrofit kits for reducing nonstructural risk. Use the Home Show to promote nonstructural strategies and mitigation information.

Coordinating Organization:	County and City Emergency Management Agencies
Partner Organization:	County Building Officials, County Emergency Response Agencies, Builder's Association, IISOI, Red Cross, OSSPAC, OIT, DOGAMI
Timeline:	1-2 years
Plan Goals Addressed:	Property Protection, Education and Outreach, Preventative

ST-EQ-2: Encourage purchase of earthquake hazard insurance.

Notes: Earthquake hazards are a major risk in Oregon. Many Oregonians, however, have not purchased earthquake insurance. There is a need to increase purchase of this insurance to alleviate financial loss from a seismic event.

Coordinating organization:	IISOI through local insurance companies
Partner organization:	Mortgage companies
Timeline:	1-2 years
Plan Goals Addressed:	Property Protection, Education and Outreach

ST-EQ-3: Maintain an inventory of all permitted dams in Jackson County:

Notes: Update appropriate seismic criteria and procedures for evaluating performance of existing dams (varies within each permitted dam Emergency Action Plan). See map on following page for dam inundation areas.

- Susceptibility to damage from flood events
- Amount of water impounded
- Type of construction
- Year completed
- Repair work performed

Coordinating Organization:	County and City Emergency Management Agencies, Water Master
Partner Organizations:	Watershed Councils, USACE, BOR, WRD
Timeline:	1-2 years
Plan Goals Addressed:	Education and Outreach, Preventative, Structural

Long-Term (LT) Earthquake Action Items

Long-term earthquake action items include general mitigation activities that are likely to take more than two years to implement and may require new or additional resources and/or authority.

LT-EQ-1: Compile Relative Earthquake Hazard maps for Jackson County.

Notes: Mapping earthquake hazards across the entire county will assist with mitigation activities and the provision of emergency services. The hazard map can be integrated with other GIS data to identify risk areas and assist in guiding land use away from hazardous areas.

Coordinating Organization:	DOGAMI, County GIS
Partner Organization:	County Planning, County Emergency Management, USGS, BLM, SOU
Timeline:	3-5 years
Plan Goals Addressed:	Education and Outreach, Preventative, Partnership and Coordination

LT-EQ-2: Promote the use of earthquake loss estimation program (HAZUS) at the local level by providing for the training to use the computer model.

Notes: HAZUS is a computer model that estimates direct losses (injury and death) and evaluates the indirect losses (economic impact and communications/transportation) associated with earthquakes. While the figures have some degree of uncertainty and should only be used for general planning purposes, HAZUS can help identify risk reduction strategies to minimize earthquake impacts on people, buildings and infrastructure.

Coordinating organization:	County GIS, DOGAMI
Partner organization:	Utility and Telecommunications Companies, County and City Emergency Management, OEM, FEMA
Timeline:	3-5 years
Plan Goals Addressed:	Education and Outreach, Preventative, Partnership and Coordination

EAGLE POINT

BROWNSBORO

ROGUE RIVER

GOLD HILL

LAKE CREEK

CENTRAL POINT

MEDFORD

JACKSONVILLE

PHOENIX

TALENT

ASHLAND

APPLEGATE

RUCH

Possible Inudation by Dam Failure

2

- Dam Failure Emigrant Lake
- Dam Failure Emigrant Hiway Dam
- Dam Failure Fish Lake
- Dam Failure Agate Lake

1 0 1 Miles

JACKSON COUNTY Oregon

Produced by JACKSON COUNTY G.I.S.

LT-EQ-3: Develop public/private partnerships – with building contractors, architects – to pursue retrofitting projects.

Notes: Encourage private contractors and architects to work on retrofitting buildings and infrastructure by recognizing their efforts through incentive programs. Incentive programs can assist in increasing the number of people and organizations aware of the importance of earthquake mitigation.

Coordinating organization:	SOREDI
Partner organization:	County Roads, Builder's Association, IISOI
Timeline:	3-5 years
Plan Goals Addressed:	Education and Outreach, Partnership and Coordination

Jackson County
Earthquake Resource Directory

County Resources

Jackson County Emergency Management

Jackson County Emergency Management helps the community be better prepared for major emergencies and disasters. They work closely with cities, emergency responders, and volunteer agencies to find ways to reduce risks and minimize damages during hazard events. When a disaster occurs, they work with these partners in their Emergency Operations Center to coordinate resources and information. Once the event is over, they help bring assistance to those that have been harmed.

Contact: Jackson County Emergency Management Coordinator
Address: 10 South Oakdale, Medford, Oregon 97501
Phone: (541) 774-6821
Fax: (541) 774-6455
Website: http://www.co.jackson.or.us

Regional Resources

Southern Oregon University

The Southern Oregon University Geology Department is working with the Oregon Department of Geology and Mineral Industries on an earthquake public awareness package for local schools. SOU has posted the preparedness plan, highlighting what to do before, during and after an earthquake.

Contact: Southern Oregon University Geology Department
Address: 1250 Siskiyou Blvd, Ashland, OR 97520
Phone: (541) 552-6477
Website: http://www.sou.edu/Geology/FieldTrip/Earthqk.htm

Northwest GeoData Clearinghouse Department of Geology – Portland State University

Portland State University conducts geologic researches and prepares inventories and reports for communities throughout Oregon. The GeoData Clearinghouse provides geologic information on earthquakes in the Northwest. It is especially useful for finding earthquake related maps or links to geospatial mapping sites around the nation.

Contact: Department of Geology
Address: Portland State University P.O. Box 751
Portland OR 97207-0751
Phone: (503) 725-3022
Fax: (503) 725-3025
Website: http://www.metro.dst.or.us/metro/growth/gms.html

State Resources

Department of Land Conservation and Development (DLCD)

DLCD administers the state's Land Use Planning Program. The program is based on 19 Statewide Planning Goals, including Goal 7, related to natural hazards, with flood as its major focus. DLCD serves as the federally designated agency to coordinate floodplain management in Oregon. They also conduct various landslide related mitigation activities. In order to help local governments address natural hazards effectively, DLCD provides technical assistance such as conducting workshops, reviewing local land use plan amendments, and working interactively with other agencies.

Contact: Natural Hazards Program Manager
Address: 635 Capitol St. NE, Suite 200, Salem, OR 97301-2540
Phone: (503) 373-0050
Fax: (503) 378-6033
Website: http://www.lcd.state.or.us/hazards.html

Oregon Department of Geology and Mineral Industries (DOGAMI)

The mission of the Department of Geology and Mineral Industries is to serve a broad public by providing a cost-effective source of geologic information for Oregonians and to use that information in partnership to reduce the future loss of life and property due to potentially devastating earthquakes, tsunami, landslides, floods, and other geologic hazards. The Department has mapped earthquake hazards in most of western Oregon.

Contacts: Deputy State Geologist, Seismic Hazards Team Leader, Tsunami and Coastal Hazards Team Leader
Address: 800 NE Oregon St., Suite 965, Portland, Oregon 97232
Phone: (503) 731-4100
Fax: (503) 731-4066
Website: http://sarvis.dogami.state.or.us/homepage/

Oregon Department of Consumer & Business Services – Building Codes Division

The Building Codes Division (BCD) sets statewide standards for design, construction, and alteration of buildings that include resistance to seismic forces. BCD is active on several earthquake committees and funds construction related continuing education programs. BCD registers persons qualified to inspect buildings as safe or unsafe to occupy following an earthquake and works with OEM to assign inspection teams where they are needed.

Contact: Building Codes Division
Address: 1535 Edgewater St. NW, P.O. Box 14470, Salem, Oregon 97309-0404
Phone: (503) 378-4133
Fax: (503) 378-2322
Website: http://www.cbs.state.or.us/external/

Oregon State Police-Office of Emergency Management (OEM)

The purpose of OEM is to execute the Governor's responsibilities to maintain an emergency services system as prescribed in Oregon Revised Statutes Chapter 401 by planning, preparing, and providing for the prevention, mitigation and management of emergencies or disasters that present a threat to the lives and property of citizens of and visitors to the state of Oregon. OEM coordinates disaster support to local governments and works with BCD to deploy additional building inspectors when needed for damage assessment.

Contact: Earthquake and Tsunami Program Coordinator
Address: 595 Cottage St. NE, Salem, Oregon 97301
Phone: (503) 378-2911
Fax: (503) 588-1378
Website: http://www.osp.state.or.us/oem/

The Nature of the Northwest Information Center

The Oregon Department of Geology and Mineral Industries and the USDA Forest Service operate the Nature of the Northwest Information Center jointly. It offers selections of maps and publications from state, federal, and private agencies. DOGAMI's earthquake hazard maps can be ordered from this site.

Address: Suite 177, 800 NE Oregon Street # 5, Portland, Oregon 97232
Phone: (503) 872-2750
Fax: (503) 731-4066
Email: Nature.of.NW@state.or.us
Website: http://www.naturenw.org/geo-earthquakes.htm

National Resources and Programs

Federal Emergency Management Agency (FEMA)

FEMA is heavily involved with seismic risks in Oregon and has aided in several projects in Portland and Klamath Falls. The Federal Emergency Management Agency (FEMA) is a department within the Office of Homeland Security. FEMA's purpose is to reduce loss of life and property and protect the nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of mitigation, preparedness, response, and recovery. FEMA coordinates the federal response and provides disaster relief funds following a natural hazard event and works most closely with Oregon Emergency Management (OEM).

Contact: Public Affairs Officer
Address: Federal Regional Center, 130 228th Street, St., Bothell, WA 98021
Phone: **(**425) 487-4610
Fax: (425) 487-4690
Website: http://www.fema.gov/library/quakef.htm
Email: opa@fema.gov

U.S. Geological Survey (USGS)

The USGS is an active seismic research organization that also provides funding for research. (For an example of such research, see Recommended Seismic Publications below). Also see the USGS Earthquake Hazards Program-Pacific Northwest Regional Center website at: http://geohazards.cr.usgs.gov/pacnw/

Contact: USGS, National Earthquake Information Center
Address: Box 25046; DFC, MS 967; Denver, Colorado 80225
Phone: 303-273-8500
Fax: 303-273-8450
Website: **http://neic.usgs.gov**

Building Seismic Safety Council (BSSC)

The Building Seismic Safety Council (BSSC) established by the National Institute of Building Sciences (NIBS), deals with complex regulatory, technical, social, and economic issues and develops and promotes building earthquake risk mitigation regulatory provisions for the nation.

Address: 1090 Vermont Avenue, NW, Suite 700, Washington, DC 20005
Phone: (202) 289-7800
Fax: (202) 289-109
Website: **http://www.bssconline.org/**

Additional Resources

Cascadia Region Earthquake Workgroup (CREW)

The Cascadia Region Earthquake Workgroup provides information on regional earthquake hazards, facts, and mitigation strategies for the home and business office. The Cascadia Region Earthquake Workgroup (CREW) is a coalition of private and public representatives working together to improve the ability of Cascadia Region communities to reduce the effects of earthquake events. Members are from Oregon, Washington, California, and British Columbia. Goals are to:

- Promote efforts to reduce the loss of life and property.
- Conduct education efforts to motivate key decision makers to reduce risks associated with earthquakes.
- Foster productive linkages between scientists, critical infrastructure providers, businesses, and governmental agencies in order to improve the viability of communities after an earthquake event.

Contact: CREW, Executive Director
Address: 1330A S. 2nd Street, #105; Mount Vernon, WA 98273
Phone: (360) 336-5494
Fax: (360) 336-2837
Website: **http://www.crew.org**

Western States Seismic Policy Council Earthquake Program Information Center (WSSPC)

WSSPC is a regional earthquake consortium funded mainly by the Federal Emergency Management Agency. Its website is a great earthquake resource, with information clearly categorized - from policy to engineering to education.

Website: http://www.wsspc.org/home.html

Institute for Business & Home Safety (IBHS)

IBHS was created as an initiative of the insurance industry to reduce damage and losses caused by natural disasters. This website provides great educational resources and on-line publications for insurers, businesses and homeowners who are interested in taking the initiative to minimize future damages and losses.

Website: http://www.ibhs.org/ibhs2/

Pacific Northwest Seismograph Network (PNSN) University of Washington Geophysics Program website

Information on Pacific Northwest earthquake activity and hazards from the Pacific Northwest Seismograph Network (PNSN), which operates seismograph stations and locates earthquakes in Washington. The PNSN is operated jointly by the University of Washington and several other northwest institutions, and is funded by the US Geological Survey (USGS), the Department of Energy, and the State of Washington.

Website: http://spike.geophys.washington.edu/SEIS/PNSN/

Earthquake Information Network (EQNET)

EQNET is a web-based clearinghouse for national and international earthquake information.

Website: http://www.eqnet.org/index.asp

Planning for Natural Hazards: The Oregon Technical Resource Guide, *Department of Land Conservation and Development (July 2000).*

Produced by the Community and Planning Workshop for the Department of Land Conservation and Development (DLCD), this is a natural hazards planning and mitigation resource for Oregon cities and counties. It provides hazard-specific resources and plan evaluation tools. The document was written for local staffs and officials. The Technical Resource Guide includes a natural hazards comprehensive plan review, a hazard mitigation legal issues guide, and five hazard-specific technical resource guides, including: flooding, wildfires, landslides, coastal hazards, and earthquakes. This document is available online. You can also write, call or fax to obtain this document:

Contact: Natural Hazards Program Manager, DLCD
Address: 635 Capitol St. NE, Suite 200, Salem, OR 97301-2540
Phone: (503) 373-0050
Fax: (503) 378-6033
Website: http://www.lcd.state.or.us/hazards.html

***Environmental, Groundwater and Engineering Geology: Applications for Oregon – Earthquake Risks and Mitigation in Oregon*, Yumei Wang, (1998) Oregon Department of Geology and Mineral Industries, Star Publishing.**

This paper deals with earthquake risks in Oregon, what is being done today, and what policies and programs are in action to help prevent loss and damage from seismic events. This article also gives a good list of organizations that are doing work in this field within the state. This article is somewhat technical but provides vital information to communities around the state.

To obtain this document: Contact DOGAMI at 503-731-4100 or the Nature of the Northwest Information Center at 503-731-4444.

***Land Use Planning for Earthquake Hazard Mitigation: A Handbook for Planners*, Wolfe, Myer R. et. al., (1986) University of Colorado, Institute of Behavioral Science, National Science Foundation.**

This handbook provides techniques that planners and others can utilize to help mitigate for seismic hazards. It provides information on the effects of earthquakes, sources on risk assessment, and effects of earthquakes on the built environment. The handbook also gives examples on application and implementation of planning techniques to be used by local communities.

To obtain this document: Contact the University of Colorado's Natural Hazards Research and Applications Information Center at (303) 492-6818.

***Using Earthquake Hazard Maps: A Guide for Local Governments In the Portland Metropolitan Region*, and *Evaluation of Earthquake Hazard Maps for the Portland Metropolitan Region* Spangle Associates, (1998/1999) Urban Planning and Research, Portola Valley, California, October.**

These two publications are handy for local governments concerned with land use in earthquake hazard areas. The proximity of Washington County to Portland and their interactive communities make these guides applicable to the County. The publications are written in clear and simplistic language and address issues such as how to apply earthquake hazard maps for land use decisions for local government.

To obtain these documents: Contact DOGAMI at 503-731-4100.

Endnotes

[1] Interagency Hazard Mitigation Team, *State Hazard Mitigation Plan* (2000) Oregon State Police – Office of Emergency Management.

[2] *Planning for Natural Hazards: Oregon Technical Resource Guide,* Community Planning Workshop, (July 2000), p. 8-8.

[3] Madin, Ian P. and Zhenming Wang, *Relative Earthquake Hazard Maps Report*, DOGAMI, 1999.

[4] Wong, Ivan G. and Jacqueline D.J. Bott, "A look back at Oregon's earthquake history, 1841-1994"*, Oregon Geology v57, no6,* November 1995.

[5] University of Washington website: www.geophys.washington.edu/SEIS/PNSN/INFO_GENERAL/faq.html#3.

[6] *Planning for Natural Hazards: Oregon Technical Resource Guide,* Community Planning Workshop, (July 2000), p. 8-8.

[7] Ibid.

[8] Ibid.

[9] Ibid.

[10] Wolfe, Myer, et al. *Land Use Planning for Earthquake Hazard Mitigation: A Handbook for Planners*, Special Publication 14, Natural Hazards Research and Applications Information Center.

[11] University of Washington website: www.geophys.washington.edu/SEIS/PNSN/INFO_GENERAL/faq.html#3.

[12] *Earthquake Damage in Oregon: Preliminary Estimates of Future Earthquake Losses.*

[13] *Planning for Natural Hazards: Oregon Technical Resource Guide,* Community Planning Workshop, (July 2000), p. 8-20.

[14] Darienzo, Mark, Office of Emergency Management, Personal Interview, (February 22, 2001).

[15] *Planning for Natural Hazards: Oregon Technical Resource Guide,* Community Planning Workshop, (July 2000), p. 8-13.

[16] Oregon Building Codes Division

[17] National Institute of Building Sciences, HAZUS, www.nibs.org/hazus.htm.

[18] Wang, Yumei and J.L. Clark, *Earthquake Damage in Oregon: Preliminary Estimates of Future Earthquake Losses*, Special Paper 29, DOGAMI, 1999.

[19] Burby, R. (Ed.) *Cooperating with Nature: Confronting Natural Hazards with Land Use Planning for Sustainable Communities* (1998), Washington D.C., Joseph Henry Press.

Section 9:
Volcanic Eruption

Community Planning Workshop Researcher:

Skye Sieber, Community and Regional Planning Master's Candidate

Jackson County Volcanic Events

Volcanoes are present in Washington, Oregon, and California where volcanic activity is generated by continental plates moving against each other (Cascadia Subduction Zone movement). Because the population of the Pacific Northwest is rapidly expanding, volcanoes of the Cascades Range are now considered some of the most dangerous in the United States.[1]

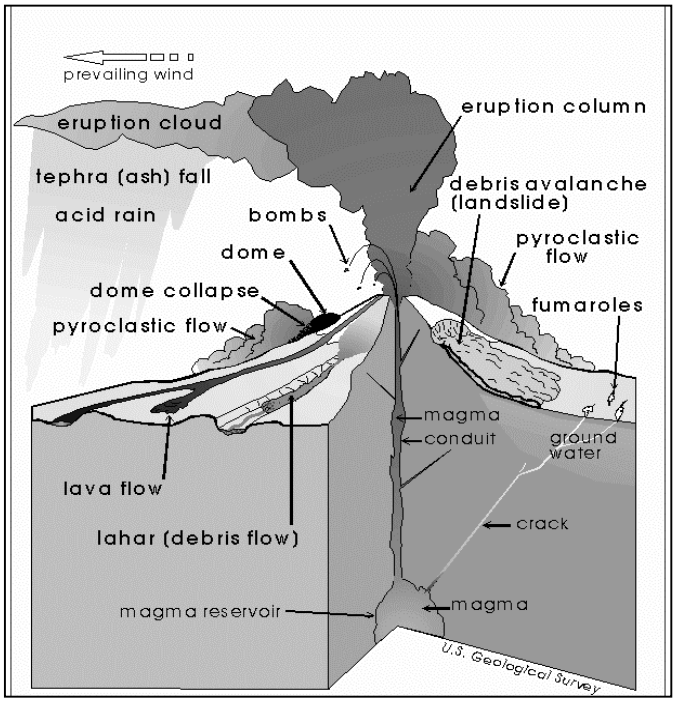
Volcanoes, however, provide benefits to humans living on or near them. They produce fertile soil, and provide valuable minerals, geothermal resources, and scenic beauty. Volcanic products are used as building or road-building materials, as abrasive and cleaning agents, and as raw materials for many chemical and industrial uses. Volcanic ash makes soil rich in mineral nutrients thus encouraging human settlement.[2]

See *Section 8: Earthquake* to read about the Cascadia Subduction Zone.

Volcano Causes and Characteristics

Volcanoes are commonly conical hills or mountains built around a vent that connect with reservoirs of molten rock below the surface of the earth.[3] Some younger volcanoes may connect directly with reservoirs of molten rock, while most volcanoes connect to empty chambers. Unlike most mountains, which are pushed up from below, volcanoes are built up by an accumulation of their own eruptive products: lava or ash flows and airborne ash and dust. When pressure from gases or molten rock becomes strong enough to cause an upsurge, eruptions occur. Gases and rocks are pushed through the opening and spill over, or fill the air with lava fragments. Figure 9.1 diagrams the basic features of a volcano.

Figure 9.1: Volcano Characteristics



Source: Topinka, USGS/CVO, 1998, Modified from Myers and Brantley, 1995, USGS Open-File Report 95-231

There are four principal types of volcanoes: cinder cones, composite, shield, and lava domes. Of these types, shield and composite volcanoes pose a threat to Jackson County.

Shield Volcanoes[4]

Shield volcanoes are built almost entirely of lava flows. In the south Cascades, lava oozes out in all directions from a central summit vent, or group

Shield Volcano Neighbors

Several large basaltic shield volcanoes along the southern High Cascade Range have steep-sided summit cones, such as Mount Bailey, Mount Thielsen, and Mount McLoughlin. These peaks rival major composite cones in size but are unlike them in origin and structure. No evidence suggests that these shield volcanoes formed during highly explosive eruptions. Most lava flow and thick tephra-fall deposits are restricted within a few kilometers of vents, and pumice-like particles are typically not traceable farther than 20 kilometers from vents. Though ashfall probably did occur much farther away, no preserved ash can be traced.

of vents, building a dome-shape cone. These cones are small when compared to shield volcanoes in other parts of the world; many south Cascades volcanoes are less than ten miles long as opposed to 40 to 50 miles long. Cascade shield volcanoes can remain active for a few months, years, or even centuries. Lava commonly erupts from vents along fractures that develop on the flanks of the cone. Shield volcanoes tend to erupt non-explosively and pour out large volumes of lava.

Composite Volcanoes[5]

Sometimes referred to as stratovolcanoes, most composite volcanoes have a crater at the summit that contains a central vent or a clustered group of vents. Lava either flows through breaks in the crater wall or from fissures on the flanks of the cone. Lava, solidified within the fissures, form dikes that greatly strengthen the cone.

The essential feature of a composite volcano is a conduit system through which magma from a reservoir deep in the Earth's crust rises to the surface. The volcano is built up by the accumulation of material erupted through the conduit and increases in size as lava, cinders, and ash, are added to its slopes. Composite volcanoes are long-lived and are recurrently active over hundreds of thousands of years. Composite volcanoes tend to erupt explosively and pose considerable danger to nearby life and property through their tendency to produce pyroclastic flows and lahars.

Nearby Composite Volcanoes[6]

Mount Shasta is a large composite volcano located about 40 miles from the Oregon-California border. Mount Shasta has been the most active volcano in California during the past 6,000 years, second in the entire Cascade Range to Mount St. Helens. During that time, Shasta has erupted on average every 200 to 300 years, producing many pyroclastic flows. It probably last erupted in 1786, when an eruption cloud was observed above the volcano from a ship passing by California's north coast.

Image of Mount Shasta
Source: USGS, photo by Lyn Topinka, 1984

Nearby Crater Lake is a composite volcano whose top collapsed and formed a huge depression, or *caldera,* that lies in the remains of Mount Mazama after a series of tremendous explosions occurred approximately 7,600 years ago – the largest known eruption from a Cascades Range volcano. Although Mount Mazama has been

quiet for a long time, it is considered active and slowly rebuilding magma from the last large eruption.[7] Mount Mazama's activity may be attributed to the nearby Basin and Range faulting that has been causing the more recent Klamath Falls earthquakes.[8]

Image of Crater Lake
Source: USGS, photo by Lyn Topinka, September 1982

Eruptions

Volcanic eruptions can be placed into two general categories: those that are explosive, such as the 1980 eruption of Mount St. Helens, and those that are effusive, such as the gentle lava flows, fountains, and spatter cones common in Hawai'i. Many eruptions are explosive in nature. They produce fragmented rocks from erupting lava and surrounding parent rock. Some eruptions are highly explosive and produce fine volcanic ash that rises many kilometers into the atmosphere in enormous eruption columns. Explosive activity also causes widespread tephra fall, pyroclastic flows and surges, debris avalanches, landslides, lahars, earthquakes, and flash floods.[9]

Related Hazards

Tephra

Tephra consists of volcanic ash (sand-sized or finer particles of volcanic rock) and larger fragments. During explosive eruptions, tephra together with a mixture of hot volcanic gas are ejected rapidly into the air from volcanic vents. Larger fragments fall down near the volcanic vent while finer particles drift downwind as a large cloud. When ash particles fall to the ground, they can form a blanket-like deposit, with finer grains carried further away from the volcano. In general, the thickness of ashfall deposits decreases in the downwind direction. Tephra hazards include impact of falling fragments, suspension of abrasive fine particles in the air and water, and burial of structures, transportation routes and vegetation.

Volcanic Landslides[10]

Landslides – or debris avalanches – are a rapid downhill movement of rocky material, snow, and (or) ice. Volcanic landslides range in size from small movements of loose debris on the surface of a volcano to massive collapses of the entire summit or sides of a volcano. Steep volcanoes are susceptible to landslides because they are built up partly of layers of loose volcanic rock fragments. Landslides on volcano slopes are triggered not only by eruptions, but also by heavy rainfall or large earthquakes that can cause materials to break free and move downhill.

Earthquakes

Volcanic eruptions can be triggered by seismic activity or earthquakes can occur during or after a volcanic eruption. Earthquakes produced by stress changes are called *volcano-tectonic earthquakes*. These earthquakes, typically small to moderate in magnitude, occur as rock is moving to fill in spaces where magma is no longer present and can cause land to subside or produce large ground cracks.[11] In addition to being generated after an eruption and magma withdrawal, these earthquakes also occur as magma is intruding upward into a volcano, opening cracks and pressurizing systems.[12] Volcano-tectonic earthquakes do not indicate that the volcano will be erupting but can occur at anytime and cause damage to manmade structures or provoke landslides.

Lahars and Flash Floods

Lahar is an Indonesian term that describes a hot or cold mixture of water and rock fragments flowing down the slopes of a volcano or river valley.[13] Lahars typically begin when floods related to volcanism are produced by melting snow and ice during eruptions of ice-clad volcanoes like Mount Shasta, and by heavy rains that may accompany eruptions. Floods can also be generated by eruption-caused waves that could overtop dams or move down outlet streams from lakes. Given the number of dams and other water retention structures in Jackson County, a lahar event could be catastrophic to downstream development.[14]

Lahars react much like flash flood events in that a rapidly moving mass moves downstream, picking up more sediment and debris as it scours out a channel. This initial flow can also incorporate water from rivers, melting snow and ice. By eroding rock debris and incorporating additional water, lahars can easily grow to more than 10 times their initial size. But as a lahar moves farther away from a volcano, it will eventually begin to lose its heavy load of sediment and decrease in size.[15]

Lahars often cause serious economic and environmental damage. The direct impact of a lahar's turbulent flow front or from the boulders and logs carried by the lahar can easily crush, abrade, or shear off at ground level just about anything in the path of a lahar. Even if not crushed or carried away by the force of a lahar, buildings and valuable land may become partially or completely buried by one or more cement-like layers of rock debris. By destroying bridges and key roads, lahars can also trap people in areas vulnerable to other hazardous volcanic activity, especially if the lahars leave deposits that are too deep, too soft, or too hot to cross.[16]

Cascadia: Living On Fire
A detailed report of the Pacific Northwest's catastrophic hazards and history written by Rick Gore appears in the May 1998 National Geographic, Vol. 193, No. 5. For more information or to request a back copy of this article, write to: National Geographic Society, P.O. Box 98199, Washington, D.C. 20090-8199 or visit www.nationalgeographic.com on the Internet.

History of Past Volcanic Eruption Events

Although there have been no recent volcanic events in the Jackson County area, it is important to note the area is active and susceptible to eruptive events since the region is a part of the volcanic Cascades Range.

Though not the same type of volcano as nearby Mount McLoughlin, the eruption of Mount St. Helens caused heavy damage and disruption to businesses and other essential services throughout Washington and much of Oregon. If Mount McLoughlin erupted, it would likely not be the same type of eruption as Mount St. Helens, though the impacts to people and property would be severe.

Mt. Rainer Landslides

At least five large landslides have swept down the slopes of Mount Rainier, Washington, during the past 6,000 years. The largest volcano landslide in historical time occurred at the start of the 1980 Mount St. Helens eruption.

Mount St. Helen's Case Study

On May 18, 1980, following two months of earthquakes and minor eruptions and a century of dormancy, Mount St. Helens in Washington, exploded in one of the most devastating volcanic eruptions of the 20th century. Although less than 0.1 cubic mile of magma was erupted, 58 people died, and damage exceeded 1.2 billion dollars. Fortunately, most people in the area were able to evacuate safely before the eruption because the U.S. Geological Survey (USGS) and other scientists had alerted public officials to the danger. As early as 1975, USGS researchers had warned that Mount St. Helens might soon erupt. Coming more than 60 years after the last major eruption in the Cascades (Lassen Peak), the explosion of St. Helens was a spectacular reminder that the millions of residents of the Pacific Northwest share the region with live volcanoes.[17]

Image of Mount McLoughlin
Source: USGS, photo by C.D. Miller and D. Mullineaux

Predicting Volcanic Eruptions

An important sign of an impending volcanic eruption is seismic activity beneath the volcanic area. The USGS and the Pacific Northwest Seismograph Network at the University of Washington continually monitor the Cascades for indications of volcanic activity. In many cases, seismologists can interpret subtle differences between earthquakes related to the rise of magma and the more familiar quakes caused by tectonic movement and fault slippage. Other warning signs of magma rising into the subsurface include increased release of volcanic gases from small openings called fumaroles and changes in the gas composition. Deformation of the ground surface in the vicinity of a volcano may also indicate that magma is approaching the surface. Typically, these warning signs appear a few weeks to months before an eruption, but can last for decades or even centuries without leading to an eruption.[1] Government officials and the public must realize the limitations in forecasting eruptions and be prepared for such uncertainty.

Community Volcanic Eruption Issues

Volcanic eruptions can send ash airborne, spreading the ash for hundreds or even thousands of miles. An erupting volcano can also trigger flash floods, earthquakes, rockfalls, and mudflows. Volcanic ash can contaminate water supplies, cause electrical storms, and collapse roofs.[18] Residents living in the vicinity of Mount McLoughlin, Mount Shasta, and Crater Lake, should be aware of its potential hazards and be ready to evacuate if it becomes necessary.

Businesses and individuals can make plans to respond to volcano emergencies. Planning is prudent because once an emergency begins, public resources can often be overwhelmed, and citizens may need to provide for themselves and make informed decisions. Knowledge of volcano hazards can help citizens make a plan of action based on the relative safety of areas around home, school, and work.[19]

Building and Infrastructure Damage

Buildings and other property in the path of a flash flood, debris flow, or tephra fall can be damaged. Thick layers of ash can weaken roofs and cause collapse, especially if wet.[20] Clouds of ash often cause electrical storms that start fires or damp ash can short-circuit electrical systems and disrupt radio communication.

Pollution and Visibility

Tephra fallout from an eruption column can blanket areas within a few miles of the vent with a thick layer of pumice. High-altitude winds may carry finer ash tens to hundreds of miles from the volcano, posing a hazard to flying aircraft, particularly those with jet engines.[21] In an extreme situation, the Medford-Jackson County Airport would need to close to prevent the detrimental effect of fine ash on jet engines and for pilots to avoid total impaired visibility.[22] Fine ash in water supplies will cause brief muddiness and chemical contamination.

Economic Impacts

Volcanic eruptions can disrupt the normal flow of commerce and daily human activity without causing severe physical harm or damage. Ash a few millimeters thick can halt traffic, possibly up to one week, and cause rapid wear of machinery, clog air filters, block drains and water intakes, and can kill or damage agriculture.[23]

Transportation of goods between Jackson County and nearby communities and trade centers could be deterred or halted. Subsequent

airport closures can disrupt airline schedules for travelers. Fine ash can cause short circuits in electrical transformers, which in turn cause electrical blackouts. Volcanic activity can also force nearby recreation areas to close for safety precautions long before the activity ever culminates into an eruption.[24] The interconnectedness of the region's economy would be disturbed after a volcanic eruption due to the interference of tephra fallout with transportation facilities such as Interstate 5 and the railroad.

Death and Injury

Inhalation of volcanic ash can cause respiratory discomfort, damage or result in death for sensitive individuals miles away from the cone of a volcano. Likewise, emitted volcanic gases such as fluorine and sulfur dioxide can kill vegetation for livestock or cause a burning discomfort in the lungs.[25] Hazards to human life from debris flows are burial or impact by boulders and other debris.

Current Mitigation Activities

Communities, businesses, and citizens can plan ahead to mitigate the effects of possible volcanic eruptions. Long-term mitigation includes using information about volcano hazards when making decisions about land use and siting of critical facilities. When volcanoes erupt or threaten to erupt, appropriate emergency response is needed. Such response will be most effective if citizens and public officials have an understanding of volcano hazards and have planned the actions needed to protect communities.

Monitoring Volcanic Activity

The U. S. Geological Survey's Cascades Volcano Observatory (CVO) in Vancouver, Washington, monitors and assesses hazards from the volcanoes of the Cascade Range in Washington, Oregon, and California. Seismic monitoring is shared with the USGS center in Menlo Park, California, (for northern California) and the Pacific Northwest Seismograph Network at the University of Washington in Seattle (for Washington and Oregon).

Education and Outreach: USGS Volcano Hazards Program

The mission of the Volcano Hazards Program (VHP) is "to help mitigate the harmful effects of volcanic activity by assessing hazards at volcanoes and monitoring volcanic unrest, providing warning information on volcanic activity and rapidly responding to volcanic crises, conducting research to understand volcanic processes, and communicating scientific findings to authorities and the public in an effective and appropriate form."[26] In short, the VHP aims to prevent volcano hazards from becoming volcano disasters. The VHP communicates with public officials, educators, media, and the public using fact sheets, websites, videos, workshops, presentations, field trips, teacher's guides, exhibits, press releases, and cooperative outreach programs.

Volcano Videos

The International Association of Volcanology and Chemistry of the Earth's Interior has produced a video entitled: *Reducing Volcanic Risk*. This 24-minute educational program and its companion, *Understanding Volcanic Hazards*, are intended to help prevent future deaths from volcanic eruptions.

Reducing Volcanic Risk showcases how people can lower their risk from volcanic activity. Three steps can prevent volcanic eruptions from becoming volcanic disasters:

1. Identify Hazard Areas
2. Monitor Volcanoes
3. Develop an Emergency Plan

Understanding Volcanic Hazards features images of erupting volcanoes and graphically shows how volcanic activity can affect people, their property, and the land on which they live. The program focuses on seven types of volcanic hazards: ash falls, hot-ash flows (pyroclastic flows), lahars, landslides, tsunamis, lava flows, and volcanic gases.

Another video program, *Pilot & Airline Training Video*, educates pilots and airline dispatchers about how to avoid volcanic eruption clouds.[27]

Volcanic Hazard Assessment

Hazard Identification

The nature of volcanic eruptions is such that the immediate danger area covers approximately a 20-mile radius from the eruptive origin, but danger can also extend 100 miles or more from a volcano.[28] Volcanoes within this proximal and distal range include composite volcanoes Crater Lake and Mount Shasta, and the broad field of shield volcanoes in the southern Cascades that includes Mount McLoughlin.

> "Shasta has been the most active volcano in the Cascades after St. Helens. A big eruption here could threaten I-5, the major transportation route on the West Coast, along with utility corridors."
>
> *Bob Christiansen, USGS Volcanologist*

The USGS has produced two hazard assessment reports for both Crater Lake and Mount Shasta, which include hazard maps. *Volcano and Earthquake Hazards in the Crater Lake Region, Oregon*[29] was completed in 1997 and *Potential Hazards from Future Eruptions in the Vicinity of Mount Shasta Volcano, Northern California*[30] was completed in 1980.

Vulnerability Assessment

Mount Shasta, considered an active volcano, could threaten Jackson County with ash fallout if there were unusual southerly winds. On the basis of its past behavior, Mount Shasta is not likely to erupt large volumes of ash in the future. Areas subject to the greatest risk from air-fall tephra are located mainly east and within about 50 kilometers of the summit of the volcano. The degree of risk from air-fall tephra decreases progressively as the distance from the volcano increases.[31]

The most probable volcanic risks for Jackson County associated with Crater Lake are lahars or earthquakes. The Rogue River drains the west side of Crater Lake National Park. Activity around Crater Lake could impact areas in the lower Rogue River basin (Prospect, Shady Cove, Gold Hill, Rogue River). It is not likely that the walls holding Crater Lake would fail, though it is a possibility.[32] Although such an event is considered a low probability, a more likely scenario is for eruptions to expel water from the lake or melt winter snowpack, eroding large quantities of sediment and becoming a lahar, or debris flow.[33] Such a massive debris flow would travel swiftly down drainage areas, devastating downstream development. Such flows would likely only be a catastrophic problem in the upper parts of river valleys, flows move downstream. A local earthquake of sufficient magnitude to seriously damage structures and disrupt transportation systems in the Crater Lake area does not occur more than once every few thousand years.[34] Heavy damage occurred when a lahar rushed down the Toutle River in Washington following the Mount St. Helens eruption. In the early afternoon of May 18, 1980, mudflow and logs tore apart the Coal

Image of damage to Coal Banks Bridge outside of Toutle, Washington
Source: Roger Werth, The Daily News, Longview, Washington

Banks bridge just outside of Toutle, Washington. The bridge has since been replaced.

A report developed by a Southern Oregon University geology student in 1996 revealed that Mount McLoughlin, located within Jackson County boundaries, is considered to be a minor threat and has not shown much activity since the early stages of its construction.[35]

Probability

Volcanic activity is ranked as the lowest natural or man-made hazard in the county's Emergency Operations Plan Hazard Analysis. It has the lowest probability of all hazards, it being less than one chance in 100 years.

Risk Analysis

Risk analysis is the third, and most advanced phase of a hazard assessment. It builds upon hazard identification and vulnerability assessments. Key factors included in assessing risk from volcanic eruptions and ash fall include population and property distribution in the hazard area, the frequency of events, and potential wind direction. At the time of publication of this plan, data was insufficient to conduct a risk analysis and the software needed to conduct this type of analysis was not available.

Volcano Goals and Action Items

The mitigation goals and action items were formulated through research of regional and national mitigation plans, natural hazards planning literature, and interviews with local stakeholders. The goals and action items were refined through discussions with the mitigation plan steering committee and through public workshops. The goals are broad based to encompass all the identified hazards addressed in this mitigation plan. Plan goals focus on seven categories:

- Property Protection
- Education and Outreach
- Preventative
- Partnership and Coordination
- Structural Projects
- Natural Resource Protection
- Emergency Services

To read about action item organization, see the *Five-Year Action Plan.*

Two public workshops were held during compilation of the mitigation plan: the first workshop was held on April 26, 2001 and the second one on June 12, 2001. The purpose of these workshops was to inform the public about natural hazards that occur in Jackson County, and identify community priorities, and potential strategies for achieving those priorities. Through a voting process, Jackson County citizens identified goal statements in the following three categories as community priorities:

1. Emergency Services
2. Education and Outreach
3. Partnership and Coordination

To read the goal statements for each of the seven categories, see *Section 3: Multi-Hazard Goals and Action Items.*

Each of the goal statements and a summary of the workshop outcomes are listed in Section 3: Multi-Hazard Goals and Action Items. A complete listing of public comment is located in Appendix A: Public Process.

This section lists action items identified to reduce the risk from volcanic eruption impacts in Jackson County. These action items are designed to meet the mitigation plan goals.

Short-term (ST) Volcanic Eruption Action Items

Short-term volcano action items include general mitigation activities that agencies are capable of implementing during the next two years, given their existing resources and authorities.

ST-V-1: Increase awareness of volcanic eruptions for county residents.

Notes: Inform and educate the public about volcanic hazards in the Jackson County region. The public awareness campaign may take many forms:

- Feature an interview with a representative of the Cascade Volcano Observatory (USGS), talking about how they determine the likelihood of a volcanic eruption;
- Place an informational kiosk in view of Mt. McLoughlin describing the area geology and potential volcanic hazards in the region;
- Develop a volcanic hazards guidebook, including how to identify possible volcanic eruption warning signals, air and water quality issues, techniques to minimize ash entering one's home, and proper clean-up procedures.

Coordinating organization:	County and City Emergency Management Agencies, USGS-CVO
Partner organization:	DOGAMI, SOU, National Park Service (Crater Lake)
Timeline:	1-2 years
Plan Goals Addressed:	Education and Outreach, Partnership and Coordination

Long-Term (LT) Volcanic Eruption Action Items

Long-term volcano action items include general mitigation activities that are likely to take more than two years to implement and may require new or additional resources and/or authorities.

LT-V-1: Create and map hypothetical eruption scenarios to display potential eruption hazards.

Notes: Hypothetical eruption scenarios for area volcanoes, showing the different possible eruption hazards can help the public understand the impacts of a volcanic eruption. Potential scenarios can show such occurrences as lava flows, tephra, ash plumes, lahars (debris flows), and possible geographic extent of impact. The scenarios can also cover likely grain size, thickness, physical properties, and hazards associated with ash fall. Pierce County, Washington uses hypothetical scenarios for Mount Rainier to show possible impacts. Cascades Volcano Observatory would partner with SOU geologists to create potential eruption scenarios.

Coordinating organization:	SOU, USGS-CVO
Partner organization:	County GIS, DOGAMI
Timeline:	3-5 years
Plan Goals Addressed:	Education and Outreach

LT-V-2: Collaborate with county environmental health for immediate warning to communities about air quality follow volcanic eruptions.

Notes: Ash fall distribution is not predictable due to its dependence on wind speed and direction. Therefore, the Jackson County Environmental Health Office can alert communities when Mount Shasta or other volcanoes produce ash, and distribute information quickly about air quality and visibility, and whether it is safe for residents to go outdoors or travel.

Coordinating organization:	County Environmental Health, DEQ
Partner organization:	County and City Emergency Management Agencies, Media
Timeline:	3-5 years
Plan Goals Addressed:	Partnership and Coordination, Emergency Services

Jackson County
Volcano Resource Directory

County Resources

Jackson County Emergency Management

Jackson County Emergency Management helps the community be better prepared for major emergencies and disasters. They work closely with cities, emergency responders, and volunteer agencies to find ways to reduce risks and minimize damages during hazard events. When a disaster occurs, they work with these partners in their Emergency Operations Center to coordinate resources and information. Once the event is over, they help bring assistance to those that have been harmed.

Contact: Jackson County Emergency Management Coordinator
Address: 10 South Oakdale, Medford, Oregon 97501
Phone: (541) 774-6821
Fax: (541) 774-6455
Website: http://www.co.jackson.or.us

Regional Resources

American Red Cross, Rogue Valley Chapter

Services provided by the American Red Cross include emergency assistance, disaster relief, and health and safety courses.

Contact: Executive Director
Address: 60 Hawthorne Street, Medford, OR 97504
Phone: (541) 779-3773
Fax: (541) 772-7212
Email: redcross@jeffnet.org
Websites: http://www.ccountry.net/~arces1/

Southern Oregon University

The Geology Department at Southern Oregon University researches the geological diversity of the southern Oregon region. Faculty and students study a variety of geological features, including volcanoes.

Contact: Southern Oregon University Geology Department
Address: 1250 Siskiyou Blvd, Ashland, OR 97520
Phone: (541) 552-6477
Website: http://www.sou.edu/Geology/index.htm

Northwest GeoData Clearinghouse Department of Geology – Portland State University

Portland State University conducts geologic researches and prepares inventories and reports for communities throughout Oregon. The GeoData Clearinghouse provides geologic information on earthquakes in the Northwest. It is especially useful for finding earthquake related maps or links to geospatial mapping sites around the nation.

Contact: Department of Geology
Address: Portland State University P.O. Box 751**,** Portland OR 97207-0751
Phone: (503) 725-3022
Fax: (503) 725-3025
Website: http://www.metro.dst.or.us/metro/growth/gms.html

State Resources

Oregon Department of Geology and Mineral Industries (DOGAMI)

The mission of the Department of Geology and Mineral Industries is to serve a broad public by providing a cost-effective source of geologic information for Oregonians and to use that information in partnership to reduce the future loss of life and property due to potentially devastating earthquakes, tsunami, landslides, floods, and other geologic hazards. The Department has mapped earthquake hazards in most of western Oregon.

Contacts: Deputy State Geologist, Seismic Hazards Team Leader, Tsunami and Coastal Hazards Team Leader
Address: 800 NE Oregon St., Suite 965, Portland, Oregon 97232
Phone: (503) 731-4100
Fax: (503) 731-4066
Website: http://sarvis.dogami.state.or.us/homepage/

U.S. Geological Survey – David A. Johnston Cascades Volcano Observatory

The USGS Cascades Volcano Observatory strives to serve the national interest by helping people to live knowledgeably and safely with volcanoes and related natural hazards including earthquakes, landslides, and debris flows in the western United States and elsewhere in the world. CVO assesses hazards before they occur by identifying and studying past hazardous events. CVO provides warnings during volcanic crises by intensively monitoring restless volcanoes and interpreting results in the context of current hazards assessments. Furthermore, CVO investigates and reports on hazardous events after they occur to improve our assessment and prediction skills, and to help develop new concepts of how volcanoes work.

Contact: U.S. Geological Survey, Cascades Volcano Observatory
Address: 5400 MacArthur Blvd, Vancouver, WA 98661
Phone: (360) 993-8900
Fax: (360) 993-8980
Website: http://vulcan.wr.usgs.gov/

National Resources and Programs

USGS Volcano Hazards Program

The U.S. Geological Survey has a website dedicated to worldwide volcanic hazards. This website includes general volcano information, updates on volcanic activity, risk reduction guides, links to other resources and observatories, and much more.

Contact: U.S. Department of the Interior, U.S. Geological Survey
Address: Menlo Park, California, USA
Website: http://volcanoes.usgs.gov/

Smithsonian Institution, Global Volcanism Program

The Global Volcanism Program (GVP) seeks better understanding of all volcanoes through documenting their eruptions--small as well as large--during the past 10,000 years. According to the GVP, the range of volcanic behavior is great enough, and volcano lifetimes are long enough, that we must integrate observations of contemporary activity with historical and geological records of the recent past in order to prepare wisely for the future. GVP's focus is the rapid dissemination of on-going eruption reports from local observers through our monthly Bulletin of the Global Volcanism Network. GVP's effort to document Earth's volcanic eruptions of the last 10,000 years has led to development of comprehensive computer databases and an archive of relevant maps, photos, and documents.

Contact: Global Volcanism Program, National Museum of Natural History
Address: Room E-421, Smithsonian Institution, Washington DC 20560-0119
Website: http://www.volcano.si.edu/gvp/

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Section 10:
Business Preparedness Assessment

Introduction

Jackson County businesses are vulnerable to an array of hazards, both natural and technological, which can affect business operations and the regional economy. The focus of Jackson County Business Preparedness Assessment is on the perception of risk of Jackson County's business owners and the current level of preparedness for natural hazard events.

In a post-disaster environment, economic recovery is a key goal for any community. However, community-wide recovery efforts often only address elements such rebuilding roads, public facilities, and other critical community infrastructure; rarely do communities address the topic of individual business continuity. Research, including reports from the Federal Emergency Management Agency (FEMA), has concluded it is not enough to look only at the internal business operations and needs. There is a codependent relationship between business and the community within it operates.

> *"Even if the facility survives a natural disaster with little or no damages, the business cannot operate if the transportation or utility systems it relies upon are damaged, if employees can't get to work and customers can't buy products or services. A business is dependent on its employees' and the community's resilience to natural disasters."*[1]
>
> James L. Witt,
> (Former) Director of the Federal Emergency Management Agency

According to U.S. Department of Labor Statistics, over 40% of all companies that experience a disaster never reopen and over 25% of the remaining companies close within two years.[2] Natural hazard events weaken the core of any community's economy. These issues underscore a strong need for coordinated efforts aimed at risk reduction in Jackson County and its business communities. Mitigation is one way to reduce the economic and structural impacts of natural hazards on Jackson County businesses.

What is business preparedness?

Business Preparedness (also known as contingency planning) is focused on putting practices, or contingencies, into place before an emergency event occurs so that (1) the business can adequately respond when the hazard event happens, and (2) continue to operate given the new circumstances. Preparedness planning or pre-emergency planning is considered any type of planning that can increase the individual, organizational, and community control over the subsequent disaster response.[3]

What is known about business preparedness?

Until recently, little empirical research was conducted on how business and industry withstands and recovers from natural hazard events, and more specifically, why some businesses survive while others fail.

The most conclusive research to date was conducted by the University of Delaware's Disaster Research Center (DRC). Since 1993, the DRC has conducted five systematic, large-scale mail surveys to gauge the level of hazard awareness, preparedness, disaster impacts and short and long term recovery across 5,000 private sector firms throughout the United States.[4] The five communities included Memphis/Shelby County Tennessee; Des Moines, Iowa, impacted by the 1993 Midwest Floods; Los Angeles, California, impacted by the 1994 Northridge Earthquake; Santa Cruz, California impacted by the 1989 Loma Prieta Earthquake; and South Dade County Florida, impacted by Hurricane Andrew (1992). This research illustrates characteristics that contribute to business resilience, and empirical data that suggests that basic assumptions may not hold up in relation to business recovery prospects. Some key points include:

- A low percentage of business owner/operators actually engage in mitigation and preparedness activities;
- The greatest trend in mitigation and preparedness planning is focusing activities on immediate life safety in the aftermath of a natural hazard event;
- The most devastating impact of natural hazards is not the event itself but the business interruption caused by utility and telecommunication disruption;
- Preparedness and post-disaster financial aid bear no relation to recovery rates; and
- The most successful preparedness and mitigation activities are the most far-reaching in scope: onsite is good but community-wide is better.

Their research also concluded that basic determinants of disaster preparedness were a series of characteristics that included the size and type of the business; whether the business was independently owned or part of a franchise; the age of the business, and whether business property was owned or leased.[5] Common sense suggests that the larger the business, the more resources at its disposal for emergency planning.

Findings from the University of Delaware's Disaster Research Center pointed to the correlation between the size of a firm and its level of preparedness. Overall, the size of a business appears to be the most important factor influencing the propensity of businesses to prepare. In every community DRC studied, larger organizations have done more to prepare than their smaller counterparts."[6] Larger firms had more financial and labor resources to organize and plan for emergency events, and the more employees working at the firm, the more likely there were evacuation plans and other preparedness measures in place. The age of the business is also a measurable determinant of business preparedness.

The older a business becomes, the more likely it is to have amassed resources and institutional knowledge for mitigation and preparedness activities. Business locations owned rather than leased are also more likely to invest additional money for mitigation or preparedness activities.[7]

The national research led to specific recommendations regarding business mitigation for natural hazard events. According to *Businesses and Disasters: Empirical Patterns and Unanswered Questions* published in the Natural Hazards Review in May of 2000 communities should:[8]

- Focus on smaller businesses and less-prepared sectors;
- Find out more about what kinds of approaches work best to get business to take action; and
- Address the crucial linkage between community and business.

The Jackson County Business Recovery Questionnaire was developed to assess the situation and determining future steps to assist the County's business community reduce risk from natural hazards.

Jackson County Business Recovery Questionnaire

Purpose

Jackson County included a Business Recovery Questionnaire as part of the development of the Jackson County Natural Hazards Mitigation Action Plan. The questionnaire surveyed local businesses, regardless of business size or type, to collect information regarding business disaster preparedness. Specifically, the questionnaire was designed to:

1. Gauge the extent of business preparedness for natural hazard events;
2. Evaluate what business have already done to be prepared for natural hazard events;
3. Document concerns local business owners/operators have related to natural hazards;
4. Identify the format in which owner/operators prefer to receive information; and
5. Increase the level of local business preparedness.

The questionnaire establishes a baseline of information about services that are critical to local business and evaluates the business community's understanding of mitigation activities that assist in reducing their risk to natural hazards. Survey results provide the basis for recommendations that the County can use to minimize natural hazard impacts on the local business and the economy.

Methodology

The questionnaire was adapted from a disaster resilience survey developed by Stephen B. Baruch & Associates of Los Altos, California. Representatives from Oregon Natural Hazards Workgroup, Institute for Business & Home Safety, Jackson County, and Southern Oregon Economic Development, Inc (SOREDI) reviewed and refined the questionnaire content before distribution. The survey was then field tested on 11 businesses representing a diverse range of industry sectors, number of employees, and geographic location in Jackson County. Input from the field test refined the survey further before its countywide distribution.

A postcard was mailed to announce the survey and describe what would be asked and how the information would be used. The survey followed, along with a business reply postcard indicating whether survey respondents wanted to receive the survey results and/or whether they wanted to participate in a workshop designed to provide information and resources to those who want to improve their business preparedness. Another survey mailing followed to remind people to fill out and return surveys.

CPW distributed questionnaires to 989 employers within Jackson County using an Oregon Employment Department database. The

sample included both private and public employers. CPW received 228 valid responses, which is a 23% response rate.

Findings

The questionnaire contained 13 questions. Following are survey results and highlights of the key findings. The questionnaire summary is comprised of three core elements:

(1) General information and background

(2) Susceptibility to natural hazards events

(3) ***Preparedness and mitigation activities***

To review a full copy of the survey and results refer to Appendix C.

General information and background

In 1999, Jackson County had about 5,269 employers representing about 71,600 jobs.[9] This survey represents 228 of those employers and 22,894 current jobs.[10] The first five questions of the survey requested general business information: years of operation, type of business, ownership status, and employees – how many and average commute time to work.

Key findings from the Jackson County respondents related to business age, business type, and ownership include:

- 18% of business owners have been in operation for 1 to 10 years; 42% of business owners have been in operation for 11 to 25 years; and 2% of business owners have been in operation for over 100 years.
- 67% owned/operated individual firms
- 23% owned/operated a chain of businesses
- 51% own the building their business occupies
- 42% lease the business location

Key findings from the Jackson County respondents related to business size and distance from business location and employees:

- 54% of respondents had 25 employees or less; 12% of respondents had between 100 and 499 employees; and 3% or respondents had over 500 employees.
- 66% report that employee commutes typically last between 15 to 29 minutes
- 27.7% of businesses that report commutes lasting between 5 to 14 minutes

Susceptibility to natural hazards events

This section of the survey addressed business vulnerability to different natural hazards and the need for various services and infrastructure.

The survey asked respondents to list the severity of impact that the listed hazard could have on their business, using a five-point scale.

Table 10-1 lists the potential hazard events and indicates the percentage the respondents associated with each hazard event.

Table 10-1. How severe are natural hazard impacts on your business?

Hazard Event	Critical	Very Important	Important	Not Very Important	No Need to Address Now
Wind damage	9.7%	14.7%	***35.0%***	34.1%	6.5%
Flooding	***24.3%***	19.8%	20.3%	***24.3%***	11.3%
Landslide / debris flow	12.4%	9.2%	15.6%	***34.9%***	28.0%
Winter storm / snow & ice	16.9%	23.7%	***34.2%***	21.5%	3.7%
Wind storm	12.1%	17.7%	***35.3%***	29.3%	5.6%
Earthquake	***35.7%***	20.4%	18.6%	17.2%	8.1%
Volcanic eruption	23.9%	10.4%	12.2%	23.0%	***30.6%***
Electricity loss	***63.4%***	21.9%	7.6%	5.8%	1.3%
Hazardous materials accident	17.8%	18.3%	***27.9%***	26.0%	10.0%
Air / train accidents	6.9%	11.9%	16.1%	***39.4%***	25.7%
Water supply loss	***41.4%***	18.5%	25.2%	11.7%	3.2%
Wildfire	19.0%	16.3%	22.6%	***26.2%***	15.8%
Other	31.8%	13.6%	4.5%	13.6%	***36.4%***

Source: Community Planning Workshop 2001

Of the twelve hazards listed in Table 10-1, flooding, earthquake, electricity and water supply loss appear to be critical business impacts. Wind damage, winter storm/snow/ice, windstorm and hazardous materials accidents were rated as important business impacts. Volcanic eruption was the only hazard event that survey respondents felt no need to address at this time. "Other" captured 36% of survey responses in the "no need to address now" category, but individual responses were not separated.

Table 10-1 shows that flooding is a critical impact for 24% of survey respondents and it also shows that 24% of survey respondents don't consider flooding to be very important in terms of potential impact. These seemingly opposite outcomes result directly from business location. If a business were located near a floodplain then it could be a critical impact, while if a business is not near a floodplain then flooding would not be a worry.

The survey asked respondents to rate the importance of infrastructure and services on business operations. Table 10-2 shows how the majority of respondents rated each type of infrastructure and service.

Table 10-2. How important are services to your business operations?

Service Type	Critical	Very Important	Important	Not Very Important	Not Important at All
Electricity	***78.1%***	15.4%	3.9%	1.8%	.9%
Water	***46.9%***	23.5%	16.8%	11.1%	1.8%
Natural gas	***31.0%***	19.0%	18.1%	16.8%	15.0%
Phone / Internet	***55.9%***	23.3%	17.6%	3.1%	0.0%
Postal / package services	19.7%	27.8%	***34.5%***	12.6%	5.4%
Sewer / wastewater treatment	***32.0%***	24.9%	27.6%	11.6%	4.0%
Transportation, e.g. roads, rail	***35.7%***	29.1%	26.4%	6.6%	2.2%

Source: Community Planning Workshop 2001

With the exception of postal/package services, all services and infrastructure were rated as a critical need for business operations. Survey respondents rated electricity as the most critical business need, followed by phone/Internet services and water. National findings also reveal that electricity is the most critical service to business operations, the absence of which is economically devastating.[11]

The survey asked how long businesses could afford to be shut down or inoperable during a natural hazard event before suffering major financial loss. The first part of the question asked whether businesses would suffer financial loss immediately, within hours, or within days.

- 39% of respondents would suffer immediate financial impacts.
- 7% of businesses feeling financial impacts in a matter of hours.
- 54% of respondents would suffer major financial loss in a matter of days.

The second part of the question tried to quantify the number of hours or days it would take for a business to suffer financially. Results yielded:

- 76% of survey respondents indicated that their business would suffer financial loss within 12 hours.
- 18% of respondents thought their business would suffer financial loss between 13 and 24 hours.
- 6% of survey respondents felt their business would suffer financial loss between 37 and 48 hours.

When asked how many days it would take before businesses suffer financial loss, he results yielded:

- 82% would suffer major financial loss within 10 days.
- 13% would suffer within 11 to 20 days.
- 4% would suffer financial loss within a one-month period.

The survey asked respondents to identify all the transportation systems upon which the business depends. Below is a breakdown of the most utilized transportation systems.

- 90% of respondents primarily relied on city roads
- 85% of respondents using state highways,
- 83% using interstate highways and
- 75% of businesses using county roads.

Though important to the businesses that use them, air and rail made up a small overall percentage. The "other" category made up 4 of survey responses and included such specific transportation modes as elevators and mass transit.

The survey specifically addressed lifeline services for business operations. Respondents were asked to rate the level of importance of each critical service for business operations. Five types of service were covered including: electrical power, telecommunications, water, sewage disposal, and natural gas. For each service category, an "other" category was provided to capture answers that were not listed in the questionnaire.

Electrical power

CPW asked responders how important electrical service is for four basic business operations: computers/cash registers; machinery; lights/office and heating/ventilation/air conditioning.

- 50% survey respondents consider electricity critical to power computers and cash registers.
- 47% think electricity is critical for machinery, lighting and office uses.

Approximately 88% of respondents stated that electrical power was important to critical in need for their business, specifically in using electricity for heating/ventilation/air conditioning (HVAC). Refrigeration and security make up the lion's share, at 22% each.

Telecommunications

Telecommunication in the form of telephones, fax machines, computer modems, and credit card machines are important to many businesses.

- 52% of survey respondents consider regular phone use a critical need for business operations.
- 44% consider computer modems as critical.
- 29% consider fax machines as critical to business operations.
- 18% of respondents consider credit card machines critical. At the opposite end of the spectrum, though, almost 40% of surveyed businesses do not use credit card machines in their daily operations.

Water

Water for drinking, cooking, bathroom and sanitary use, industrial use, and HVAC systems, is considered a critical service for many survey respondents.

- 42% of respondents consider the "other" category as the most critical need for water for their business.
- 37% consider water as critical for bathroom use.
- 33% consider water as critical for drinking and cooking use.
- Of the 13% of survey respondents who considered water critical to their HVAC systems, 28% at least considered it important and anther 27% didn't use water for that purpose.

Sewage disposal

Sewage disposal is used for bathroom/sanitary and industrial use.

- Over 39% consider bathroom use and sanitary sewers as critical to business operations.
- 12% consider industrial wastewater disposal as critical.
- Almost 47% of surveyed businesses do not use water for industrial processes.
- What is difficult to decipher is that 77% of "other" is noted as not being used, but it is not evident what water is not being used for.

Natural gas

Natural gas is used in industrial processes and HVAC systems for many businesses. Key respondent findings include:

- Of those surveyed, 15% consider natural gas critical for industrial processes.
- 22% who consider natural gas critical for HVAC systems.
- 22% consider natural gas to be critical for other service categories.
- Approximately 50% use natural gas for kitchen use.

Mitigation activities and business preparedness

CPW asked survey respondents to identify how important various mitigation activities would be to their business and to gauge their level of preparedness.

Survey respondents evaluated the potential importance of specific mitigation activities for their business by rating the activities as very useful, somewhat useful, not useful or already addressed. Five categories of mitigation activities were listed in the questionnaire including: facility and road access; utilities; businesses helping businesses; training and public outreach; and mitigation incentives.

Facility and road access

Table 10-4 indicates how respondents rated potential activities, and also shows whether a particular mitigation activity is not considered useful or has already been addressed. All five activities were considered very useful by between 41% and 53% of survey respondents though much smaller percentages, ranging from 4% to 6% had actually implemented such activities.

Table 10-4. How important would facility and road access mitigation activities be to your business?

Facility & Road Access	Very Useful	Somewhat Useful	Not Useful	Already Addressed
Road access issues & debris removal	***52.9%***	37.6%	5.9%	3.6%
Alternate route availability	***48.9%***	38.0%	9.5%	3.6%
Data & equipment protection	***52.7%***	32.3%	8.6%	6.4%
Retrieval of critical data from storage	***41.0%***	36.9%	16.7%	5.4%
Allocation of emergency response efforts	30.5%	***54.9%***	9.9%	4.7%

Source: Community Planning Workshop 2001

Utilities

Table 10-5 shows which utility-related mitigation activities survey respondents considered to be very useful and somewhat useful. Back-up power sources were considered the most potentially useful activity at 71%, followed by forming single points of contact to report utility failure (60%) and forming single points of contact for businesses regarding business preparedness activities (57%). Relatively small percentages had already addressed these types of mitigation activities.

Table 10-5. How important would utility mitigation activities be to your business?

Utilities	Very Useful	Somewhat Useful	Not Useful	Already Addressed
Make information "one phone call away" for businesses	***56.9%***	37.3%	3.6%	2.2%
Back-up power sources	***71.0%***	21.4%	3.1%	4.5%
Single point of contact for reporting utility failure	***60.4%***	32.4%	4.9%	2.2%
Alternate communications	***50.7%***	39.5%	6.7%	3.1%
Alternate shipping / transportation	25.7%	***44.5%***	27.5%	2.3%
Sewage plant protection	31.2%	***46.0%***	20.0%	2.8%
Central input progress reports	18.9%	***47.6%***	29.1%	4.4%

Source: Community Planning Workshop 2001

Businesses helping businesses

Businesses helping businesses refers to reaching out and forming partnerships before a disaster strikes and mutually increasing business resilience after a disaster. Table 10-6 shows that almost 45% of

respondents consider sharing resources in an emergency as potentially beneficial. About 25% of respondents concluded that mentoring programs would not be useful. Again, very small percentages, ranging between 0.5% and 2.3%, had already addressed such measures.

Table 10-6. How important would "businesses helping businesses" be for your business?

Businesses Helping Businesses	Very Useful	Somewhat Useful	Not Useful	Already Addressed
Resource sharing in an emergency situation	***44.6%***	41.4%	11.7%	2.3%
Work with "like" businesses on mitigation projects	35.7%	***40.7%***	21.7%	1.8%
Mentoring program between more & less prepared businesses	20.5%	***52.5%***	25.1%	1.8%
Mutual aid networks for emergency shelter & food	36.7%	***45.0%***	17.9%	0.5%
Large scale food vendors / facilities that could cooperate with smaller, related businesses	28.8%	***40.5%***	30.2%	0.5%

Source: Community Planning Workshop 2001

Training and public outreach

Table 10-7 indicates that a central point of contact for information dissemination was considered to be the most useful activity, at 53%. Alternate school and daycare sites, information from work about personal preparedness and an informational website were considered somewhat useful to survey respondents. A negligible percentage reported having conducted these mitigation activities. Communication with the Jackson County Emergency Management Office, however, rated the most commonly completed activity.

Table 10-7. How important would training & public outreach mitigation activities be for your business?

Training and Public Outreach	Very Useful	Somewhat Useful	Not Useful	Already Addressed
Develop a direct notification plan for vulnerable businesses	***44.2%***	42.9%	12.5%	0.4%
Develop a central contact office to quickly disseminate information	***52.7%***	36.6%	9.8%	0.9%
Communicate with Jackson County Emergency Management Office	41.8%	***45.8%***	9.8%	2.7%
Plan & publicize alternate commute routes	***44.8%***	43.9%	10.8%	0.4%
Alternate school / day care sites so employees can leave home for work	29.3%	***50.5%***	20.3%	0.0%
Help employees make plans to protect themselves & their home	37.8%	***51.4%***	10.8%	0.0%
Develop a website for business & community to report damages and recovery after a disaster	30.0%	***50.5%***	19.5%	0.0%

Source: Community Planning Workshop 2001

Mitigation incentives

Just over half the survey respondents, at 51%, would consider expediting the permit process to facilitate mitigation projects. Financial aid for structural retrofits (46%) and asset management as a part of disaster preparedness and recovery (54%) were considered somewhat useful, as shown in Table 10-8. These percentages actually translate into about 100 people willing to participate in some mitigation incentive program to promote disaster mitigation and preparedness.

Table 10-8. How important would mitigation incentives be for your business?

Mitigation Incentives	Very Useful	Somewhat Useful	Not Useful	Already Addressed
Loans & grants for structural retrofits & other disaster preparedness measures	40.1%	***46.1%***	13.4%	0.5%
Expedite permit process for mitigation projects	***51.4%***	38.0%	10.2%	0.5%
Information that emphasizes asset management as part of disaster preparedness & recovery	28.4%	***53.5%***	16.7%	1.4%

Source: Community Planning Workshop 2001

The survey also asked respondents to indicate their preferred format for receiving information about mitigation and preparedness activities. About 59% of respondents favored a fact sheet/brochure that could be distributed to interested business owners. A self-paced handbook came in at a close second at 54%, followed by the Internet at 36%, newspapers at (27%) and TV/radio at 20%.

CPW asked respondents to identify which preparedness activities are addressed by the business. Additionally, respondents identified activities that the business had already done, planned to do, or was unable to do. If the activity was not applicable, respondents were given the opportunity to say so.

Table 10-3 lists types of preparedness activities and the percentage of survey respondents who have engaged in such activities at their business. The bold and italicized percentages indicate the majority of responses for a given activity. Only the purchase of business interruption insurance was identified as having been done for the most survey respondents.

The majority of survey respondents indicated that the remaining ten disaster preparedness activities had not been done for their business. Since respondents were given the option to express whether they planned to conduct the activity, were unable to engage in the activity, or that the activity was not applicable to their business, then the conclusion is that survey respondents simply have not taken action in regard to specific business preparedness activities.

Table 10-3. Have you engaged in natural disaster preparedness activities at your business?

Preparedness Activities	Have Done	Plan to Do	Not Done	Unable to Do	Not Applicable
Attended meetings / received written information on preparedness	35.1%	6.7%	***52.4%***	0.0%	5.8%
Talked with employees about what to do in an emergency	43.8%	7.5%	***44.7%***	0.0%	4.0%
Developed an employee plan about disaster procedures	35.0%	14.8%	***47.5%***	0.0%	2.7%
Purchased flood insurance	17.1%	3.3%	***46.4%***	3.8%	29.4%
Purchased business interruption insurance	***39.1%***	2.9%	38.2%	1.9%	17.9%
Stored extra fuel / batteries & other emergency supplies	31.8%	7.3%	***51.4%***	2.3%	7.3%
Developed a business emergency response plan	36.0%	12.2%	***49.1%***	0.5%	2.3%
Developed a business emergency recovery plan	17.1%	13.5%	***63.5%***	0.5%	5.4%
Conducted employee disaster drills / exercises	30.0%	11.2%	***56.1%***	0.4%	2.2%
Made arrangements for alternate business sites in an natural disaster	9.5%	4.1%	***57.2%***	15.3%	14.0%
Obtained an emergency back-up generator for power	28.8%	6.3%	***55.4%***	4.5%	5.0%

Source: Community Planning Workshop 2001

Survey and Research Conclusions

The Jackson County Business Recovery Questionnaire yielded several interesting findings. A low overall percentage of surveyed businesses are actually engaged in mitigation and preparedness activities, though all the potential mitigation activities were rated as useful to very useful. Almost 30% of respondents had purchased flood insurance, followed by approximately 18% who had purchased business interruption insurance, and 14% of respondents who had secured alternate business sites.

Central points of contact for reporting problems and receiving information were listed as the most useful type of future mitigation activities. There also exists a need for increasing the public education and outreach related to hazard mitigation tools and techniques and response procedures for disaster events.

Preservation of community infrastructure and services is necessary for overall economic recovery. Mitigation and preparedness techniques should be a dual effort between the individual business owner for on-site needs and the community for off-site needs.

National research results spell out that there are some general determinants of post disaster recovery include: the size of the business,

whether the firm is an individual firm or part of a chain, age of the business and whether the business location is owned or leased. Additionally, individual economic trends figure more prominently than the disaster itself. In other words, if the business was not doing well for whatever reason before the disaster, then chances are it will not survive the disaster event.[12] However, this does not suggest a 'do nothing approach.' It supports working towards an understanding of the risks that communities and business face, and determining appropriate means to reduce the risk of natural hazards.

Recommendations

Overall, both nationally and in Jackson County, research to date suggests that businesses are not adequately prepared for disaster events.[13] Businesses rely on government and private sector services such as utilities, telecommunication, and infrastructure. Public/private sector partnerships are therefore essential in achieving business preparedness and implementing mitigation activities. This assessment lists several conclusions resulting from the Jackson County Business Recovery Questionnaire and from national research.

Questionnaire findings yield potential activities for reducing businesses' risk from natural hazards. These recommended activities can be undertaken on a personal level or community level. Businesses can choose to participate and decide how the activities will be accomplished. Community level activities are broader in scope and affect larger areas than individual business sites, and require greater cooperation than individual activities and projects.

Recommendation #1:

Conduct a business preparedness focus group/workshop within the County

It was evident in the survey that people wanted more information on natural hazards mitigation and business preparedness. How information is disseminated within a community, however, can impact the number of people who actually receive and understand the information. When respondents were asked how they would like to receive information about natural hazard mitigation, the indicated preferences for the following:

- 59% fact sheet or brochure
- 54% a handbook
- 36% Internet
- 27% newspaper
- 20% radio or TV
- 19% workshops
- 14% Chamber of Commerce

This recommendation is focused on ensuring that when business preparedness information is developed for Jackson County businesses, it is designed and disseminated in way that is useful and reaches a large percentage of Jackson County businesses.

Conducting a focus group with a cross-section of business representatives from Jackson County will provide an opportunity to gather information on the type of information needed, and how best to spread that information out to the community. Forty-nine of the survey respondents returned postcards indicating that they would be interested in participating in a workshop aimed at increasing Jackson County business resilience. These respondents could be targeted for the initial focus group/workshop that will lead to a more widespread outreach campaign.

Once outreach programs are developed, the County can present resources on basic mitigation and preparedness planning that deal with immediate life safety issues in the disaster's aftermath and contingencies that will help secure economic recovery. Disaster plans can take many forms and focus on many things, (i.e. evacuation, response, recovery). A *Capital District Business Review* article emphasizes the four C's: Circumvention (avoid it entirely); Continuity (What are you going to do to keep essential processes running?); Crisis management (As well as the business, what are you doing to respond to the crisis itself?); and Contingency planning (develop enough contingencies to minimize overall impact to the business).[14]

Two examples of self-paced publications and programs that are helpful include:

> ***Open for Business: A Disaster Planning Toolkit for the Small Business Owner***, compiled by the Institute for Business and Home Safety in partnership with the Small Business Administration. The booklet is designed to help the business owner identify and plan for potential hazards, continue operating after the disaster and give basic advise on equipment and supplies.
>
> ***Emergency Management Guide for Business and Industry: A Step-by-step Approach to Emergency Planning, Response and Recovery for Companies of All Sizes***, compiled by the Federal Emergency Management Agency, Publication #141 (1993) identifies steps business owners can engage in to increase business resilience.

Recommendation #2:

Send survey results to interested parties to stimulate thought and dialogue about emergency preparedness.

Use the database that resulted from the returned postcards to create a mailing list to mail out survey results. This list contains about 80 people. From this group, leaders may emerge who are committed to building a more disaster resilient economy.

Develop strategies to engage agencies, businesses, and community-based organizations in this dialogue include fostering partnerships and developing outreach programs to assist businesses engage in mitigation and preparedness activities. The initial list of survey respondents interested in receiving more information on business preparedness is just a start to the stakeholders who can engage in this process. Chamber of Commerce's, Small Business Development Center's, Economic Alliances, Business Associations, and other state, county, and community agencies and organizations should be included in future discussions on business preparedness.

The Jackson County Business Preparedness Survey provides information on both the severity of impact that natural hazards have on county businesses, as well as programs and informational needs desired by county business owners. This information can be used to design, implement, and target various business groups for technical assistance and education and outreach related to business preparedness.

Endnotes

[1] Protecting Business Operations: Second report on costs and benefits of natural hazard mitigation, FEMA REPORT 331, Federal Emergency Management Agency, Mitigation Directorate, Washington, DC August 1998,

[2] Tampa Bay Regional Planning Council, "Your Business Disaster Continuity Planning Guide", *Small Business Disaster Survival Kit* CD-ROM.

[3] James M. Dahlhamer and Melvin J. D'Souza, University of Delaware Disaster Research Center. "*Determinants of Business Preparedness*," International Journal of Mass Emergencies and Disaster 15 (1997) 267.

[4] Gary R. Webb, Kathleen J. Tierney, and James M. Dahlhamer, University of Delaware Disaster Research Center. "*Businesses and Disasters: Empirical Patterns and Unanswered Questions*," Natural Hazards Review 1 (2000) 83.

[5] James M. Dahlhamer and Melvin J. D'Souza, University of Delaware Disaster Research Center. "*Determinants of Business Preparedness*," International Journal of Mass Emergencies and Disaster 15 (1997) 267.

[6] Gary R. Webb, Kathleen J. Tierney, and James M. Dahlhamer, University of Delaware Disaster Research Center. "*Businesses and Disasters: Empirical Patterns and Unanswered Questions*," Natural Hazards Review 1 (2000) 85.

[7] James M. Dahlhamer and Melvin J. D'Souza, University of Delaware Disaster Research Center. "*Determinants of Business Preparedness*," International Journal of Mass Emergencies and Disaster 15 (1997) 267.

[8] Ibid.

[9] Oregon Employment Department, *1999 Covered Employment and Payroll.* http://www.olmis.org.

[10] Community Planning Workshop/Oregon Natural Hazards Workgroup, 2001 *Jackson County Business Preparedness Survey.*

[11] Kathleen J. Tierney and Joanne M. Nigg. University of Delaware Disaster Research Center. *Business Vulnerability to Disaster-Related Lifeline Disruption*. From the Proceedings of the Fourth U.S. Conference on Lifeline Earthquake Engineering. New York: Technical Council on Lifeline Earthquake Engineering, American Society of Civil Engineering. (1995) 72-79.

[12] Daniel J. Alesch, James N. Holly, Elliott Mittler and Robert Nagy. *When Small Businesses and Not-For-Profit Organizations Collide with Natural Disasters*. Preliminary Research in cooperation with the Public Entity Risk Institute, Fairfax, Virginia. (2000).

[13] Gary R. Webb, Kathleen J. Tierney, and James M. Dahlhamer, University of Delaware Disaster Research Center. "*Businesses and Disasters: Empirical Patterns and Unanswered Questions*," Natural Hazards Review 1 (2000) 85.

[14] Dan Napolitano and Richard Pearl. *Having Business Impact Plan can aid in Disaster Recovery*. Capital District Business Review. (1999). http://albany.bcentral.com/albany/stories/1999/05/24/focus5.html.

Appendix A:
Public Participation Process

The Two Phases of Public Participation

Public participation is vital to the value, effectiveness, and usefulness of any plan. This plan was developed through two distinct phases of public participation and involvement, the first from 2001 – 2003 and the second from 2004 – 2005. The first phase was dedicated to gathering input and ideas from various members of the public. This input was incorporated into the plan in a variety of ways, as described below. The second phase of public involvement was characterized by the refinement and elaboration of the plan and efforts to bring the final draft to the public for their review and additional input. A description of this second phase ends this Appendix.

The first phase of public involvement was distinguished by the work of the Community Planning Workshop. To produce a plan that fit the needs of Jackson County agencies, businesses, and residents, Community Planning Workshop (CPW) engaged the public in three primary ways. A steering committee comprised of individuals representing different parts of the community guided the CPW team through the steps involved in producing the plan. CPW conducted stakeholder interviews to target the specialized knowledge of individuals working in the natural hazard field. Finally, CPW held two public workshops to inform the public about natural hazards that occur in Jackson County and to identify potential hazard mitigation strategies.

Steering Committee

The steering committee was CPW's initial contact with community leaders, and the guiding force behind the Mitigation Plan. The knowledge and background information provided by this committee laid a foundation, and structure for the project. The steering committee assisted CPW with major decisions including goal setting and identifying pertinent action items.

Methodology

Steering committee members possessed familiarity with the Jackson County community and how it's affected by natural hazard events. The steering committee guided the plan through several steps including goal formation, action item development, stakeholder identification, and information sharing to make the plan as comprehensive as possible. CPW met with the steering committee on the following dates:

- February 8, 2001

- April 4, 2001
- April 26, 2001
- May 30, 2001
- June 12, 2001

The steering committee formed under the guidance of Sandy Eccker, Jackson County Emergency Management Coordinator, in conjunction with inputs from CPW team manager, Dara Decker and Oregon Natural Hazards Workshop Director, Andre LeDuc. The steering committee invested considerable time into the mitigation plan. Members of the steering committee include:

Name	Organization
Eric Dittmer	Southern Oregon University
Sandy Eccker	Jackson County Emergency Management
Terry Haines	American Red Cross
Mike Mathews	Applegate River Watershed Council
Mike Mattson	Jackson County Planning
Dale Petrasek	Jackson County Engineering
Gordon Safley	Southern Oregon Regional Economic Development, Inc.
Margaret Wilson	Jackson County Planning

Stakeholder Interviews

The second avenue of public participation was a series of stakeholder interviews. The interviews offered alternative ways for Jackson County citizens to participate in the plan's development. Individuals who have a specialized knowledge of particular natural hazard issues in Jackson County were telephoned and interviewed by CPW. These individuals provided insight into the kinds of natural hazard events that occur in Jackson County, what factors make a given hazard particularly damaging, which mitigation activities are in place, which ones have worked in the past, and what future actions might work well to diminish the impacts of natural hazards.

Methodology

The stakeholder interviews were conducted from February through May 2001. CPW telephoned the stakeholders individually and asked a series of standard questions. The questions are as follows:

1. What is the history of natural hazard events in Jackson County (or in your community)?
2. What types of natural hazards currently affect Jackson County (or your community)?
3. How is growth and development in Jackson County (or in your community) attributing to natural hazard events?
4. Does your organization currently work in natural hazard mitigation?

5. If yes, how?
6. How can your organization contribute to regional coordination to reduce risk from natural hazards?
7. What activities will assist Jackson County in reducing risk and preventing loss from future natural hazard events? (If you had the money, how would you spend it?)
8. What are the ways you would like to see agencies, organizations or individuals in Jackson County participating and coordinating to reduce risk from natural hazards?
9. Can you think of other people or organizations we should contact?

The information yielded from these interviews was compiled into various sections of the plan, particularly each of the hazard specific sections. Paper copies of the interview outcomes were compiled into a standard form and are available by contacting:

Jackson County Emergency Management Coordinator
10 South Oakdale, Room 214
Medford, OR 97501
PHONE: (541) 774-6821
FAX: (541) 774-6455

Note: The information recorded in the stakeholder interviews has been recorded and transcribed by Community Planning Workshop as accurately as possible. Community Planning Workshop makes no representations, express or implied, as to the accuracy of the information. This information is provided with the understanding that it is not guaranteed to be correct or complete and conclusions drawn from such information are the responsibility of the reader.

First Name	Last Name	Agency/Affiliation
Lu	Anthony	Little Butte Watershed Council
Paula	Brown	Ashland Public Works
Dick	Converse	Rogue Valley Council of Governments
Sandy	Eccker	Jackson Co. Emergency Management Coordinator
Tom	Ferraro	Ferraro Geologic (consulting)
Bill	Harrington	Chief Forester, Pacific Power and Light
MJ	Harvie	United States Forest Service
David	Hussell	Eagle Point City Administrator
Randy	Iverson	Fire District #3
Phil	Kessler	Chief Administrator, Medford Fire Department
Bill	Ludwig	National Weather Service
Betty	McRoberts	Jackson County Housing Authority
Ralph	Nelson	Law Enforcement, Ret.

Dale	Petrasek	Jackson County Engineer
Chris	Reising	Medford Building Official
Nancy	Rose	USFS
Gordon	Safley	Southern Oregon Regional Economic Development Inc.
Claudia	Steinbroner	Pacific Power and Light
John	Viles	ODOT Region Manager
Ron	Wilson	White City Community Improvement Association
Jim	Wolfe	ODF District Office, Jackson County
Keith	Woodley	Chief, Ashland Fire and Rescue

Public Workshops

The third method of public participation was a series of public workshops. The general public was invited to participate by addressing concerns relating to natural hazards, discussing ideas for mitigation strategies and establishing community priorities for plan goals. With involvement from the general public, the plan has greater community support and is best tailored to fit the needs of Jackson County residents.

Methodology

Two public workshops were held on the following dates:

- April 26, 2001
- June 12, 2001

The workshops were advertised through several means. Print ads were sent to local newspapers. Two local radio spots were aired on local stations. Flyers were posted in areas of town with heavy pedestrian traffic. Flyers were also sent to civic organizations, government agencies and other interested groups. Personal invitations were sent to stakeholders.

Workshop #1

The first workshop focused on common concerns relating to natural hazards, and on mitigation ideas and possible action items. Twelve participants attended. CPW facilitated a small group process during which the group voiced common mitigation concerns. Workshop outcomes are as follows:

Summary of Public Workshop Outcomes – April 26, 2001

Jackson County Natural Hazard Mitigation Action Plan

Property Protection

1. Identify a method of disposal or utilization of fire fuels removed from individual properties.

Partnership and Coordination

1. Work proactively with county development services to make land use regulations stronger.
2. Work with the volunteer community to increase the volunteer pool and identify which volunteer groups will respond to certain hazard events:
    i. Identify scenarios of need so that volunteer groups can target their efforts (i.e. food storage/distribution, removing seniors from hazardous locations, immediate response)
    ii. Identify different thresholds of activation so that volunteer efforts aren't duplicated
    iii. Identify ways to utilize brand new volunteers during a hazard event
    iv. Institutionalize volunteer coordination (i.e. a professional coordinator for volunteer programs, activities, grant opportunities, etc.)

Education and Outreach

1. Mandatory regulations aren't working. Increase education and focus volunteer efforts toward particular mitigation activities – *Keep the message positive (i.e. You're the best organization for this job because…)*.
2. Make known countywide the grant opportunities available to non-profits, like watershed councils for instance.
3. Promote local community plans that balance ecological and human needs.
4. Promote public education about the financial aspects of building (and rebuilding) in floodplains, and present information on how other communities have addressed building in the floodplains.
5. Work with the Fire Districts to flag properties that could not be saved if a wildfire event occurred.
6. Promote the pathways of communication before, during and after a natural hazard event.
7. Promote the CERT program to the business community.
8. Gather information about lessons learned from other cities, counties and regions affected by natural hazard events.
9. Promote education programs in schools that focus on first aid and individual preparedness (partner with SOLV).
10. Promote the importance of being prepared for at least 72 hours on an individual level.
11. Develop a curriculum for elementary aged students (perhaps based off CIM/CAM) about natural hazards and mitigation planning (partner with SOU).

Preventative

1. Need for immediate mitigation remedies following an event, like planting vegetation right after a landslide.
2. Do the things we know we should do:
    a. Review building activity in flood-prone areas
    b. Review regulations and codes for effectiveness

c. Provide economic incentives to engage individual property owners in mitigation activities

3. Work with the fire districts to strengthen regulations regarding fuel reduction around individual properties.

Natural Resource Protection

1. Coordinate with landowners on a watershed basis to assist with grant writing opportunities.
2. Invest in watershed councils.

Emergency Services

1. Develop a plan for large-scale power failure including response procedures and a communication plan.
2. Develop a plan for the phone system.
3. Identify alternative communication modes during natural hazard events (i.e. amateur radio).
4. Inventory emergency systems to determine how long they will last.
5. Critical medical facilities are on one side of the Rogue River while Medford lies on both sides. Concern is that the population could become cut off of medical services if a severe natural hazard event (like a flood or earthquake) struck.
6. Promote a clearinghouse of information for families after a natural disaster strikes.
7. Promote first aid training for businesses and other organizations.

Workshop #2

The second workshop focused on plan goals. Participants in the workshop went through a goal selection process to "prioritize" the goals, as recommended by FEMA. Three "dots", sticky colored labels, were passed out to the participants. Each dot had a value, blue ones with a value of three, red ones with a value of two, and yellow ones with a value of one. The dots were placed on a board with a list of the goals, organized under goal areas, to determine the public priorities. A discussion of the choices was held afterward. A summary of workshop outcomes follows:

Summary of Public Workshop Outcomes – June 12, 2001

Jackson County Natural Hazard Mitigation Action Plan

What influenced your goal choices?

Property Protection

1. Spread property protection information via the neighborhood watch.

Education and Outreach

1. It is good to get information into the hands of the people.
2. Public education is important because government/volunteer organizations cannot protect the public as well as they can protect themselves.
3. It is important to provide public information about current mitigation efforts.

4. Looking for things that require ongoing maintenance provides the opportunity for the public to become knowledgeable about how hazards affect them.

Prevention

1. County and City planning departments have resources to apply to prevention activities.

Partnership and Coordination

1. From the planning perspective, only through partnership and coordination of public and private sector participation in mitigation activities will something workable result.
2. The more public and private coordination and partnership, the better off Jackson County will be.
3. Mitigation through the government has a hard time succeeding without partnerships.
4. Evaluate the coordination of paid and volunteer duties related to hazard events; coordination of volunteers is key.

Natural Resource Protection

1. Preserving and rehabilitating natural systems is undervalued in Jackson County and often neglected, but in the long term it helps mitigate hazard events the most.

Emergency Services

1. There MUST be emergency response plans.
2. Evaluating the performance of critical facilities **during** a natural hazard event should actually occur **before** or **after** natural hazard events.
3. The public often turns to volunteers during a hazard event for communications back-up and information transfer, which support the police and emergency services.
4. It is important to have “back-up” when communications/utilities go down.
5. Streamline communication given at critical facilities during emergency events.
6. Volunteer service is key during natural hazard events and more volunteers are needed. Professionals are most capable to handle intense/large-scale emergencies and volunteers can really support them.
7. The coordination of emergency volunteers and emergency response plans would be very helpful.

What are your ideas for outreach?

1. Provide information about flood hazards and mitigation opportunities to residents in the floodplain.
2. Have earthquake retrofit information, flood information, and information about communication breakdowns available at the planning office.
3. Create “how to” guides for people; send with other annual/semi-annual mailings (such as taxes or other regular mailings from the private sector) to save on costs.
4. Pool resources and coordinate efforts to send out more glossy publications like the Jackson County Preparedness Plan for Families.
5. Use emergency management/response groups to speak to other existing groups about natural hazard events.
6. Keep volunteer response teams “active” by conducting/including them in drills.
7. In the coordination of volunteers, have them help get mitigation messages out.

8. Try to find what motivates people and use those motivations as a vehicle for outreach messages.
9. Use “personal” recommendations/messages – not only the government (neighbor to neighbor, which allows questions to be more freely asked).
10. Use existing networks, such as Boy/Girl Scouts, Neighborhood Watch, Rotary, etc.
11. Amateur Radio Field Day is a chance for the public to witness emergency communications. It is also an opportunity to hand out emergency preparedness/mitigation information and receives media coverage.
12. Promote “72-hour kits” during the holiday season.

Phase Two of the Public Involvement Process

Given the length of time which elapsed from the start of plan development in 2001 to the development of a final draft in 2005, it was necessary to undertake a second phase of public involvement. The purpose was to share the revised and refined draft and to ensure that the plan continued to meet local government expectations and needs, as well as those of local citizens.

Getting the final draft out to the general public was of prime importance. This goal was achieved by putting the plan on Jackson County’s website and achieving immediate availability for thousands of people.

With the plan on the website, the Emergency Program Coordinator was able to attend a variety of regional community meetings, make a presentation on the plan and refer participants to the website. He did so, as detailed in Plan Section 1: Mitigation Plan Introduction. The Coordinator spoke about the plan at every significant regional professional meeting of emergency responders, including fire, police, medical and coordinating county departments.

While interest in and appreciation for the plan was often expressed and questions posed, the Emergency Program Coordinator did not receive input leading to any specific changes in the document. In general, people were pleased that the plan had been developed and curious about the mitigation activities to be undertaken.

The discussion with the newly forming Community Organizations Active in a Disaster (COAD) was particularly useful for disseminating information to interested members of the public. Participants in this group have responded to disasters in the region and are working to develop a strong community response to disaster that complements government’s response.

In October 2005, two Jackson County Commissioners and the Emergency Program Manager were guests on the local government television program “Jackson County Live”. They spoke about disaster preparedness and the NHMP during the show, which had a live call-in feature. This particular program was rebroadcast more than 20 times on two local stations, providing broad public exposure to the plan.

In November 2005, the Emergency Program Manager was the featured speaker at a luncheon meeting of the League of Women Voters, where he discussed the NHMP

Appendix B:
Resource Directory

The following matrix provides information on county, state, and federal mitigation resources and programs. The resource directory is organized in five sections:

- County Resources and Programs
- State Resources and Programs
- Federal Resources and Programs
- Business Resources and Programs
- Additional Organizations

County and Regional Resources and Programs				
Program	**Hazard**	**Agency**	**Contact Information**	**Type of Assistance**
Geological Research	Volcano, Earthquake	Southern Oregon University	Southern Oregon University Geology Department, 1250 Siskiyou Blvd, Ashland, OR 97520, (541) 552-6477, www.sou.edu/Geology/index.htm	The Geology Department at Southern Oregon University researches the geological diversity of the southern Oregon region. Faculty and students study a variety of geological features, including volcanoes. The Southern Oregon University Geology Department is
Business Asssistance	Multi-hazard	Southern Oregon Regional Economic Development, Inc (SOREDI)	SOREDI, Inc. 332 West 6th Street, Medford, OR 97501-2711 (541) 773-8946, www.soredi.org/	Business assistance and industrial development services for Southern Oregon are provided by SOREDI. SOREDI is a private non-profit organization coordinating Economic Development programs for Jackson and Josephine Counties. SOREDI represents more than 100
Emergency Assistance	Multi-hazard	American Red Cross, Rogue Valley Chapter	Executive Director, 60 Hawthorne Street, Medford, OR 97504, (541) 779-3773, redcross@jeffnet.org http://www.redcross.jffnet.org	Services provided by the American Red Cross include emergency assistance, disaster relief, and health and safety courses.
Disaster Management	Multi-hazard	Jackson County Office of Emergency Management	Jackson County Emergency Program Manager, 10 South Oakdale, Medford, Oregon 97501 (541) 774-6821 (541) 774-6455	Jackson County Emergency Management helps the community be better prepared for major emergencies and disasters. They work closely with cities, emergency responders, and volunteer agencies to find ways to reduce risks and minimize damages during hazard eve
Weather Forecasts and Warnings	Winterstorm/ Windstorm, Flood	National Weather Service, Medford Office	National Weather Service, 4003 Cirrus Drive, Medford, OR 97504, (541) 773-1067, www.wrh.noaa.gov/Medford/index.html	The National Weather Service Office in Medford provides timely weather warnings and forecasts for southern Oregon and northern California.

State Resources and Programs				
Program	**Hazard**	**Agency**	**Contact Information**	**Type of Assistance**
Landslide/Debris Flow Warnings and Fire Protection	Landslide and Wildfire	Oregon Department of Forestry (ODF)	801 Gales Creek Road, Forest Grove, Oregon 97116 (503) 359-7448, www.odf.state.or.us or 2600 State Street, Salem, Oregon 97310, (503) 945-7446, http://www.odf.state.or.us/FIREPROT.HTM	The mission of the Oregon Department of Forestry is to serve the people of Oregon through the protection, management, and promotion of a healthy forest environment, which will enhance Oregon's livability and economy for today and tomorrow.
Emergency Management and Mitigation Programs	Multi-hazard	Oregon State Police (OSP)-Office of Emergency Management (OEM)	Office of Emergency Management, 595 Cottage Street NE, Salem, OR 97310, (503) 378-2911, http://www.osp.state.or.us/oem/	The purpose of OEM is to execute the Governor's responsibilities to maintain an emergency services system as prescribed in Oregon Revised Statutes Chapter 401 by planning, preparing and providing for the prevention, mitigation and management of emergencie
State Land Use Planning Program	Multi-hazard	Department of Land Conservation and Development (DLCD)	DLCD, 635 Capitol St. NE, Suite 200, Salem, OR 97301-2540, (503) 373-0050, http://www.lcd.state.or.us/hazards.html	DLCD administers the State's Land Use Planning Program. DLCD serves as Oregon's federally designated agency to coordinate floodplain management in Oregon. They also conduct various landslide related mitigation activities.
Hazard Related Publications	Multi-hazard	Nature of the Northwest Information Center (NNIC)	NNIC, 800 NE Oregon Street #5, Suite 177, Portland, Oregon 97232, (503) 872- 2750, www.naturenw.org, Nature.of.Northwest@state.or.us	The Nature of the Northwest Information Center is operated jointly by DOGAMI and the USDA Forest Service. It offers a selection of maps and publications from state, federal and private agencies.

State Resources and Programs				
Program	**Hazard**	**Agency**	**Contact Information**	**Type of Assistance**
Climate Information	Multi-hazard	Oregon Climate Service (OCS)	OCS, Oregon State University, Strand Ag Hall Room 316, Corvallis, OR 97331 (541) 737-5705, www.ocs.orst.edu, email: oregon@oce.orst.edu	The Oregon Climate Service collects, manages and maintains Oregon weather and climate data. OCS provides weather and climate information to those within and outside the state of Oregon and educates the citizens of Oregon on current and emerging climate issues. OCS also performs independent research related to weather and climate issues.
Building Codes	Multi-hazard	Oregon Department of Consumer and Business Services	1535 Edgewater St. NW, P.O. Box 14470, Salem, OR 97309 Phone:(503) 373-4133, www.cbs.state.or.us/external/bcd	The Building Codes Division of Oregon's Department of Consumer and Business Services is responsible for administering statewide building codes. Its responsibilities include adoption of statewide construction standards that help create disaster-resistant buildings, particularly for flood, wildfire, wind, foundation stability, and seismic hazards. Information about wildfire related building codes is found through this department.
Water Resources	Multi-hazard	Oregon Division of State Lands (DSL)	DSL, 775 Summer Street NE, Suite 100, Salem, OR 97301, (503) 378-3805, http://statelands.dsl.state.or.us/	DSL is a regulatory agency, responsible for administration of Oregon's Removal-Fill Law. This law is intended to protect, conserve and allow the best use of the state's water resources. It generally requires a permit from DSL to remove, fill or alter more than 50 cubic yards of material within the bed or banks of waters of the state. Exceptions are in State Scenic Waterways and areas designated essential salmon habitat, where a permit is required for all instream activity, regardless of size. These permits may be issued jointly by DSL and the U.S. Army Corps of Engineers.
Economic Development	Multi-hazard	Oregon Economic and Community Development Department (OECDD)	775 Summer Street, Suite 200, Salem, OR 97301-1280, 1-800-233-3306, www.econ.state.or.us/	Oregon's Economic and Community Development Department can assist business owners in numerous ways. The department collects economic data throughout the state by region and has specific activities geared toward business owner/operators; particularly the Governor's Small Business Council.
Fire Protection and Prevention	Wildfire	Office of the State Fire Marshal (OSFM)	OSFM, 4760 Portland Road NE, Salem, Oregon 97305-1760, (503) 378-3473	The Prevention Unit of Oregon's Office of the State Fire Marshal contains 19 Deputy State Fire Marshals located in various regions. The responsibilities of these Deputies include public education for local fire districts and inspection of businesses, public assemblies, schools, daycare centers, and adult foster homes.

Federal Resources and Programs				
Program	**Hazard**	**Agency**	**Contact Information**	**Type of Assistance**
National Earthquake Hazards Reduction Program	Earthquake	FEMA, Department of Interior (DOI) - US Geological Survey (USGS), Office of Emergency Management (OEM)	Oregon Earthquake Program Coordinator (503) 378-2911 xt. 237	Training, planning and technical assistance under grants to States or local jurisdictions. Technical and planning assistance for activities associated with hazards mitigation.
National Earthquake Hazards Reduction Program	Earthquake	DOI-USGS, OEM	Oregon Earthquake Program Coordinator (503) 378-2911 xt. 22+D4237	Seismic mapping for US
Water Resources	Flood	US Army Corps of Engineers (USACE)	USACE-Portland District, Floodplain Information Branch, P.O. Box 2946, Portland, OR 97208-2946, (503) 808-4874, Fax: (503) 808-4875, http://www.nwp.usace.army.mil	USACE administers a permit program to ensure that the nation's waters are used in the public interest. In Oregon, joint permits may be issued with the Division of State Lands. The Corps is responsible for the protection and development of the nation's wat
Floodplain Management services	Flood	Department of Defense (DOD)-USACE	Northwestern Regional Office: (503) 808-3853	Technical and planning assistance at the local and regional or national level needed to support effective floodplains management
Aquatic ecosystem restoration	Flood	DOD-USACE	Chief of Planning, Northwestern Division (503) 808-3850	Direct support for carrying out aquatic ecosystem restoration projects that will improve the quality of the environment.
Beneficial uses of dredged materials	Flood	DOD-USACE	Chief of Planning, Northwestern Division (503) 808-3851	Direct assistance for projects that protect, restore, and create aquatic and ecologically-related habitats, including wetlands, in connection with dredging an authorized Federal navigation project.
Damaged Flood Control Works	Flood	DOD-USACE	Northwestern Regional Office: (503) 808-3853	Direct planning and construction grants for non-structural alternatives to the structural rehabilitation of flood control works damaged in floods.

Federal Resources and Programs				
Program	**Hazard**	**Agency**	**Contact Information**	**Type of Assistance**
Project modifications for improvement of the environment	Flood	DOD-USACE	Northwestern Regional Office: (503) 808-3853	Provides for ecosystem respiration by modifying structures and/or operations or water resources projects constructed by the USACE, or restoring areas where a USACE project contributed to the degradation of the area.
Stream gauging and flood monitoring network	Flood	Department of Energy (DOE)-USGS	USGS, Chief, Office of Surface Water, (703) 648-5303	Operation of a network of over 7,000 stream gauging stations that provide data on the flood characteristics of rivers.
Partners for Fish and Wildlife	Flood	DOI-Fish and Wildlife Service (FWS)	National Coordinator, Ecological Services: (703) 358-2201	Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.
North American Wetland Conservation Fund	Flood	DOI-FWS	North American Waterfowl and Wetlands Office (703) 358-1784	Cost-share grants to stimulate public/private partnerships for the protection, restoration and management of wetland habitats.
Mapping standards support	Flood	DOI-USGS	USGS - National Mapping Division (573) 308-3802	Expertise in mapping and digital data standards to support the National Flood Insurance Program.
NFIP: Technical Mapping Advisory Council	Flood	DOI-USGS	National Mapping Division (573) 308-3802	Technical guidance and advice to coordinate FEMA's map modernization efforts for the National Flood Insurance Program (NFIP).
Wetlands protection - development grants	Flood	Environmental Protection Agency (EPA)	EPA Wetlands Hotline: (800) 832-7828 or EPA Headquarters, Office of Water, Chief, Wetlands Strategies and State Programs (202) 260-6045	Grants to support the development and enhancement of State and tribal wetlands protection programs

Federal Resources and Programs				
Program	**Hazard**	**Agency**	**Contact Information**	**Type of Assistance**
Clean Water Act	Flood	EPA	EPA, Office of Water, Chief, Non-Point Source Control Branch (202) 260-7088, 7100	Grants to States to implementation-point source programs, including support for non-structural watershed resource restoration activities.
NFIP	Flood	FEMA	Region X 130 228th Street, Southwest Bothell, WA 98021 www.fema.gov	Formula grants to States to assist communities to comply with NFIP floodplain management requirements (Community Assistance Program). Makes available flood insurance to residents of communities that adopt and enforce minimum floodplain management requirem
Flood Hazard Mapping	Flood	FEMA - Cooperative Technical Partners	http://www.fema.gov/fima	Tthe CTP initiative fosters partnerships with communities, states, and/or regional agencies to fully integrate them into FEMA's flood hazard mapping process. FEMA will maintain its national standards for NFIP mapping while building on local, state, and re
NFIP: Flood Mapping	Flood	FEMA	Region X 130 228th Street, Southwest Bothell, WA 98021 www.fema.gov	Flood Insurance Rate Maps and floodplain management maps for all NFIP communities.
Flood Mitigation Assistance	Flood	FEMA	Region X 130 228th Street, Southwest Bothell, WA 98021 www.fema.gov	Grants to States and communities for pre-disaster mitigation to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program.
Watershed Protection and Flood Prevention Program	Flood	USDA-Natural Resource Conservation Service (NRCS)	Watersheds and Wetlands Division (202) 720-3042 or (202) 690-4614 www.nrcs.usda.gov	Technical and financial assistance for installing works of improvement to protect, develop and utilize land or water resources in small watersheds under 250,000 acres
Watershed Surveys and Planning	Flood	USDA-NRCS	Watersheds and Wetlands Division (202) 720-4527 www.nrcs.usda.gov	Surveys and planning studies for appraising water and related resources, and formulating alternative plans for conservation use and development. Grants and advisory/counseling services to assist with planning and implementation improvement.
Wetlands Reserve Program	Flood	USDA-NRCS	National Policy Coordinator NRCS Watersheds and Wetlands Division: (202) 720-3042	Financial and technical assistance to protect and restore wetlands through easements and restoration agreements.

Federal Resources and Programs				
Program	**Hazard**	**Agency**	**Contact Information**	**Type of Assistance**
National Dam Safety Program	Flood, Earthquake	FEMA	Region X 130 228th Street, Southwest Bothell, WA 98021	Technical assistance, training and grants to help improve State dam safety and programs.
Environmental Stewardship	Multi-hazard	National Oceanic and Atmospheric Administration (NOAA)	NOAA, 14th Street & Constitution Avenue, NW, Room 6013, Washington, DC 20230, (202) 482-6090, http://www.noaa.gov/, answers@noaa.gov	NOAA's historical role has been to predict environmental changes, protect life and property, provide decision makers with reliable scientific information, and foster global environmental stewardship.
Climate Information	Multi-hazard	The National Weather Service (NWS)	NWS, 5241 NE 122nd Ave, Portland, Oregon 97230, (503) 326-2340, http://nimbo.wrh.noaa.gov/Portland	NWS provides weather, hydrologic, and climate forecasts and warnings for the US, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national i
Disaster Mitigation Planning	Multi-hazard	Department of Commerce, Economic Development Administration	EDA Disaster Recovery Coordinator (800) 345-1222, www.eda.gov	Technical and planning assistance grants for capacity building and mitigation project activities focusing on creating disaster resistant jobs and workplaces
Post-Disaster Economic Recovery	Multi-hazard	DOC-EDA	EDA Headquarters Disaster Recovery Coordinator (202) 482-6225	Grant funding to assist with the long-term economic recovery of communities, industries, and firms adversely impacted by disasters.
Planning Assistance to States	Multi-hazard	DOD-USACE	Northwestern Regional Office: (503) 808-3853	Technical and planning assistance for the preparation of comprehensive plans for the development, utilitization and conservation of water and related land resources
Indian Housing Assistance (Housing Improvement Program)	Multi-hazard	DOI-Bureau of Indian Affairs (BIA)	Division of Housing Assistance Office of Tribal Services (202) 208-5427	Project grants and technical assistance to substantially eliminate sub-standard Indian Housing

Federal Resources and Programs				
Program	**Hazard**	**Agency**	**Contact Information**	**Type of Assistance**
Land Acquisition	Multi-hazard	DOI-FWS	Division of Realty, National Coordinator (703) 358-1713	Acquires or purchases easements on high-quality lands and waters for inclusion into the National Wildlife Refuge System
Federal Land Transfer/Federal Land to Parks Program	Multi-hazard	DOI-National Parks Service (NPS)	Federal Lands to Parks Leader, National Parks Office (202) 565-1184	Identifies, assesses, and transfers available Federal real property for acquisition for state and local parks and recreation, such as open space.
National Digital Orthophoto Program	Multi-hazard	DOI-USGS	National Mapping Division (573) 308-3802	Develops topographic quadrangles for use in mapping of flood and other hazards
Center for Integration of Natural Disaster Information	Multi-hazard	DOI-USGS	The Center for Integration of Natural Hazards Research: (703) 648-6059 hazinfo@usga.gov	Develops and evaluates technology for information integration and dissemination
Emergency Management/ Mitigation Training	Multi-hazard	FEMA	Region X 130 228th Street, Southwest Bothell, WA 98021 www.fema.gov	Training in disaster mitigation, preparedness, planning
Hazard Mitigation Grant Program	Multi-hazard	FEMA	Region X 130 228th Street, Southwest Bothell, WA 98021 www.fema.gov	Grants to states and communities for implementing long-term hazard mitigation measures following a major disaster declaration.
Public Assistance Program	Multi-hazard	FEMA	Region X 130 228th Street, Southwest Bothell, WA 98021 www.fema.gov	Grants to states and communities to repair damaged infrastructure and public facilities, and help restore government or government-related services. Mitigation funding is available for work related to damaged components of the eligible building or structu
Disaster Recovery Initiative	Multi-hazard	Department of Housing and Urban Development (HUD)	Community Planning and Development, Grant Programs, Office of Affordable Housing (800) 998-9999	Grants to fund gaps in available recovery assistance after disasters (including mitigation).

Federal Resources and Programs				
Program	**Hazard**	**Agency**	**Contact Information**	**Type of Assistance**
Public Housing Modernization Reserve for Disasters and Emergencies	Multi-hazard	HUD	Director, Office of Capital Improvements: (202) 708-1640	Funding to public housing agencies for modernization needs resulting from natural disasters (including elevation, floodproofing, and retrofit.)
HOME Investments Partnerships Program	Multi-hazard	HUD	Community Planning and Development, Grant Programs, Office of Affordable Housing (800) 998-9999	Grants to States, local government and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons.
Community Development Block Grant	Multi-hazard	HUD, Oregon Economic Community Development Department (OECDD)	State or Small Cities Division, Office of Block Grant Assistance, HUD Headquarters (202) 708-3587 or OECCD	Grants to entitled cities and urban counties (e.g. housing, a suitable living environment, expanded economic opportunities) in non-entitled areas, for low-income and moderate-income persons.
Conservation	Multi-hazard	US Department of Agriculture (USDA) - Farm Service Agency (FSA)	Farm Loan Programs (202) 720-3467	Transfers title of certain inventory farm properties owned by FSA to federal and state agencies for conservation purposes (including the restoration of wetlands and floodplain areas to reduce future flood potential.)
Small Business Development	Multi-hazard	Small Business Administration (SBA)	Portland, OR District Office, 1515 SW 5th Avenue, Suite 1050, Portland, OR 97201-5494. (503) 326-2682.	The Small Business Administration is broken down into districts. The Portland District assists business in the state of Oregon and includes information for new business owners and for those suffering in disaster situations.
Environmental Quality Incentives Program	Multi-hazard	USDA-NRCS	NRCS County Offices (202) 720-1834	Technical, educational, and limited financial assistance to encourage environmental enhancement
Soil survey/Erosion Control	Multi-hazard	USDA-NRCS	NRCS-Deputy Chief for Soil Science and Resource Assessment (202) 720-4630	Maintains soil surveys of counties or other areas to assist with farming, conservation, mitigation or related purposes.
Emergency Watershed Protection	Multi-hazard	USDA-NRCS	National Office (202) 690-0848	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 hazards.

Federal Resources and Programs				
Program	**Hazard**	**Agency**	**Contact Information**	**Type of Assistance**
Land Protection	Multi-hazard	USDA-NRCS	National Office (202) 720-4527	Technical Assistance for run-off retardation and soil erosion prevention to reduce hazards to life and property
Rural Development Assistance	Multi-hazard	USDA-Rural Housing service	Community Programs (202) 720-1502	Grants, loans, and technical assistance in addressing rehabilitation , health and safety needs in primarily low-income rural areas.
Rural Development Assistance	Multi-hazard	USDA-Rural utilities service	Program Support (202) 720-1382	Direct and guaranteed rural economic loans and business enterprise grants to address utility issues and development needs.
Natural Hazards Mitigation and Research	Multi-hazard	U.S. Geological Survey (USGS)	10615 S.E. Cherry Blossom Dr., Portland, OR 97216, (503) 251-3200, dc_or@usgs.gov, http://www.usgs.gov	The USGS conducts various researches on the conditions, issues, and problems of the natural resources in the nation. This information is useful for natural hazards mitigation and planning and is provided by USGS through its publications, maps, brochures a
Volcano Hazards	Volcano	DOI-USGS	Volcano Program: (703) 648-6708	Volcano hazard warnings and operation of four volcano observatories to monitor and assess volcano hazard risk
Wildfire Mitigation	Wildfire	United States Fire Administration (USFA)	Mitigation Directorate, 16825 S. Seton Ave., Emmitsburg, MD 21727, www.usfa.fema.gov	As an entity of the Federal Emergency Management Agency, the mission of the USFA is to reduce life and economic losses due to fire and related emergencies through leadership, advocacy, coordination, and support.
National Wildland/ Urban Interface Fire Protection	Wildfire	National Fire Protection Association (NFPA)	Public Fire Protection Division, 1 Battery March Park, P.O. Box 9101, Quincy, MA 02269-9101, (617) 770-3000	This is the principal federal agency involved in the National Wildland/Urban Interface Fire Protection Initiative. NFPA has information on the Initiative's programs and documents. Other members of the initiative include: the National Association of Stat

Business Resources and Programs				
Program	**Hazard**	**Agency**	**Contact Information**	**Type of Assistance**
Business Education and Resources	Multi-hazard	Institute for Business & Home Safety (IBHS)	1408 North Westshore Boulevard - Suite 208 - Tampa, FL 33607, (813) 286-3400, www.ibhs.org	IBHS was created as an initiative of the insurance industry to reduce damage and losses caused by natural disasters. This website provides educational resources and on-line publications for insurers, businesses, and homeowners who are interested in taking
Insurance Information	Multi-hazard	Insurance Information Service of Oregon and Idaho (IISOI)	5100 Macadam Avenue, Suite 350, Portland, OR 97201, (503) 241-1757, http://insuranceoregon.org/iisoicontents.htm	IISOI is a non-profit consumer education/communications organization supported by the property-casualty insurance industry in the Oregon & Idaho. Its primary purpose is to explain the function and services of the insurance industry.
Risk Management	Multi-hazard	Public Entity Risk Institute (PERI)	11350 Random Hills Road #210, Fairfax, VA 22030, (703) 352-1846, www.riskinstitute.org	The Public Entity Risk Institute's mission is to serve public, private, and nonprofit organizations as a dynamic, forward thinking resource for the practical enhancement of risk management.
Contingency Planning	Multi-hazard	Association of Contingency Planners, (Business Emergency Planning)	http://www.acp-international.com/	The Association of Contingency Planners is a non-profit trade association dedicated to fostering continued professional growth and development in effective Contingency and Business Planning.
Small Business Development	Multi-hazard	Small Business Administration (SBA)	1515 SW 5th Avenue, Suite 1050, Portland, OR 97201-5494, (503) 326-2682, www.sba.gov/or/	The Small Business Administration is broken down into districts. The Portland District assists business in the state of Oregon and includes information for new business owners and for those suffering in disaster situations.
Post-Disaster Economic Recovery	Multi-hazard	Department of Commerce, Economic Development Administration	EDA Headquarters Disaster Recovery Coordinator (202) 482-6225	Grant funding to assist with the long-term economic recovery of communities, industries, and firms adversely impacted by disasters.
Mitigation Planning and Technical Assistance	Multi-hazard	Department of Commerce, Economic Development Administration	EDA Disaster Recovery Coordinator (800) 345-1222, www.eda.gov	Technical and planning assistance grants for capacity building and mitigation project activities focusing on creating disaster resistant jobs and workplaces
Economic Development	Multi-hazard	Oregon Economic and Community Development Department (OECDD)	775 Summer Street, Suite 200, Salem, OR 97301, 1-800-233-3306, www.econ.state.or.us/	Oregon's Economic and Community Development Department can assist business owners in numerous ways. The department collects economic data throughout the state by region and has specific activities geared toward business owner/operators; particularly the G

Additional Resources and Programs				
Program	**Hazard**	**Agency**	**Contact Information**	**Type of Assistance**
Minimizing Landslide Risk	Landslide	American Planning Association (APA)	122 S. Michigan Ave., Suite 1600, Chicago, Illinois 60603-6107 (312) 431-9100, http://www.planning.org/landslides, landslides@planning.org	The APA's research department embarked on a program to bring together solutions from multiple disciplines into a single source. It will help serve local planning efforts in identifying landslide hazards sufficiently early in the planning process so as to
Emergency prevention, preparedness, and response	Multi-hazard	American Red Cross	American Red Cross, Oregon Trail Chapter, P.O. Box 3200, Portland, OR 97208-3200, 503-284-1234, http://www.redcross-pdx.org, info@redcross-pdx.org	The Oregon Trail Chapter was chartered as a Red Cross unit in 1917. The chapter serves the residents of Clackamas, Columbia, Multnomah, Washington, Yamhill and Tillamook counties. The American Red Cross is a humanitarian organization, led by volunteers, t
Business Education and Resources	Multi-hazard	Institute for Business & Home Safety (IBHS)	IBHS, 1408 North Westshore Boulevard - Suite 208 - Tampa, FL 33607, (813) 286-3400, info@ibhs.org, http://www.ibhs.org	IBHS was created as an initiative of the insurance industry to reduce damage and losses caused by natural disasters. This website provides educational resources and on-line publications for insurers, businesses, and homeowners who are interested in taking
Insurance Information	Multi-hazard	Insurance Information Service of Oregon and Idaho (IISOI)	5100 Macadam Avenue, Suite 350, Portland, OR 97201, (503) 241-1757, http://insuranceoregon.org/iisoicontents.htm	IISOI is a non-profit consumer education/communications organization supported by the property-casualty insurance industry in the Oregon & Idaho. Its primary purpose is to explain the function and services of the insurance industry, to inform the public o
Risk Management	Multi-hazard	Public Entity Risk Institute (PERI)	11350 Random Hills Road #210, Fairfax, VA 22030, (703) 352-1846, (703) 352-6339, www.riskinstitute.org	The Public Entity Risk Institute's mission is to serve public, private, and nonprofit organizations as a dynamic, forward thinking resource for the practical enhancement of risk management.

Additional Resources and Programs				
Program	**Hazard**	**Agency**	**Contact Information**	**Type of Assistance**
Landslide Mitigation	Landslide	State of Washington, Department of Ecology	Department of Ecology, PO Box 47600, Olympia, WA 98504, http://www.ecy.wa.gov/programs/sea/landslides/	The Washington State Department of Ecology has a landslide website with tips for reducing risk, warning signs, and maps.
Planning for Natural Hazards: TRG	Multi-hazard	Department of Land Conservation and Development (DLCD)	635 Capitol St. NE, Suite 200, Salem, OR 97301-2540, (503) 373-0050, http://www.lcd.state.or.us/hazards.html	This is a natural hazards planning and mitigation resource for Oregon cities and counties. It provides hazard-specific resources and plan evaluation tools. The document was written for local staffs and officials. The Technical Resource Guide includes a na
Internet Resource	Multi-hazard	Association of Contingency Planners, International (Business Emergency Planning)	http://www.acp-international.com/	The Association of Contingency Planners is a non-profit trade association dedicated to fostering continued professional growth and development in effective Contingency and Business Planning.
Internet Resource	Multi-hazard	Department of Health and Human Services (DHHS), Office of Emergency Preparedness (OEP)	http://ndms.dhhs.gov/index.html	OEP is an office within the US Department of Health and Human Services and has the Departmental responsibility for managing and coordinating federal health, medical, and health related social services and recovery to major emergencies and federally declar
Internet Resource	Multi-hazard	International Association of Emergency Managers	http://www.iaem.com/	IAEM is a non-profit educational organization dedicated to promoting the goals of saving lives and protecting property during emergencies and disasters.
Internet Resource	Multi-hazard	The National Emergency Management Association	http://www.nemaweb.org/index.cfm	NEMA is the professional association of state, pacific, and Caribbean insular state emergency management directors.
Internet Resource	Multi-hazard	National Voluntary Organizations Active in Disasters (NVOAD)	http://www.nvoad.org/	NVOAD coordinates planning efforts by many voluntary organizations responding to disasters. Member organizations provide more effective and less duplication in service by getting together before disaster strikes,

Appendix C:
Business Recovery Questionnaire

This questionnaire is comprised of three elements: (1) assessing disaster preparedness of Jackson County businesses and (2) understanding business community needs in reducing risk and loss from natural hazards and (3) gauging business owner knowledge of mitigation tools and techniques. This information is intended to help improve public/private coordination of mitigation, preparedness, response and recovery following a natural hazard event by obtaining more accurate information on your recovery needs. We ask that you please take a few minutes to answer this questionnaire.

GENERAL INFORMATION

1. How many years has this business been in operation?

18%	1 to 10 years
42%	11 to 25 years
28%	26 to 50 yea
10%	51 to 99 years
2%	100+ years

Mean # of years of operation: 22 years

Median # of years of operation: 27 years

2. Is your business:

67%	An individual firm with no other units	2%	Public organization
5%	A franchise	1%	Non-Profit organization
23%	Part of a chain of businesses	1%	Other

3. Does your company own or lease the building in which the business is located?

51%	Own	2%	Own and lease
42%	Lease	2%	Other
3%	Rent		

4a. How many employees work with/for you?

54%	1 to 25 employees
21%	26 to 50 employees
10%	51 to 99 employees
12%	100 to 499 employees
3%	500 + employees

Mean # of employees: 101 employees

Median # of employees: 25 employees

4b. Please convert the above number into full-time equivalency (1.0 FTE equals 40 hrs/wk).

61%	1 to 25 FTE
14%	26 to 50 FTE
9%	51 to 99 FTE
11%	100 to 499 FTE
5%	500 + FTE

Mean # of FTE: 112 employees

Median # of FTE: 20 employees

5. On average, how long (in minutes) does it take your employees to arrive at work?

28%	5-14	0%	45-59
66%	15-29	0%	60 or more
6%	30-44		

6. Jackson County is vulnerable to several types of natural hazards. Please rate these hazard events in terms of possible impact on your business. **[Circle the corresponding number for each hazard]**
    1. **Critical**
    2. **Very Important**
    3. **Important**
    4. **Not Very Important**
    5. **No need to address now**

	Critical	Very Important	Important	Not Very Important	No need to address now
Wind damage	10%	15%	**35%**	34%	7%
Flooding	**24%**	20%	20%	**24%**	11%
Landslide / debris flow	12%	9%	16%	**35%**	28%
Winter storm / snow & ice	17%	24%	**34%**	22%	4%
Wind storm	12%	18%	**35%**	29%	6%
Earthquake	**36%**	20%	19%	17%	8%
Volcanic eruption	24%	10%	12%	23%	**31%**
Loss of electricity	**63%**	22%	8%	6%	2%
Hazardous materials accident	18%	18%	**28%**	26%	10%
Air or train accidents	7%	12%	16%	**39%**	26%
Loss of water supply	**41%**	19%	25%	12%	3%
Wildfire	19%	16%	23%	**26%**	16%
Other	32%	14%	5%	14%	**36%**

7. Please rate the services listed below in terms of their importance for your business operations. **[Circle the corresponding number for each service]**
    1. **Critical**
    2. **Very Important**
    3. **Important**
    4. **Not Very Important**
    5. **Not Important At All**

	Critical	Very Important	Important	Not Very Important	Not Important At All
Electricity	**78%**	15%	4%	2%	1%
Water	**47%**	24%	17%	11%	2%
Natural gas	**31%**	19%	18%	17%	15%
Phone/Internet	**56%**	23%	18%	3%	0%
Sewer and waste water treatment	**32%**	25%	28%	12%	4%
Postal	20%	28%	**35%**	13%	5%
Transportation, e. g. roads, rail	**36%**	29%	26%	7%	2%

8. If your business was forced to shut down during a natural hazard event such as a flood or winter storm for instance, how long could you afford to be closed without suffering major financial loss? **[Please check only one box]**

    39% Would immediately suffer major losses
    7% Hours *How many?* ***65%*** *1 to 10 hours, 29% 11 to 25 hours, 6% 25+ hours*
    54% Days How *many?* ***82%*** *1 to 10 days, 13.5% 11 to 25 days, 4.5% 25+ days*

9. Upon which of the following transportation systems does your business depend? **[Please check all that apply]**

49%	Private roads	28%	Air
91%	City streets	8%	Rail
75%	County roads	2%	Other
85%	State highways	1%	Elevator
83%	Interstate highways	1%	Bus or Taxi

PREPAREDNESS ACTIVITIES AT YOUR BUSINESS

10. There are many things that businesses can do to prepare for a natural disaster such as a flood or wildfire, for example. In the following list, please check all those things that you have already done at your business, plan to do in the near future, or are unable to do. **[Please check one answer for each action].**

At your business, have you or your employees:

	Have Done	Plan To Do	Not Done	Unable To Do	N/A
Attended meetings or received written information on natural disaster preparedness?	35%	7%	**53%**	0%	6%
Talked with those working in your business about what to do in case of a natural disaster?	44%	8%	**45%**	0%	4%
Developed a plan to notify employees?	35%	15%	**48%**	0%	3%
Purchased flood insurance for your business?	17%	3%	**47%**	4%	29%
Purchased business interruption insurance?	**39%**	3%	38%	2%	18%
Stored extra fuel or batteries or other emergency supplies?	32%	7%	**51%**	2%	7%
Developed a business emergency response plan?	36%	12%	**49%**	1%	2%
Developed a business emergency recovery plan?	17%	14%	**64%**	1%	5%
Conducted any disaster drills or exercises for your employees?	30%	11%	**56%**	0%	2%
Made arrangements to move the business to another location in case of disaster damage?	10%	4%	**57%**	15%	14%
Obtained an emergency generator for use if electrical power fails?	27%	6%	**55%**	5%	5%

11. How important is each of the following types of service in conducting your business? **[Please circle the corresponding number for each service]**
    1. **Critical** - Business would have to close without it.
    2. **Very Important** - Loss would cause major disruption.
    3. **Important** - Loss would cause some disruption
    4. **Not Very Important -** Loss would cause minor inconvenience.
    5. **Not Used -** Business doesn't use this service.

NOTE - Write in Option for "Other": *This table includes the options written for "other" categories, and the number of times that they were listed as Critical, Very Important, Important, etc. Some respondents wrote in an answer, but did not evaluate its importance. These responses are marked "no value assigned."*

		Critical	Very Important	Important	Not Very Important	Not Used
Electrical power for:						
A.	Computers / Cash registers	**50%**	27%	16%	4%	3%
B.	Heavy machinery	**47%**	18%	11%	15%	10%
C.	Lights / Office	**47%**	34%	16%	3%	0%
D.	Heating ventilation A/C	28%	29%	**34%**	8%	2%
E.	Other:	**77%**	0%	0%	0%	24%
		Refrigeration (2)				
		Security (2)				
		Video Equip. (1)				
		Phones (1)				
		Sewer (1)				
		Fuel (1)				
		Compressor (1)				
Telecommunications for:						
F.	Regular phone calls	**52%**	31%	14%	4%	0%
G.	Fax machines	**29%**	26%	25%	16%	4%
H.	Computers – Modems	**44%**	29%	15%	9%	4%
I.	Credit card machines	18%	14%	17%	13%	**38%**
J.	Other:	29%	24%	0%	6%	**41%**
		Security (1)				
		ATM (1)				
Water used for:						
K.	Drinking – Cooking	**33%**	23%	18%	23%	3%
L.	Bathrooms – Sanitary	**37%**	32%	23%	7%	1%
M.	Industrial use	17%	13%	14%	18%	**39%**
N.	Heating ventilation A/C	13%	17%	**28%**	15%	27%
O.	Other:	42%	12%	0%	12%	**35%**
		Refrigeration (1)				
		White Water (1)				
		Dental Equip (1)				
		Onwell (1) - No Value Assigned				
Sewage disposal:						
P.	Bathrooms – Sanitary	**40%**	32%	19%	7%	2%
Q.	Industrial wastewater	15%	12%	12%	14%	**47%**
R.	Other:	9%	0%	5%	9%	**77%**
		Back-up (1) - No Value Assigned				
		Ice Machine (1) - No Value Assigned				
		Septic Systems (1) - No Value Assigned				
Natural gas used for:						
S.	Industrial processes	15%	9%	7%	9%	**60%**
T.	Heating ventilation A/C	22%	20%	20%	8%	**30%**
U.	Other:	29%	7%	7%	3%	**55%**
				Propane (1)	*Propane (1)*	
		Kitchen (5)	*Kitchen (1)*			
		Fuel (1)				
		Boilers (1)				
		ATM (1)				
				Water (1)		

12. Below is a list of potential mitigation activities in which businesses can engage. Rate the importance of each measure to your business and employees using the following scale:

1. **Very Useful**
2. **Somewhat Useful**
3. **Not Useful**
4. **Already Addressed**

		Very Useful	Somewhat Useful	Not Useful	Already Addressed
Facility and road access					
A.	Road access issues and debris removal	**53%**	38%	6%	4%
B.	Alternate route availability	**49%**	38%	10%	4%
C.	Data and equipment protection	**53%**	32%	9%	6%
D.	Retrieval of critical data from storage	**41%**	37%	17%	5%
E.	Allocation of emergency response efforts	31%	**55%**	10%	5%
Utilities					
F.	Making information "one phone call away" for businesses	**57%**	37%	4%	2%
F.	Back-up sources of power	**71%**	21%	3%	5%
H.	Single point of contact for reporting any utility failures	**60%**	32%	5%	2%
I.	Alternate communications	**51%**	40%	7%	3%
J.	Alternate shipping/transportation	26%	**45%**	28%	2%
K.	Sewage plant protection	31%	**46%**	20%	3%
L.	Central input progress reports	19%	**48%**	29%	4%
Businesses helping businesses					
M.	Share resources among businesses in an emergency situation	**45%**	41%	12%	2%
N.	Work with "like" businesses on mitigation projects	36%	**41%**	22%	2%
O.	Mentoring program between more and less prepared businesses	21%	**53%**	25%	2%
P.	Mutual aid networks for emergency shelter and food	37%	**45%**	18%	1%
Q.	Food vendors able to supply large facilities, which could in turn host smaller businesses	29%	**41%**	30%	1%
R.	Developing a plan for direct notification of vulnerable businesses	**44%**	43%	13%	0%
S.	Developing a central contact office to quickly disseminate information	**53%**	37%	10%	1%
Training and public outreach					
T.	Need for communication with Jackson County Emergency Management Office	42%	**46%**	10%	3%
U.	Planning and publicizing alternate commute routes	**45%**	44%	11%	0%
V.	Alternate schools/day care sites so employees can leave home for work	29%	**51%**	20%	0%
W.	Help employees make plans to protect themselves and their home	38%	**51%**	11%	0%
X.	Develop a website for business & community to report damages and recovery after a disaster	30%	**51%**	20%	0%
Mitigation incentives					
Y.	Loans and grants for structural retrofits and other disaster preparedness measures	40%	**46%**	13%	1%
Z.	Expedite permit process for mitigation projects	**51%**	38%	10%	1%
A.	Information that emphasizes asset management as part of disaster preparedness and recovery	28%	**54%**	17%	1%

13. How would you like to receive information about the mitigation activities listed above?
[Please check all that apply]

54%	Handbook
59%	Fact sheet / brochure
27%	Newspaper
20%	Radio / TV
36%	Internet
14%	Chamber of Commerce
19%	Workshop
7%	Administrative meetings, i.e. monthly, quarterly
0%	Other

THANK YOU VERY MUCH FOR PROVIDING THIS INFORMATION

Survey prepared by Community Planning Workshop in partnership with the Community Service Center's Oregon Natural Hazard Workshop at the University of Oregon, Institute for Business & Home Safety, and the Oregon Showcase State for Natural Disaster Resistance and Resilience Initiative. Elements of the Business Recovery Questionnaire courtesy of: Stephen B. Baruch & Associates, 1752 Selig Lane, Los Altos, California 94024, USA

Appendix D:
GIS Metadata

A Geographic Information System was used, to the extent that data was available, to identify specific natural hazards and locate areas within Jackson County that are vulnerable to natural hazard events.

Information about the data used to create the maps is contained in this appendix. For further information about the data used or the process involved in compiling the hazard identification maps, contact the following people:

Keith Massie, GIS Manager Jackson County GIS Office 10 South Oakdale Medford, Oregon 97501	Andre LeDuc, Director Oregon Natural Hazards Workshop 1209 University of Oregon Eugene, Oregon 97403

Critical Facilities

The following themes were added to produce the Critical Facilities map:

Shapefile	Name (Theme Name)	Source
Critical_Facilities.shp	Critical Facilities	Jackson County GIS
Arterial.shp	Roads	Jackson County GIS
Railroads.shp	Railroads	Jackson County GIS
Str98303.shp	Rivers and Streams	Jackson County GIS
Lak98303.shp	Lakes	Jackson County GIS
Cntypoly.shp	County Boundary	Jackson County GIS
Ugb.shp	Urban Growth Boundaries	Jackson County GIS
Jcdem100_g.tfw	Gray Shaded Relief Image	Jackson County GIS

The Rural Residential shapefile was based on the Jackson County zoning shapefile – (zone.shp). The genzone field was queried for rural or suburban taxlots.

Tax Lots in Floodplain

1. Tax Lots were intersected with 100-year flood plain. A new shapefile was created from the selected tax lots.
2. Tax Lots were queried where Impvalue was less then or equal to $1000 and these tax lots were deleted.
3. Tax Lots that are Public Lands (Nacode = 40,41,42,43) were selected and deleted.
4. The field TotalAcres was added to Tax Lots.

5. A union was performed with the 100-year flood plain using the Geoprocessing wizard. This created a new shapefile.
6. The field Acres was added to the newly created Tax Lots shapefile.
7. The field PercentIn was added to Tax Lots shapefile and the value equal to Acres / TotalAcres was calculated.
8. All Tax Lots that were inside the flood plain (the field is added during the union) and have a PercentIn value less then or equal to 0.1 (10%) were selected.
9. Selected Tax Lots using the MapLot field were summarized.
10. All records in the Summarized table were selected and the table was linked back to the Tax Lots using the MapLot field.
11. The selected Tax Lots were those that had less then 10% of their area inside the 100-year flood plain. These tax lots were deleted.
12. The selected Tax Lots were then visually reviewed using aerial photos. If actual home sites on the selected tax lots were located outside the 100-year floodplain they were deleted from the shapefile.

Flood Land Use

1. A new table was created called buildcode.dbf.
2. Two fields were added – "Buildcode" and "Landuse".
3. Sixty three records were added with building code numbers ranging from 0 to 790
4. Land use names that corresponded to the building code numbers were added.
5. The tables buildingcode.dbf and taxlots_floodplain.dbf were joined.
6. To create a table of improved values in the 100-year flood plain according to landuse, all fields except shape, flood, impvalue, and landuse were hidden.
7. The taxlots_floodplain.dbf was then exported and opened in excel. The pivot wizard was used to create a table of sum improvement values in the 100-year flood plain. See Chart below.

Improvement Value of Development in 100-Year Floodplain

Single-Family	$	124,868,310.00
Multi-Family	$	6,679,110.00
Mobil Home	$	10,206,010.00
Commercial	$	11,891,640.00
Industrial	$	511,810.00
Other or Unknown	$	30,295,384.00
Grand Total	**$**	**184,452,264.00**

Number of Properties with development in 100-Year Floodplain

Single-Family	1207
Multi-Family	311
Mobil Home	20
Commercial	49
Industrial	2
Other or Unknown	242
Grand Total	**1831**

Total Acreage of Tax lots with development in 100-Year Floodplain

Single-Family	10509.701
Multi-Family	3718.556
Mobil Home	149.83
Commercial	331.976
Industrial	9.427
Other or Unknown	5383.236
Grand Total	**20102.726**

Unmitigated Properties

The taxlots_floodplain.shp was queried under year built between 1850 and 1973. There were 567 tax lots with a year built value of 0, indicating this information is unknown and so those tax lots were not included. The following charts list the number of known unmitigated properties and their improvement value according to land use. This information indicates that at least 868 of the total 1,831 tax lots in the 100-year floodplain are unmitigated or were built before 1973. This map is located in the Jackson County Office of Emergency Management.

Number of Unmitigated Properties in 100-Year Floodplain

Single-Family	834
Multi-Family	13
Mobil Home	11
Commercial	10
Total	**868**

Improvement Value of Unmitigated Properties in 100-Year Floodplain

Single-Family	$ 71,050,230.00
Multi-Family	$ 619,350.00
Mobil Home	$ 4,890,860.00
Commercial	$ 1,367,360.00
Grand Total	**$ 77,927,800.00**

Acreage of Unmitigated Property in 100-Year Floodplain

Single-Family	7658.36
Multi-Family	302.36
Mobil Home	66.34
Commercial	14.23
Grand Total	**8041.29**

Flood Layout

The following themes were added to produce the floodplain map.

Shapefile	Name (Theme Name)	Source
Arterial.shp	Roads	Jackson County GIS
Railroads.shp	Railroads	Jackson County GIS
Str98303.shp	Rivers and Streams	Jackson County GIS
Lak98303.shp	Lakes	Jackson County GIS
Cntypoly.shp	County Boundary	Jackson County GIS
Ugb.shp	Urban Growth Boundaries	Jackson County GIS
Jcdem100_g.tfw	Gray Shaded Relief Image	Jackson County GIS

The Rural Residential shapefile was based on the Jackson County zoning shapefile – (zone.shp). The genzone field was queried for rural and suburban taxlots.

Landslides

The following themes were added to produce the landslide map:

Shapefile	Name (Theme Name)	Source
ODF_Debris_Flow.shp	Debris Flow Risk Areas	Oregon Department of Forestry
Landslide_inventory.shp	Recent Landslide events	DOGAMI
Arterial.shp	Roads	Jackson County GIS
Railroads.shp	Railroads	Jackson County GIS
Str98303.shp	Rivers and Streams	Jackson County GIS
Lak98303.shp	Lakes	Jackson County GIS
Cntypoly.shp	County Boundary	Jackson County GIS
Ugb.shp	Urban Growth Boundaries	Jackson County GIS
Jcdem100_g.tfw	Gray Shaded Relief Image	Jackson County GIS

The Rural Residential shapefile was based on the Jackson County zoning shapefile – (zone.shp). The genzone field was queried for rural or suburban taxlots.

Annual Precipitation

The following themes were added to produce the precipitation map:

Shapefile	Name (Theme Name)	Source
Prec90.shp	Precipitation	Jackson County GIS
Arterial.shp	Roads	Jackson County GIS
Railroads.shp	Railroads	Jackson County GIS
Str98303	Rivers and Streams	Jackson County GIS
Lak98303.shp	Lakes	Jackson County GIS
Cntypoly.shp	County Boundary	Jackson County GIS
Ugb.shp	Urban Growth Boundaries	Jackson County GIS
Jcdem100_g.tfw	Gray Shaded Relief Image	Jackson County GIS

1. Annual Precipitation in inches was broken into four categories: 19-33, 34-45, 46-56, 57-74.
2. The Rural Residential shapefile was based on the Jackson County zoning shapefile – (zone.shp). The genzone field was queried for rural or suburban taxlots.

Wildfire

The following themes were added to produce the wildfire map:

Shapefile	Name (Theme Name)	Source
High_risk.shp	High Risk Wildfire Areas	Oregon Department of Forestry
Fire_9298_state_plane.shp	Fire Starts 1992-1998	Jackson County GIS
Arterial.shp	Roads	Jackson County GIS
Railroads.shp	Railroads	Jackson County GIS
Str98303.shp	Rivers and Streams	Jackson County GIS
Lak98303.shp	Lakes	Jackson County GIS
Cntypoly.shp	County Boundary	Jackson County GIS
Ugb.shp	Urban Growth Boundaries	Jackson County GIS
Jcdem100_g.tfw	Gray Shaded Relief Image	Jackson County GIS

The Rural Residential shapefile was based on the Jackson County zoning shapefile – (zone.shp). The genzone field was queried for rural or suburban taxlots. ODF developed the High Risk Overlay theme. They determined this overlay area by looking at wildfire fuels (vegetation), slope, and weather, and correlating this information with housing density. Areas with a large number of houses, a high degree of fuels, and located on steep slopes were considered particularly at risk. In terms of weather, the entire county is considered to have extreme fire danger. See attachment for more information concerning the High Risk Overlay theme

Appendix E:
Approaches for Economic 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.

This appendix outlines several approaches for conducting economic analysis 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 provide the details of economic analysis methods that can be used 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 natural hazard mitigation provides decision-makers with an understanding of the potential benefits and costs of an activity, as well as a standpoint 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, thus increasing some of the social and economic impacts a disaster may have on a community.

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 Mitigation Strategies?

The approaches used to identify the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into two general categories: benefit-cost analysis and cost-effectiveness analysis. The distinction between the two methods is the way in which the relative costs and benefits are measured. Additionally, there are varying approaches to assessing the value of mitigation for public sector and private sector activities.

Benefit-Cost Analysis

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, avoided 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 (i.e.: if net benefits exceed net costs, the project is worth pursuing). A project must have a benefit/cost ratio greater than 1 in order to be funded.

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 to whom they shall accrue, 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 that involves 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 of 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:

1. Request cost sharing from public agencies;
2. Dispose of the building or land either by sale or demolition;
3. Change the designated use of the building or land and change the hazard mitigation compliance requirement; or
4. 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 purchasers. 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.

How can an Economic Analysis be Conducted?

Benefit-cost analysis and cost-effectiveness analysis are important tools in evaluating whether or not to implement a mitigation activity. A framework for evaluating alternative mitigation activities is outlined below:

Estimating the costs and benefits of a hazard mitigation strategy can be a complex process.

Employing the services of a specialist can assist in this process.

1. Identify the Alternatives

Alternatives 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 project 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 alternative. 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 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 Alternatives

Once costs and benefits have been quantified, economic analysis tools can rank the alternatives. Two methods for determining the best alternative 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 expected future cost expressed in today's dollars. If the net present value is greater than the project 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.

How are Benefits of Mitigation Calculated?

Economic Returns of Natural Hazard Mitigation

The estimation of economic returns, which accrue to building or landowner 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
- Contents damage 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 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

The building or landowner 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 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. Many communities are looking towards developing multi-objective 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

CUREe Kajima Project, *Methodologies For Evaluating The Socio-Economic Consequences Of Large Earthquakes*, Task 7.2 Economic Impact Analysis, Prepared by University of California, Berkeley Team, Robert A. Olson, VSP Associates, Team Leader; John M. Eidinger, G&E Engineering Systems; Kenneth A. Goettel, Goettel and Associates Inc.; and Gerald L. Horner, Hazard Mitigation Economics Inc., 1997.

Federal Emergency Management Agency, *Benefit/Cost Analysis of Hazard Mitigation Projects*, Riverine Flood, Version 1.05, Hazard Mitigation Economics Inc., 1996.

Federal Emergency Management Agency *Report on Costs and Benefits of Natural Hazard Mitigation*. Publication 331, 1996.

Goettel & Horner Inc., *Earthquake Risk Analysis Volume III: The Economic Feasibility of Seismic Rehabilitation of Buildings in The City of Portland*, Submitted to the Bureau of Buildings, City of Portland, August 30, 1995.

Goettel & Horner Inc., *Benefit/Cost Analysis of Hazard Mitigation Projects* Volume V, Earthquakes, Prepared for FEMA's Hazard Mitigation Branch, October 25, 1995.

Horner, Gerald, *Benefit/Cost Methodologies for Use in Evaluating the Cost Effectiveness of Proposed Hazard Mitigation Measures*, Robert Olson Associates, Prepared for Oregon State Police, Office of Emergency Management, July 1999.

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

Risk Management Solutions, Inc., *Development of a Standardized Earthquake Loss Estimation Methodology*, National Institute of Building Sciences, Volume I and II, 1994.

VSP Associates, Inc., *A Benefit/Cost Model for the Seismic Rehabilitation of Buildings*, Volumes 1 & 2, Federal Emergency Management Agency, FEMA Publication Numbers 227 and 228, 1991.

VSP Associates, Inc., *Benefit/Cost Analysis of Hazard Mitigation Projects: Section 404 Hazard Mitigation Program and Section 406 Public Assistance Program,* Volume 3: *Seismic Hazard Mitigation Projects*, 1993.

VSP Associates, Inc., *Seismic Rehabilitation of Federal Buildings: A Benefit/Cost Model*, Volume 1, Federal Emergency Management Agency, FEMA Publication Number 255, 1994.

Appendix F
Plan Maintenance & Action Item Prioritizing Methodology

Background

The plan maintenance chapter of this document details the formal process that will ensure that the Jackson County Natural Hazards Mitigation Action Plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the Plan annually and producing a plan revision every five years. This chapter describes how the County will integrate public participation throughout the plan maintenance process. Finally, this chapter includes an explanation of how the County intends to incorporate the mitigation strategies outlined in this Plan into existing planning mechanisms such as the County comprehensive land use plan, capital improvement plans, and building codes.

Implementing the Plan

The success of the Jackson County Natural Hazard Mitigation Action Plan depends on how well the outlined action items are implemented. In an effort to ensure that the activities identified are implemented, the following steps will be taken. The plan will be formally adopted, a coordinating body will be assigned, a convener shall be designated, the identified activities will be prioritized and evaluated, and finally, the plan will be implemented through existing plans, programs, and policies.

Plan Adoption

The Jackson County commission will be responsible for adopting the Jackson County Natural Hazards Mitigation Action Plan and providing the support necessary to ensure plan implementation. Once the plan has been adopted, the County Emergency Manager will be responsible for submitting it to the State Hazard Mitigation Officer at Oregon Emergency Management. Oregon Emergency Management will then submit the plan to the Federal Emergency Management Agency (FEMA) for review. This review will address both the federal criteria outlined in FEMA's Flood Mitigation Assistance program and Interim Final Rule 44 CFR Part 201. Upon acceptance by FEMA, the Jackson County will gain eligibility for Flood Mitigation Assistance, Hazard Mitigation Grant Program and Pre-Disaster Mitigation program funds.

Coordinating Body

The Jackson County Hazard Mitigation Steering Committee will be responsible for coordinating implementation of plan action items and undertaking the formal review process. The County Administrator's Office and emergency management will ensure that appropriate

representatives are assigned from each County department, including, but not limited to, the current Hazard Mitigation Steering Committee members. The County formed the Hazard Mitigation Steering Committee to assist in the development of the plan and currently consists of members from local agencies, organizations, and citizens, and including:

- Jackson County Emergency Management
- Beaverton Foods/Westside Economic Alliance
- Portland General Electric
- Jackson County Land Use and Transportation
- Clean Water Services
- Tualatin River Watershed Council
- Metro Regional Government
- Oregon State Police – Office of Emergency Management

In order to make this committee as broad and useful as possible, the committee is encouraged to engage other relevant organizations and agencies in hazard mitigation. The recommendations for adding to the Hazard Mitigation Steering Committee include:

- An insurance representative
- Representation from a professional organizations such as Home Builders
- Representation from the Committee for Citizen Involvement (CCI)

The Hazard Mitigation Steering Committee will have no less than quarterly meetings, which will be scheduled once the final Hazard Mitigation Steering Committee has been established. These meetings will provide an opportunity to discuss the progress of the action items in the plan, and maintain the partnerships that are essential for the sustainability of the Mitigation Plan.

Convener

Although the County Administrator will provide ownership of the Jackson County Natural Hazard Mitigation Action Plan, the County's Emergency Manager will take responsibility for plan implementation. The Emergency Manager will facilitate the Hazard Mitigation Steering Committee meetings and will assign tasks such as updating and presenting the plan to the rest of the members of the committee. Plan implementation and evaluation will be a shared responsibility among all of the assigned Hazard Steering Committee Members.

Implementation through Existing Programs

Jackson County addresses statewide planning goals and legislative - 2 -requirements through its comprehensive land use plan, capital improvement plans, and building codes. The Natural Hazard Mitigation

Action Plan is non-regulatory in nature and provides a series of recommendations – many of which are closely related to the goals and objectives of existing planning programs. To the extent possible the County will incorporate the recommended mitigation action items into existing programs and procedures. These goals and action items will help the County address statewide land-use planning Goal 7 which was developed to protect life and property from natural disasters and hazards through planning strategies that restrict development in areas of known hazards. Goal 7 requires that local governments base development plans on inventories of known areas of natural disasters and hazards and that the intensity of development should be limited by the degree to which the natural hazard occurs within the areas of proposed development. The County can use review of this plan as an avenue to update the Goal 7: Natural Hazards element of their comprehensive plan and to integrate mitigation into zoning and planning documents.

The County Building Division is responsible for administering the building codes in County. After the adoption of the mitigation plan, they will work with the State Building Code Office to make sure that the County adopts, and is enforcing, the minimum standards established in the new State Building Code. In addition, the Hazard Steering Committee will work with other agencies for promoting more stringent building codes regarding natural hazard mitigation at the state level. This is to ensure that life/safety criteria are met for new construction.

Capitol improvement planning that occurs in the future will also contribute to the goals in the Hazard Mitigation Plan. Various County Departments develop Capital Improvement Programs (CIPs), and review them on an annual basis. Upon annual review of the CIPs, the Hazard Mitigation Steering Committee will work with the County departments to integrate the Jackson County Natural Hazard Mitigation Action Plan into appropriate sections of the CIPs.

Within six months of formal adoption of the Mitigation Plan, the policies listed above will be incorporated into the process of existing planning mechanisms at the County level. The meetings of the Hazard Mitigation Steering Committee will provide an opportunity for committee members to report back on the integration progress of mitigation planning elements and action items into County planning documents and procedures.

Economic Analysis of Mitigation Projects

FEMA's methods of identifying the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis. 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. 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.

The Hazard Mitigation Steering Committee will use FEMA-approved cost benefit methodology as a tool for identifying and prioritizing mitigation action items when applying for federal mitigation funding. For other projects and funding sources, the Hazard Mitigation Steering Committee will use other approaches to understand the costs and benefits of each action item and develop a prioritized list. For more information regarding economic analysis of mitigation action items, please see Appendix C of the Plan.

Evaluating and Updating the Plan

Formal Review Process

Jackson County has developed a method to ensure that a regular review and update of the Hazard Mitigation Plan occurs. All Committee members will be responsible for monitoring and evaluating the progress of the mitigation strategies in the Plan and the Emergency Manager is responsible for contacting the Committee members and organizing a plan review meeting at least annually.

The committee will review each goal and objective to determine their relevance to changing situations in the County, as well as changes in State or Federal policy, and to ensure they are addressing current and expected conditions. The committee will also review the risk assessment portion of the Plan to determine if this information should be updated or modified. The designated parties responsible for the various implementation actions will report on the status of their projects and will include which implementation process worked well, any difficulties encountered, how coordination efforts were proceeding, and which strategies should be revised.

The Emergency Management Program will be responsible for incorporating the changes and updates to the plan before submitting the final document to the Hazard Steering Committee members, and presenting it to the County Commissioners for approval. The updated Plan will then be submitted to the State Hazard Mitigation Officer for review. If no changes are necessary, the State Hazard Mitigation Officer will be given a justification for this determination.

Continued Public Involvement

Jackson County is dedicated to involving the public directly in the continual reshaping and updating of the Hazard Mitigation Plan. The Hazard Mitigation Steering Committee members are responsible for the annual review and update of the plan. Although they represent the public to some extent, the public will have the opportunity to provide feedback about the Plan.

Copies of the Plan will be catalogued and kept at the Jackson County public library. The existence and location of these copies will be publicized through a newsletter. The Plan includes the address and the phone number of the Emergency Management Program Office, responsible for keeping track of public comments on the Plan.

In addition, copies of the plan and any proposed changes will be posted on the County website. This site will also contain an email address and phone number to which people can direct their comments and concerns.

A public meeting will also be held after each annual evaluation or when deemed necessary by the Hazard Mitigation Steering Committee. The meetings will provide the public a forum for which they can express their concerns, opinions, or ideas about the Plan. The County Administrators Office will maintain the public's involvement through advertisements concerning the public meetings and through existing community organizations. The County Emergency Manager will be responsible for using County resources to publicize the annual public meetings and maintain public involvement to include the public cable access channel (TVTV), County webpage, and local newspapers.

Methodology for Prioritizing Plan Action Items

To prioritize the plan's action items the County will utilize a multi-tiered approach. The prioritized list of action items will be developed by first prioritizing the plan goals, then referring to the County Hazard Analysis scores to determine the natural hazards priority. Using the outcome of these two activities each action item will be examined to determine its relative priority within the plan. The prioritized list of action items serves simply as a starting point for the implementation of mitigation activities.

The Hazard Mitigation Steering Committee and the leadership of Jackson County have the option to implement any of the action items at any time. This option to consider all action items for implementation at any given time allows the committee to consider mitigation strategies as new situations arise, such as funding opportunities that could fund an action item that may not be of highest priority. The following is the method by which the Hazard Mitigation Steering Committee will prioritize the plan action items.

Step One: Prioritizing Plan Goals

To accomplish this task the Hazard Mitigation Steering Committee examined and voted on the importance of each of the plan's four goals. The steering committee was led through a "dot prioritization" activity to determine the relative priority of each goal. Steering committee members were given a voting sheet with 4 different colored adhesive "dots". Each "dot" had a number assigned to it ranging from 1 to 4 points (four being the highest value). They were asked to place a single "dot" on each of the plan goals, whereby ranking the importance of each goal in making Jackson County more disaster resilient. The steering committee was asked to do this regardless of how easy each goal would

be to accomplish. After the vote, their priorities, the "dots" and their associated points were tallied and the results are as follows:

Highest Priority NEEDS TO BE UPDATED

2nd Highest Priority NEEDS TO BE UPDATED

3rd Highest Priority NEEDS TO BE UPDATED

4th Highest Priority NEEDS TO BE UPDATED

In developing the prioritized list – each action item was examined according to the plan goals addressed and what priority those goals were assigned. In this first step, action items were assigned the following number of points for addressing each goal.

4 Points - NEEDS TO BE UPDATED

3 Points - NEEDS TO BE UPDATED

2 Points - NEEDS TO BE UPDATED

1 Point - NEEDS TO BE UPDATED

Action items that address multiple goals were assigned points for all of the goals that they address.

Step 2: Prioritizing Community Hazards

The second step in prioritizing the plan's action items was to examine which hazards they are associated with and where these hazards rank in terms of community risk.

To rank the hazards, the Counties Hazard Analysis scores and methodology was utilized. This hazard analysis identified various hazards both man-made and natural that may threaten Jackson County. The hazard analysis examined each of these hazards based on history, vulnerability, maximum threat, and probability. A formula was used to produce an overall score for the hazards risk. According to this analysis, the hazards identified in this plan were ranked in the following order or priority: NEEDS TO BE UPDATED Depending on which hazards each action item addresses the following point system will be assigned to each:

10 Points - Multi-Hazard

6 Points - NEEDS TO BE UPDATED

5 Points - NEEDS TO BE UPDATED

4 Points - NEEDS TO BE UPDATED

3 Points - NEEDS TO BE UPDATED

2 Points - NEEDS TO BE UPDATED

1 Point - NEEDS TO BE UPDATED

Multi-Hazard action items are assigned the most points due to the fact they address multiple hazards.

The points assigned to each action item depend on which hazard they address. These points are then combined with the points assigned to each item based on the goals address as detailed in step one to arrive at an Action Item Priority Score noted in the Action Item Matrix included in the Executive Summary. Higher scores indicate higher priorities. The point totals for step one were combine with the point totals in step two to create a number by which each action item is prioritized.

The one action item, which does not follow this prioritization process, is Multi-Hazard Short Term Action Item #2: *Establish a Jackson County Natural Hazards Mitigation Committee to facilitate implementation, monitoring, and evaluation of countywide mitigation activities.* This action item is instead placed as the first priority because it is seen as crucial to ensuring plan implementation.

Step 3: Action Item Implementation

Along with the prioritized Action Item Matrix, a Capability Assessment Matrix is also included and is found in the Appendix. The blank Capability Assessment is included for the Office of Emergency Management along with County's Natural Hazards Mitigation Committee. This Capability Assessment is designed to assess the operations, readiness, and capabilities of those organizations associated with the plan's action items to assess which items in the prioritized list can be implemented using existing resources and which items require outside funding. The concept of the Capability Assessment is to further refine how and when the plan's actions items are implemented based on the implementing organization's capability.

Jackson County Natural Hazards Mitigation Committee, headed by Emergency Management, will administer the implementation of action items with overall guidance of the County.

In examining the feasibility of the plan's prioritized action items benefit-cost analysis will be encouraged for all structural mitigation projects. See Appendix C for more information on this process.

Appendix G:
Hazard Analysis Matrix

Natural and Man-made Hazards in Jackson County, Oregon

HAZARD	HISTORY WF = 2	VULNERABILITY WF = 5	MAXIMUM THREAT WF = 10	PROBABILITY WF = 7	TOTAL =
Severe Weather	**10** X 2 = 20	**10** X 5 = 50	**10** X 10 = 100	**10** X 7 = 70	= **240**
Earthquake	4 **X 2** = 8	**10** X 5 = 50	**10** X 10 = 100	**6** X 7 =42	= **200**
Utility Failure	**5** X 2 = 10	**5** X 5 = 25	**10** X 10 = 100	**7** X 7 = 49	= **184**
Drought	**10** X 2 = 20	**6** X 5 = 30	**6** X 10 = 60	9 X 7 = 63	= **173**
Hazardous Materials	10 **X 2** = 20	**4** X 5 = 20	**5** X 10 = 50	**10** X 7 = 70	= **160**
Floods	**10** X 2 = 20	**2** X 5 = 10	**5** X 10 = 50	**10** X 7 = 70	= **150**
Wildland Fire	**10** X 2 = 20	**2** X 5 = 10	**5** X 10 = 50	**10** X 7 = 70	= **150**
Terrorism	7 **X 2** = 14	**3** X 5 = 15	**7** X 10 = 70	**7** X 7 = 49	= **148**
Epidemic	**2** X 2 = 4	**2** X 5 = 10	**7** X 10 = 70	**5** X 7 = 35	= **119**
Landslide	**10** X 2 = 20	**1** X 5 = 5	**1** X 10 = 10	**10** X 7 = 70	= **105**
Transportation	10 X 2 = 20	**1** X 5 = 5	**1** X 10 = 10	**10** X 7 =70	= **105**
Dam Failure	**1** X 2 = 2	**4** X 5 = 20	**4** X 10 = 40	**2** X 7 = 14	= **76**
Volcano	**1** X 2 = 2	**1** X 5 = 5	**5** X 10 = 50	**1** X 7 = 7	= **64**

AGENCY: Jackson County Emergency Management

DATE: Revised March 2004

Appendix H:
Acronyms

The following acronyms are used in the action plan and are provided here for clarification.

ARC	American Red Cross
ARES	Amateur Radio Emergency Services
BLM	Bureau of Land Management
CDBG	Community Development Block Grant
CERT	Community Emergency Response Team
CPW	Community Planning Workshop (University of Oregon)
CVO	Cascade Volcano Observatory (USGS)
DEQ	Department of Environmental Quality (State of Oregon)
DLCD	Department of Land Conservation & Development (State of Oregon)
DOGAMI	Department of Geology & Mineral Industries (State of Oregon)
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance (FEMA Program)
FTE	Full Time Equivalent
GIS	Geographic Information System
HMGP	Hazard Mitigation Grant Program
HUD	Housing & Urban Development (United States)
IISOI	Insurance and Information Services of Oregon & Idaho
LEPC	Local Emergency Planning Committees
MCIC	Mass Casualty Incident Committee
NCDC	National Climate Data Service
NFIP	National Floodplain Insurance Program
NOAA	National Oceanic & Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
ODF	Oregon Department of Forestry
ODOT	Oregon Department of Transportation

OEM	Office of Emergency Management (Oregon State Police)
OIT	Oregon Institute of Technology
ONHW	Oregon Natural Hazards Workshop (University of Oregon)
OSP	Oregon State Police
OSSPAC	Oregon Seismic Safety Policy Advisory Commission
PP&L	Pacific Power & Light
RVCOG	Rogue Valley Council of Governments
RVFCA	Rogue Valley Fire Chief's Association
RVIRNet	Rogue Valley Interfaith Relief Network
SAR	Search and Rescue
SOREDI	Southern Oregon Regional Economic Development Inc.
SOU	Southern Oregon University
UGB	Urban Growth Boundary
USACE	United States Army Corps. of Engineers
USFS	United States Forest Service
USGS	United States Geological Survey
VOAD	Voluntary Organizations Active in Disaster
WRD	Water Resources Department (State of Oregon)