Linn County
Natural Hazard Mitigation Plan

Produced By:

Linn County Planning and Building Department

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Linn County
Natural Hazard Mitigation Plan
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Regional Partners

Federal Emergency Management Agency Region 10
Oregon Emergency Management
Oregon Department of Geology and Mineral Industries
Oregon Partnership for Disaster Resilience (OPDR)
Benton County
Linn County
Yamhill County
City of Albany
Mid-Willamette Valley Council of Governments

Board of Commissioners

Roger Nyquist
John K. Lindsey
William Tucker

Steering Committee

Steve Barnett
Mike Beaver
Brian Carroll
David Furtwangler
John Hixson
Jim Howell
Chuck Knoll
Darrel Tedisch
Mary VanAgtmael
Robert Wheeldon

Public Meeting Contributors

Cliff Wooton, City of Scio
Carolyn Neve, City of Scio
Darrel Tedisch, City of Albany

James Howell, Linn County Emergency Management Coordinator
Mary Price, Engineering Technician, Linn County Road Department
John Hixson, Linn County Building Official

Survey Respondents

Donna Chastain, Lebanon Community School District 9
Trisha Ruby, Mill City RFPD
Darrel Tedisch, City of Albany
David Blake, Consumers Power
Charles Gibbs, Linn County Surveyor
Steve Druckenmiller, Linn County Clerk
Dan McGrath, Linn County Extension Agent
Rosemary Wilson, City of Idanha
Tim Bunnell, City of Harrisburg
Steve Nielsen, Santiam Canyon School District 127
Carol Lewis, City of Sweet Home
Kevin Crowell, State Forestry Department
Jon Taylor, Linn, Benton, Lincoln ESD
Don Hoover, Santiam Canyon School District 129

Project Manager

Olivia Glantz, Assistant Planner, Linn County Planning and Building Department

Geographic Information Systems (GIS) Maps:

Steve Barnett, GIS Manager

Special Thanks

Jeff Volkman, Hazard Identification and Risk Assessment, FEMA Region 10
Dennis Sigrist, Oregon Emergency Management
Bill Burns, Department of Geology and Mineral Industries
Jon Hofmeister, Department of Geology and Mineral Industries
Andre LeDuc, Director, Oregon Partnership for Disaster Resilience
Gregoor Passchier, Planning Coordinator, Oregon Partnership for Disaster Resilience
Gregory Butler, Graduate Research Fellow, Community Planning Workshop
Ben Reder, Community Planning Workshop Researcher
Evan Lewis, Community Planning Workshop Researcher
Rachel Tochen, Community Planning Workshop Researcher
Mark Swenson, Community Planning Workshop Researcher
Darren Lane, Linn County Roadmaster
Brian Carroll, Linn County Parks Director

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Executive Summary

Why Develop this Mitigation Plan?

Linn County developed this Natural Hazard Mitigation Plan to protect life and property and reduce damages resulting from natural disasters by reducing vulnerability to natural hazard risks. Reducing potential damages improves public safety and economic stability. The mitigation plan identifies resources, information, and strategies to reduce risks from natural hazards, and guides the County's mitigation activities. Mitigation plan activities may be considered for funding through state and federal grant programs, including the Federal Emergency Management Agency's Hazard Mitigation Grant Program and Pre-Disaster Mitigation Competitive Grant Program, as funds are made available.

How is the Plan Funded?

Primary funding for this plan is from a grant through the federal Pre-Disaster Mitigation (PDM) Competitive Grant Program for pre-disaster mitigation planning and projects addressing natural hazards. The grant program is administered by the Federal Emergency Management Agency (FEMA). The County contributed additional matching funds of at least 25 percent.

How is the Plan Organized?

The Mitigation Plan is organized into three volumes. Volume I contains the executive summary plus five plan sections: Introduction; Community Profile; Risk Assessment; Action Plan; and Plan Implementation and Maintenance. These sections detail how the plan was developed and what action items are proposed. The five-year action plan matrix is included in the Executive Summary. Volume II contains the six natural hazard sections – Flood, Landslide, Wildfire, Severe Weather, Drought and Earthquake – and a Multi-hazard section. The hazard-specific sections provide background information on each hazard, specific action items, and local, county, and state resources. The appendices in Volume III provide information on the plan development process and other technical resources.

What is the Plan's Mission?

The mission statement expresses the purpose and defines the primary function of the Mitigation Plan. The plan mission answers the following three questions: 1) Who does the plan serve? 2) What does the Plan do? 3) What can the plan accomplish? The Hazard Mitigation Steering Committee developed and adopted the following Plan Mission:

> *The mission of the Linn County Natural Hazard Mitigation Plan is to reduce the impact of natural hazards on the community through planning, communication, coordination and partnership development.*

Who Participated in Developing the Plan?

The Linn County Natural Hazards Mitigation Plan was developed under a collaborative process through the participation of Linn County citizens, private business representatives, public agencies, special districts and private organizations. The planning process was coordinated through the Linn County Planning and Building Department (Department). The Steering Committee is comprised of a diverse group of Linn County department officials and citizens with extensive understanding of the geography, history and issues critical to guiding the development of the natural hazard mitigation plan. Additional public and agency participation through a stakeholder survey and open committee meetings played a key role in the development of goals and action items.

What are Plan Goals and Objectives?

The Mitigation Plan goals and objectives describe the steps that Linn County, public and private agencies, organizations, and citizens can take toward reducing risk from natural hazards. The Steering Committee, in conjunction with public and agency input, developed the following three plan goals and corresponding objectives.

Goal #1: Enhance coordination and communication among Linn County stakeholders to implement the Plan

- Objective 1.1: Establish and maintain methods to ensure plan implementation
- Objective 1.2: Provide leadership to promote, communicate, and support disaster safety messages and activities

Goal #2: Protect life, the built environment and natural systems through County policies, procedures and services

- Objective 2.1: Incorporate mitigation into planning and policy development
- Objective 2.2: Support the enhancement of County vulnerability assessment activities
- Objective 2.3: Ensure continuity of County emergency service functions
- Objective 2.4: Implement structural and non-structural mitigation of publicly owned facilities and infrastructure

Goal #3: Protect life, the built environment, the economy and natural resources through community-wide partnerships

- Objective 3.1: Increase citizen awareness and promote risk reduction activities through education and outreach
- Objective 3.2: Develop collaborative programs that encourage local businesses to plan for disasters
- Objective 3.3: Develop partnerships with external partners for hazard specific mitigation projects

How are the Action Items Organized?

The Linn County Natural Hazard Mitigation Plan Action Item Matrix displays the multi-hazard and hazard-specific action items adopted in the mitigation plan. The action items were developed through data collection, research and the public participation process. The matrix includes the following information for each action item.

Goals: The Action Plan lists three goals. All plan objectives are tied to one of the three goals.

Objectives: There are nine objectives listed within the plan. All action items fit within one of the nine objectives as well as being a part of the multi-hazard or hazard-specific sections.

Action Items: The mitigation plan identifies short-term and long-term action items. Action items address both multi-hazard (MH) and hazard specific issues for the hazards addressed in this plan. To facilitate implementation, each action item in the matrix includes the action item priority score, an estimated timeline, the lead organization, and a list of possible partner organizations. The action item proposal forms in ***Appendix B*** include the rationale for the proposed action item, critical issues addressed, ideas for implementation and other action item information.

Lead Organization: The lead organization is the public agency with regulatory responsibility to address the action item, or other public or private entity that is willing and able to champion the action item or otherwise organize resources and coordinate action item implementation.

Internal/External Partners: Internal and external partner organizations are public, private or nonprofit agencies that may be able to assist in the implementation of action items by providing relevant resources to the coordinating organization. External partner organizations can assist the county in implementing the action items in various functions and may include local, regional, state, or federal agencies, as well as local and regional public and private sector organizations. The internal and external partner organizations listed in the mitigation plan are potential partners recommended by the steering committee, but who were not necessarily contacted during the development of the plan.

Timeline: Action items include both short and long-term activities. Each action item includes an estimate of the timeline for implementation. *Short-term action items (ST)* are activities which may be implemented 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.

How Will the Plan be Implemented, Monitored, and Evaluated?

The plan implementation and maintenance section of this plan (Volume I, Section 5) details the formal process that will ensure that Linn County's Natural Hazards Mitigation Plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the Plan annually and producing an updated plan every five years.

The plan maintenance section describes how the County will integrate public participation throughout the plan maintenance and implementation process. This section also includes an explanation of how the County intends to incorporate the mitigation strategies outlined in this Plan into existing planning mechanisms and programs such as the Linn County comprehensive land use planning process, capital improvement planning process, and building codes enforcement and implementation.

Plan Adoption

The Linn County Board of Commissioners will be responsible for adopting the Natural Hazards Mitigation Plan by resolution. The Board has the authority to promote sound public policy regarding natural hazards.

Coordinating Body

The Hazard Mitigation Steering Committee will be the coordinating body for the hazard mitigation plan. The Steering Committee is responsible for plan maintenance, coordinating the implementation of plan action items, and undertaking the formal review process. The Linn County Planning Commission will continue to serve as the Steering Committee with other stakeholders serving on working committees as needed.

Convener

The Linn County Emergency Management Coordinator and the Planning and Building Department Director, as co-conveners, will each have authority to convene the Steering Committee to address action items; to facilitate Steering Committee meetings; and to assign tasks such as updating the plan and making presentations to the committee.

Implementation through Existing Programs

Linn County addresses statewide planning goals and legislative requirements through its comprehensive land use plan, capital improvement plans, and building codes. To the extent possible, Linn County will work to incorporate the recommended mitigation action items into existing programs and procedures.

Economic Analysis of Mitigation Projects

The two FEMA-approved methods of identifying the costs and benefits associated with natural hazard mitigation measures or projects are: (1) benefit/cost analysis; and (2) cost-effectiveness analysis. Benefit/cost analysis is used to determine 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. The County will use FEMA-approved cost/benefit methodology to identify and prioritize action items when applying for federal mitigation funding. For other projects and funding sources, the County will use other approaches. Economic analysis methods are described in detail in ***Appendix C***.

Formal Review Process

Plan maintenance and review is a critical component of the natural hazard mitigation plan. Proper maintenance of the plan will ensure that this plan will benefit Linn County's efforts to reduce the risks posed by natural hazards. Linn County and its partners have developed a method to ensure that a regular review and update of the plan occurs.

The Steering Committee will maintain and update the plan through a series of meetings. The committee will meet annually to review updates on risk assessment data and local planning efforts and to evaluate program effectiveness. The committee will also evaluate and update the plan every five years in accordance with the Disaster Mitigation Act of 2000.

Continued Public Involvement

Linn County is dedicated to involving the public directly in the ongoing reshaping and updating of the Hazard Mitigation Plan. The Steering Committee will continue to solicit feedback and input from the general public and affected agencies during annual reviews and plan updates.

Copies of the plan will be catalogued and made available at the office of Linn County Emergency Management, the Planning and Building Department, the Linn County Commissioners, the County Recorder, and other appropriate county agencies. Copies of the plan and any proposed changes will also be posted on the Linn County and the Oregon Natural Hazard Workgroup (ONHW) web sites. These sites will contain the email address and phone number to which people can direct their comments and concerns.

The hazard mitigation action items may be made a part of many county documents that will be available for public review and comment. These include the budgeting process, capital improvement project reviews, Comprehensive Plan review and in goals and objectives developed by individuals departments.

All meetings where portions of the Mitigation Plan are discussed will provide the public a forum for which they can express concerns, opinions, or ideas about the plan and parts of it. Public meetings relating to plan maintenance and implementation will be publicized on the county web page and in local newspapers to ensure an opportunity for public input.

Linn County *Natural Hazard Mitigation Plan Action Item Matrix*

Goals & Objectives	Action Item:					
GOAL 1: Enhance coordination and communication among Linn County stakeholders to implement the Plan						
Objective 1.1. Establish and maintain methods to ensure plan implementation		Action Item Priority Score	Time Line	Lead Organization	Internal/External Partners	Status
MH-ST	**Action 1.1.1.** Develop formal agreements with internal and external partners to work together on risk reduction efforts in the County	10	Ongoing	Board of County Commissioners	Emergency Management; COG; Cities; State Agencies; Non-profit Organizations; OSU Extension Service; ODOT; Private Industry; Roads	Deferred - some agreements have been made through Emergency Management.
MH-ST	**Action 1.1.2.** Explore funding opportunities with internal and external partners to implement the actions identified in the plan	10	Ongoing	Emergency Management	Oregon Emergency Management; DOGAMI; FEMA; OPDR; State & Federal Agencies;	Deferred - exploring funding opportunities is a ongoing action item and should be utilized in the update
MH-LT	**Action 1.1.3.** Establish benchmarks to assist in evaluating and updating the plan	10	3-5 years	Steering Committee	Planning and Building Dept.; Linn County Emergency Management; State & Federal Agencies; Private Industry	Deferred - Linn County has made progress on many of the Action Items in the plan. The Steering Committee determined to defer this item since it is still relevant to the 2010 update.
Objective 1.2. Provide leadership to promote, communicate, and support disaster safety messages and activities		Action Item Priority Score	Time Line	Lead Organization	Internal/External Partners	
MH-ST	**Action 1.2.1.** Encourage and support the development of local community plan supplements to the County Natural Hazard Mitigation Plan	10	Ongoing	Steering Committee	Cities; Emergency Mngt; Planning and Building Dept; OEM; OPDR; Fire Defense Board	Deferred - There are still Cities within Linn County that could develop addendums
MH-ST	**Action 1.2.2.** Develop County protocols and strategies for the dissemination of media messages that focus on individual responsibility for disaster safety and risk reduction.	10	Ongoing	Public Information Officer	Planning and Building; Emergency Management; State Agencies; FEMA	Deferred - No progress has been made due to lack of resources.
MH-ST	**Action 1.2.3.** Distribute information regarding the Natural Hazard Mitigation Plan to public officials and community leaders, and provide updates on hazard vulnerability and County hazard mitigation activities.	10	1-3 years	Steering Committee	Planning and Building; County Departments; State Agencies	Deferred - This action item was modified so the Steering Committee could better accomplish the task.

MH-ST	**Action 1.2.4.** Develop and maintain a database of current action items	10	1-3 years	Steering Committee	Planning and Building; Emergency Management	Deferred - No progress has been made due to lack of resources.
GOAL 2: Protect life, the built environment and natural systems through County policies, procedures and services						
Objective 2.1. Incorporate mitigation into planning and policy development		Action Item Priority Score	Time Line	Lead Organization	Internal/External Partners	
MH-ST	**Action 2.1.1.** Provide mitigation awareness training to Planning and Building, Public works and GIS Staff	11	1-3 years	Emergency Management	Oregon Emergency Management; DOGAMI; FEMA; ONHW; Fire Marshall; Insurance Companies; Linn County Roads	Deferred - As training is announced, it will be forwarded to Department for dissemination to their staff members.
MH-ST	**Action 2.1.2.** Develop a continuity of government plan that details how core governmental operations will be maintained in the event of an emergency	11	1-3 years	Linn County Administrative Officer	Emergency Management; Elected Officials; Board of Commissioners; County Departments	Deferred since it is not yet completed in January 2010 the County started to develop this plan.
MH-LT	**Action 2.1.3.** Evaluate current development codes to incorporate mitigation principles	11	3-5 years	Planning & Building Department	Emergency Management; Planning Commission; Board of Commissioners;	Deferred - Due to lack of resources and funds this item was not completed.
FL-ST	**Action 2.1.4.** Participate in the National Flood Insurance Program's Community Rating System	9	Ongoing	Planning & Building Department	Building Official; Emergency Management; Board of Commissioners; FEMA; Insurance Companies; Cities	Deferred - Due to lack of resources and funds this item was not completed.
FL-LT	**Action 2.1.5. D**evelop management strategies to preserve the function of the floodplain	9	Ongoing	Planning & Building Department	Building Official; Cities; FEMA; DSL; ODFW; OWRD; Watershed Councils	Deferred -Due to lack of resources and funds this item was not completed.
MH-LT	**Action 2.1.6.** Develop a scour protection plan for Linn County Bridges.	11	Ongoing	Road Department	Bridge Maintenance Supervisor	new - See appendix
Objective 2.2. Support the enhancement of County vulnerability assessment activities		Action Item Priority Score	Time Line	Lead Organization	Internal/External Partners	
MH-ST	**Action 2.2.1.** Develop an inventory of county assets including replacement costs	11	1-3 years	General Services	Linn County Property Management; Treasurer; Assessor; GIS; Road Department	Deferred - Due to lack of resources and funds this item was not completed.

EQ-LT	**Action 2.2.2.** Re-run DOGAMI HAZUS with local refined data	8	Ongoing	GIS Department	Emergency Management; Planning and Building; Assessor; DOGAMI; FEMA	Deferred - Linn Co. Updated the information from the final DOGAMI Hazus information provided. Since HB 3375 (2003)
FL-LT	**Action 2.2.3.** Update Flood Insurance Rate Maps (FIRM)	9	2-5 years	Planning & Building Department	Building Official; Emergency Management; Insurance Companies; Cities; FEMA; OEM;GIS	Deferred - In progress during update. Should be updated September 2010
WS-ST	**Action 2.2.4.** Develop pre-storm strategies for coordinated debris removal following wind and winter storms	7	Ongoing	Road Department	Emergency Management; Sheriff; 911 Coordinator; Utility Companies, Cities	Deferred - Due to lack of resources and funds this item was not completed.
WS-LT	**Action 2.2.5.** Identify severe weather hazard areas and inventory vulnerable buildings, infrastructure and critical facilities.	7	2-5 years	Emergency Management	Road Dept; Planning & Building; Assessor; GIS; Emergency Services Providers; ODOT; OEM; FEMA; Insurance Companies; Utility Companies	Deferred - Due to lack of resources and funds this item was not completed.
LS-LT	**Action ~~2.2.6.~~** Use final DOF Debris Flow Hazard maps and improved development data to update the landslide vulnerability and risk analysis.	0	3-5 years	Emergency Management	GIS; Assessor; Road Department; Planning and Building; DOF; DOGAMI; OEM; FEMA	Delete - The maps identified in the 2005 plan had inaccurate data and were never adopted.
WF-ST	**Action ~~2.2.7.~~** Develop wildfire hazard maps and vulnerable asset inventories.	0	1-3 years	Emergency Management	GIS; Assessor; Road Department; Planning and Building; DOF; OEM; FEMA; State and Local Fire Marshalls; Local RFPDs, Insurance Companies	Completed/Delete - ODF and local Rural Fire Districts completed this item, therefore the action item will be deleted
DR-ST	**Action 2.2.6** Support local agency programs that promote measures to reduce water use during drought emergencies.	4	Ongoing	Board of County Commissioners	Planning and Building; Emergency Management; Parks and Recreation Department; NRCS; Department of Agriculture; WRD; Local Water Districts	New - See Appendix
MH-LT	**Action 2.2.7.** Geo-code the location, type, footprint and elevation data for buildings, infrastructure, and critical facilities in natural hazard areas.	11	Ongoing	GIS Department	Assessor; Planning & Building Dept.; Emergency Management; Road Dept.; FEMA; OEM; DOGAMI; Cities; Insurance Companies	Deferred - Due to lack of resources and funds this item was not completed.
LS-LT	**Action 2.2.8.** Continue to improve identification of debris flow area in Linn County by using mapping with current data technology.	5	3-5 years	GIS Department	Board of Commissioners; DOGAMI	New action Item replacing Action Item 2.2.6 in the 2005 Plan

LS-LT	**Action 2.2.9.** Implement Linn County existing development standards for structures located within a “mass movement area”.	5	Ongoing	Planning & Building Department	GIS Department; Emergency Management;DOGAMI	New-See Appendix
MH-LT	**Action 2.2.10.** Develop a County wide List and Evaluate for Flood, Scour, Seismic and structural integrity of all bridge crossings leading to private structures on private and public lands.	11	Ongoing	Emergency Management	Linn County Road Department, Private land owners, Public agencies	New - See Appendix
FL-LT	**Action 2.2.11.** Discuss funding opportunities to conduct a new hydraulic study for Linn County.	9	Ongoing	Road Department	Surveyor; GIS	new - See appendix
FL-LT	**Action 2.2.12.** Develop a risk analysis for each section identified in the Linn County Natural Hazard Mitigation Plan	11	Ongoing	Steering Committee	County Departments	new - See appendix
Objective 2.3. Ensure continuity of County emergency service functions		Action Item Priority Score	Time Line	Lead Organization	Internal/External Partners	
MH-ST	**Action 2.3.1.** Update the Emergency Operations Plan	11	1-3 years	Emergency Management	County Administrator; Sheriff; Road Dept; COG; Cities; 911 Coordinator; State Police; Utility Companies	Deferred - development of plan is in progress
MH-LT	**Action 2.3.2.** Consolidate the Mitigation Plan, Emergency Operations Plan, recovery plans, and continuity of operations plans into a Unified Disaster Plan	11	3-5 years	Emergency Management	County Administrator; Sheriff; Road Dept; COG; Cities; 911 Coordinator; State Police; Utility Companies	Since the update is not completed, the Action Item is deferred - The County is working on a revision of the Basic Plan portion of the EOP
MH-ST	**Action 2.3.3.** Identify and evaluate county-owned emergency transportation routes and determine which roads and bridges are critical to the transportation network	11	1-3 years	Road Department	Emergency Management; 911 Coordinator; Sheriff; State Police; OEM; Fire Marshall	Deferred - This is an ongoing process to provide continual improvement to the County wide Transportation network.
Objective 2.4. Implement structural and non-structural mitigation of publicly owned facilities and infrastructure		Action Item Priority Score	Time Line	Lead Organization	Internal/External Partners	
EQ-ST	**Action 2.4.1.** Develop a program to implement non-structural retrofit of County staff offices and workspaces	8	1-3 years	General Services	General Services; County Insurance Carrier; OEM; OR-OSHA; BC; Safety Committee	Deferred - lack of County funds to complete action item

EQ-LT	**Action 2.4.2.** Conduct a seismic vulnerability assessment of all County-owned structures and prioritize vulnerable publicly owned structures	8	3-5 years	General Services	General Services; Board of Commissioners; Building Official; OEM; Assessor; DOGAMI; Safety Committee	Deferred - lack of County funds to complete action item
EQ-LT	**Action 2.4.3.** Implement structural mitigation projects for prioritized, vulnerable publicly owned structures identified in Action 2.4.2.	8	5-Mar	General Services	General Services; Board of Commissioners; Building Official; OEM; Assessor; DOGAMI; Safety Committee	new - See appendix
EQ-LT	**Action 2.4.4.** Conduct a seismic vulnerability assessment of all County-owned bridges on lifeline routes and prioritize vulnerable bridges	8	3-5 years	Road Department	County Engineer; Board of Commissioners; DOGAMI; Fire Marshall; 911 Coordinator; OEM; ODOT; Sheriff	Deferred - funding have not been made available to complete new assessment
EQ-LT	**Action 2.4.5.** Implement structural mitigation projects for prioritized, vulnerable publicly owned bridges identified in Action 2.4.3	8	3-5 years	Road Department	General Services; Road Department; Board of Commissioners; FEMA; DOGAMI; OEM; ODOT; U.S. DOT	Modified to create Action 2.4.3

GOAL 3: Protect life, the built environment, the economy and natural resources through community-wide partnerships

Objective 3.1. Increase citizen awareness and promote risk reduction activities through education and outreach		Action Item Priority Score	Time Line	Lead Organization	Internal/External Partners	
MH-ST	**Action 3.1.1.** Maintain a public awareness campaigns aimed at homeowners, children, the elderly, and non-English speaking residents to make them aware of what they can do to prepare for natural hazard events.	9	Ongoing	Emergency Management	Red Cross; COG; Cities; Linn Benton ESD; United Way; State Agencies; Hospitals; Insurance Companies; Children and Families Commission	Deferred - lack of funding and resources
DR-LT	**Action 3.1.2** Support local agency programs for farmers and ranchers, that provide education and training on water conservation measures, including drought management practices for crops and livestock.	2	Ongoing	Planning and Building Department	OSU Extension Services; NRCS; Farm Bureau: WRD; ODFW; Watershed Councils; Water Districts	new - See appendix
LS-ST	**Action ~~3.1.2.~~** Use and publicize the Oregon Department of Forestry's debris flow warning system	0	Ongoing	Emergency Management	Dept of Forestry; DOGAMI; OEM; ODOT; Road Department; Radio Stations	Delete - The debris flow warning system is no longer part of ODF functions; a new action item is created.
LS-ST	**Action 3.1.3.** Use and publicize the NOAA debris flow warning system	3	Ongoing	Emergency Management	Dept of Forestry; DOGAMI; OEM; ODOT; Road Department; Radio Stations	new - See appendix
LS-ST	**Action 3.1.4.** Increase public education related to landslide hazards by distributing DOGAMI landslide informational brochure.	3	Ongoing	Emergency Management	Dept of Forestry; DOGAMI; OEM; ODOT; Road Department; Radio Stations	new - See appendix

Objective 3.2. Develop collaborative programs that encourage local businesses to plan for disasters		Action Item Priority Score	Time Line	Lead Organization	Internal/External Partners	
MH-LT	**Action 3.2.1.** Encourage small businesses to develop recovery plans in the event of a disaster and to implement non-structural mitigation	9	3-5 years	Emergency Management	Business Development Coordinator; COG; LBCC Business Development; Cities;	Deferred - lack of funding and resources
Objective 3.3. Develop partnerships with external partners for hazard specific mitigation projects		Action Item Priority Score	Time Line	Lead Organization	Internal/External Partners	
EQ-ST	**Action 3.3.1.** Assist K-12 schools, child care facilities and private schools to develop vulnerability assessment and mitigation projects to improve safety	6	1-3 years	Linn-Benton Educational Service District	Emergency Management; School Districts; Private Schools; American Red Cross; DOGAMI; OEM; Commission on Children and Families	Deferred; The Linn-Benton Educational Service District lost the position duet o cut backs and has not completed or made progress on this action item.
FL-LT	**Action 3.3.2.** Encourage multi-objective stream and river enhancement projects that maximize flood mitigation	7	Ongoing	Road Department	Emergency Management; Watershed Councils; Water Control Districts; DSL; ODFW; DOF; DEQ; FEMA; USCE; Cities; Planning and Building Department	Deferred - Since there are future projects that would support multi-objective stream and river enhancement projects that maximize flood mitigation
WF-LT	**Action 3.3.3.** Conduct community based fuel reduction demonstration projects in the interface	4	Ongoing	Oregon Department of Forestry	Emergency Management; Department of Forestry; Fire Districts; Cities; OEM	Deferred; the program can still continue to reduce fire hazard.
WF-ST	~~**Action 3.3.4.**~~ Develop a countywide Community Wildfire Protection Plan	0	1-3 years	Emergency Management	Department of Forestry; Fire Districts; Cities; Fire Marshall; OEM	Completed/Delete - CWPP is complete
WF-ST	**Action 3.3.4.** Partner with the Oregon Department of Forestry and Rural Fire Districts to promote home site assessment programs for the wildfire hazard	4	Ongoing	Oregon Department of Forestry	Emergency Management; Department of Forestry; Fire Districts; Cities; Fire Marshall; OEM	Deferred - ongoing project
WS-LT	~~**Action 3.3.6.**~~ Develop partnerships to implement programs to keep trees from threatening lives, property, and public infrastructure during wind and winter storms	0	2-5 years	Emergency Management	Road Dept; Parks Dept; Utilities; Insurance Cos; OSU Extension Service; Timber Cos; DOF; Arbor Care Companies	delete - Not Feasible to accomplish
MH-LT	**Action 3.3.5.** Implement a routine bridge inspection program for bridges identified in Action 2.2.10 to ensure the bridges continues to be structurally sound.	9	Ongoing	Road Department	Planning and Building; Linn County Fire Defense Board; Private Land owners Public agencies	New - See Appendix
WS-LT	**Action 3.3.6.** Develop a partnership to identify areas where required visual buffers along designated scenic highways have potential blow down issues endangering life and infrastructure.	5	Ongoing	Emergency Management	Road Dept; ODOT;ODF; Private timber owners; private land owners	New - See Appendix
MH-LT	**Action 3.3.7.** Create database of local private resources including equipment, labor, special expertise and operating area as well as contact information that could be mobilized rapidly in event of fire, earthquake, flood or severe weather impacts.	9	Ongoing	Emergency Management	Road Dept; ODOT;ODF; Private timber owners; private land owners	New - See Appendix

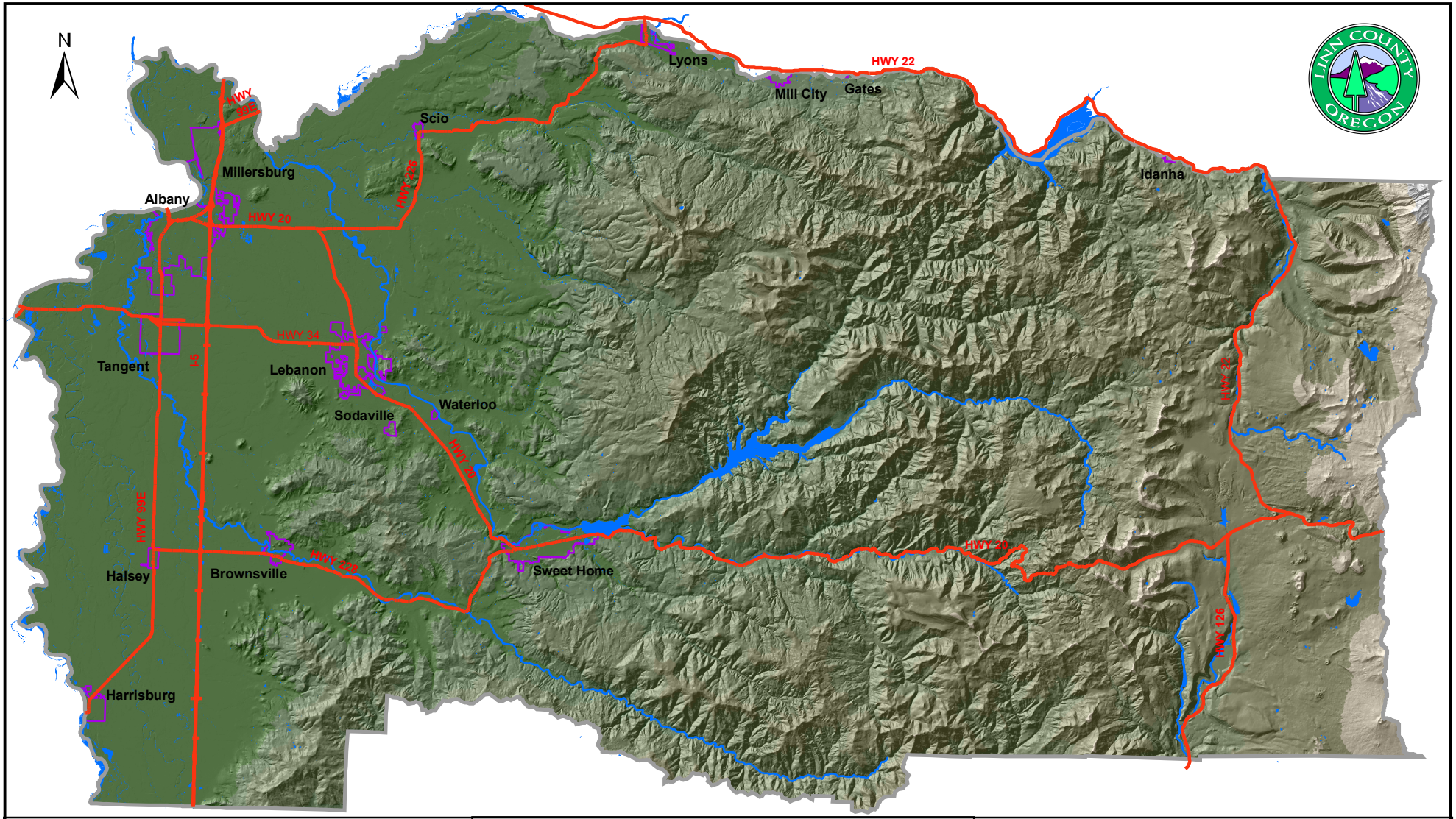
Linn County
Natural Hazard Mitigation Plan
Maps

The Linn County Natural Hazard Mitigation Plan uses a number of mapped resources which were created by the Linn County Geographic Information Systems (GIS) Department. The following table is a reference guide to the types of information included in the maps that were used to create the plan. The maps in ***Appendix D*** were generated by the Oregon Department of Geology and Mineral Industries (DOGAMI) and used in the analysis of potential earthquake hazards.

Map #	Map Title	Featured Information	Relevant Plan Chapter
1	Linn County, Oregon	County boundary; Cities; Highways; Rivers; Water Bodies; Topography	Section 1: Introduction
2	Critical Infrastructure	Major roads; Bridges; Hospitals; Dams Schools; Emergency Facilities; Community Centers	Section 2: Community Profile Section 3: Risk Assessment
3	Lifeline Routes: Albany	Priority lifeline routes	Section 2: Community Profile
4	Lifeline Routes: Halsey	Priority lifeline routes	Section 2: Community Profile
5	Lifeline Routes: Lebanon	Priority lifeline routes	Section 2: Community Profile
6	Lifeline Routes: Scio	Priority lifeline routes	Section 2: Community Profile
7	Lifeline Routes: Sweet Home	Priority lifeline routes	Section 2: Community Profile
8	Precipitation	Annual Precipitation	Section 2: Community Profile Section 6: Floods
9	Watersheds	Fifth Field Watersheds	Section 2: Community Profile Section 6: Floods
10	FEMA Flood Plain	100-year Flood Zone	Section 6: Floods
11	Mass Movement Areas	Mass Movement; Vulnerable Structures and Roads	Section: 7: Landslide
12	Potential Debris Flow Areas	Debris Flow Hazards; Vulnerable Structures and Roads	Section 7: Landslide
13	Rural Fire Districts	Fire Districts	Section 2: Community Profile Section 8: Wildfire

14	Peak Ground Acceleration – Crustal	Peak Ground Acceleration from a Crustal Fault Earthquake (Appendix D)	Section 10: Earthquake Appendix D
15	Peak Ground Acceleration – Cascadia	Peak Ground Acceleration from a Cascadia Subduction Earthquake (Appendix D)	Section 10: Earthquake Appendix D
16	Ground Shaking Amplification	Relative Ground Shaking Amplification Susceptibility (Appendix D)	Section 10: Earthquake Appendix D
17	Liquefaction Susceptibility	Relative Liquefaction Susceptibility (Appendix D)	Section 10: Earthquake Appendix D
18	Earthquake Induced Susceptibility	Relative Earthquake Induced Landslide Susceptibility (Appendix D)	Section 10: Earthquake Appendix D
19	Landslide Areas	Identified Landslides (Appendix D)	Section 10: Earthquake Appendix D
20	Repetitive Loss Areas	General Area of Repetitive Loss	Section 5: Floods

Note: *The information on the maps in this plan was derived from the Linn County GIS and other sources. Care was taken in the creation of these maps, but is provided "as is". Linn County cannot accept any responsibility for any errors, omissions or positional accuracy, and therefore, there are no warranties that accompany these products (the maps). In no way does this product represent or constitute a Land Survey. Users are cautioned to field verify information on this product before making any decisions.*



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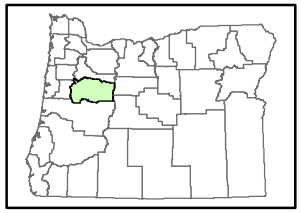
Map Created by the Linn County GIS Department
Data Provided by Linn County and the

10/21/05

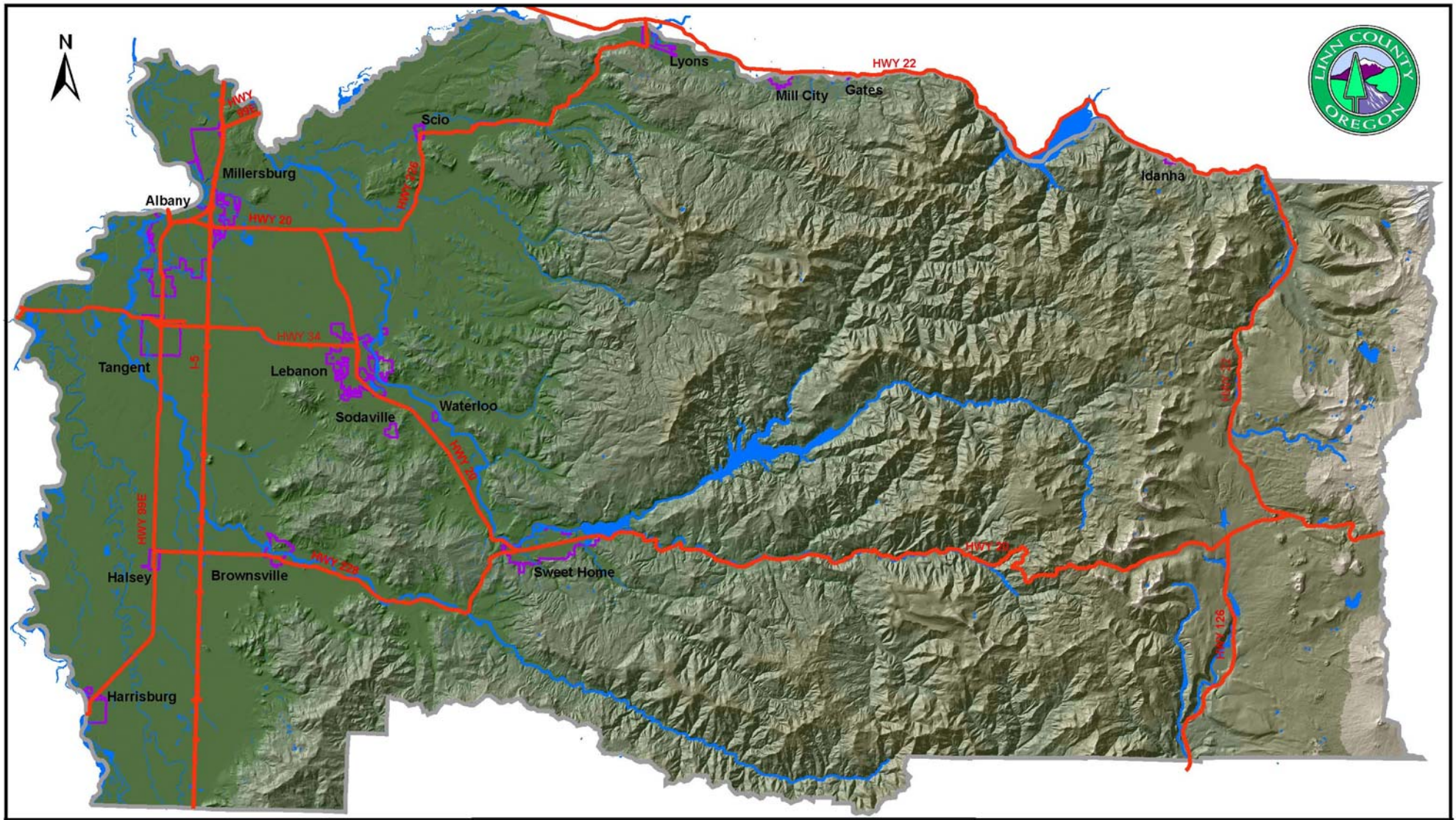


Linn County, Oregon

1 inch equals 7.20 miles

Legend

- State Highways
- City Limits
- Water Bodies
- County Boundary
- Rivers



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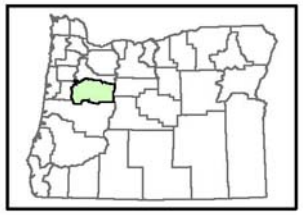

Linn County, Oregon

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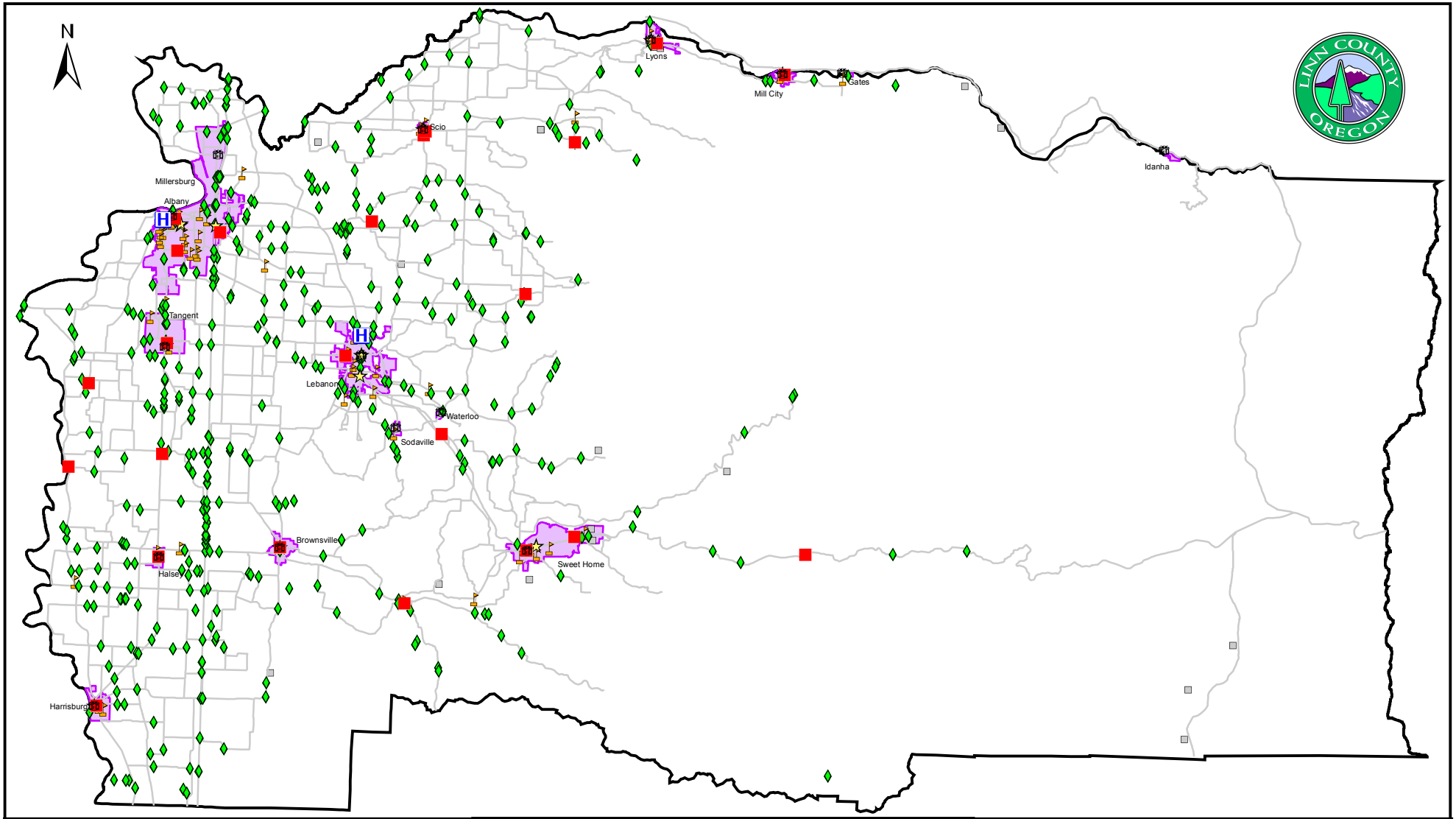

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10/21/05

Critical Infrastructure Linn County, Oregon

1 inch equals 7.20 miles

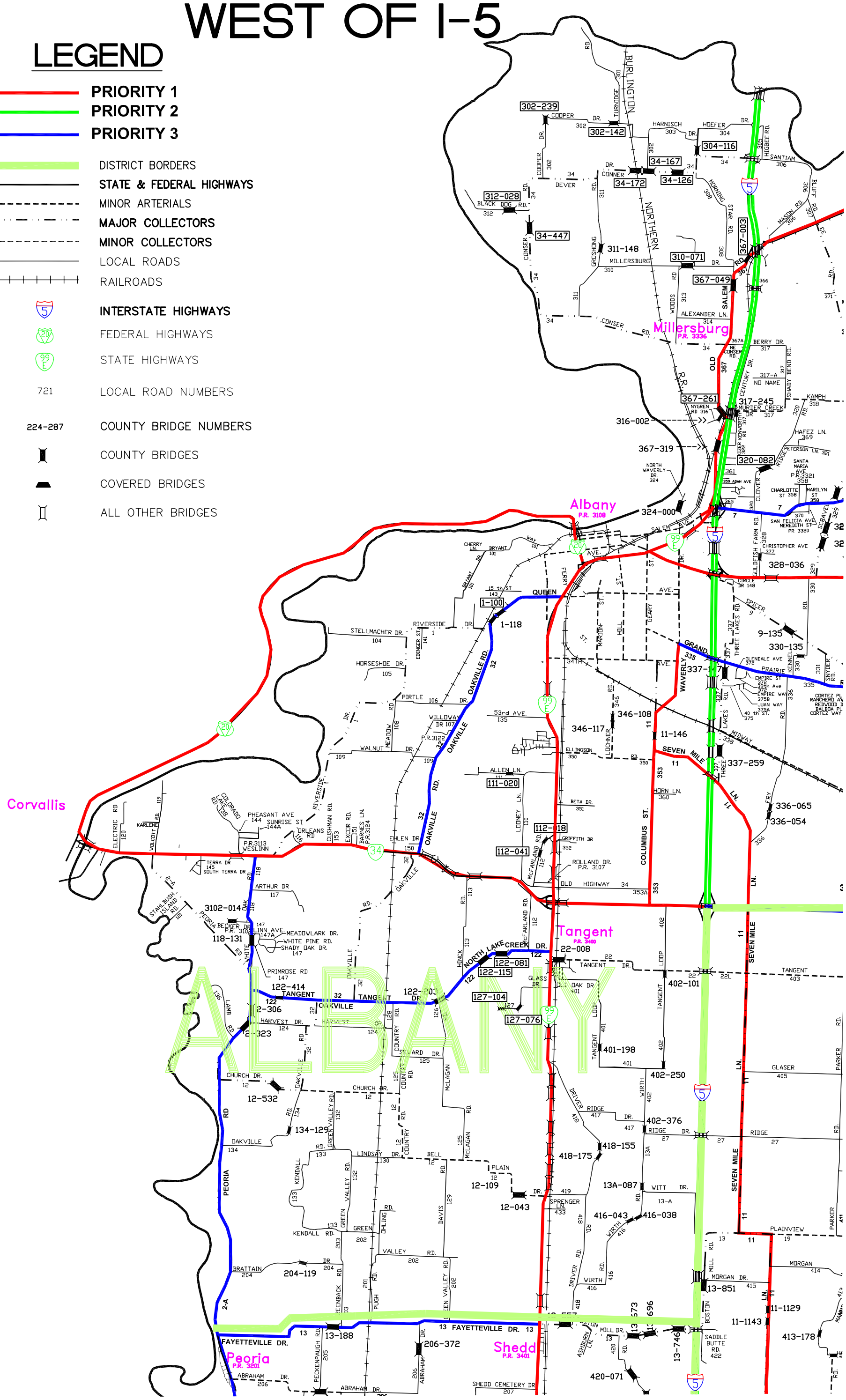
Legend

- City Halls
- Fire Stations
- Police Stations
- Bridges
- Schools
- Major Roads
- Hospitals
- Dams
- City Limits
- County Boundary

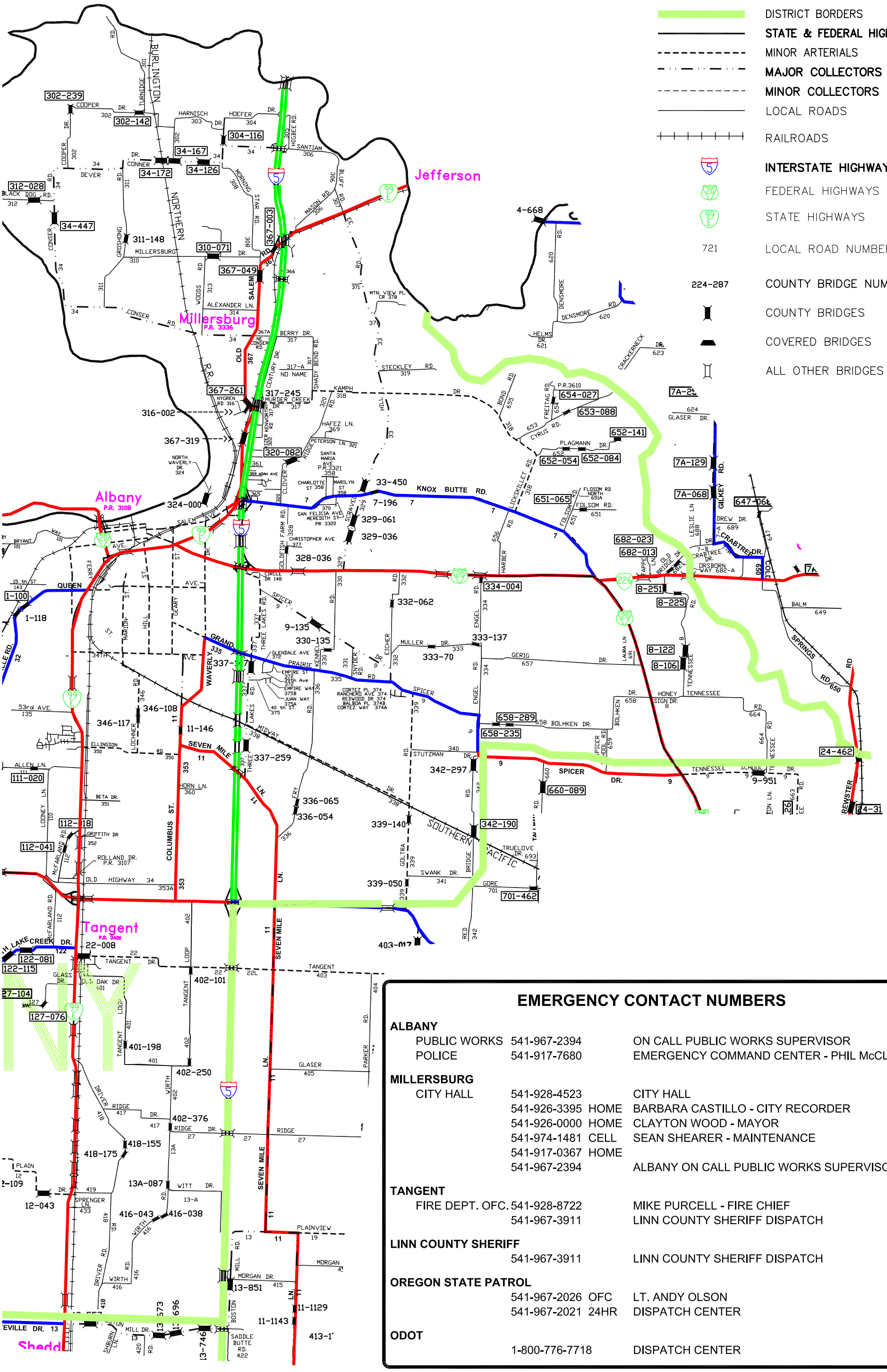
ALBANY DIST
WEST OF I-5

LEGEND

- PRIORITY 1
- PRIORITY 2
- PRIORITY 3
- DISTRICT BORDERS
- STATE & FEDERAL HIGHWAYS
- MINOR ARTERIALS
- MAJOR COLLECTORS
- MINOR COLLECTORS
- LOCAL ROADS
- RAILROADS
- INTERSTATE HIGHWAYS
- FEDERAL HIGHWAYS
- STATE HIGHWAYS
- 721 LOCAL ROAD NUMBERS
- 224-287 COUNTY BRIDGE NUMBERS
- COUNTY BRIDGES
- COVERED BRIDGES
- ALL OTHER BRIDGES

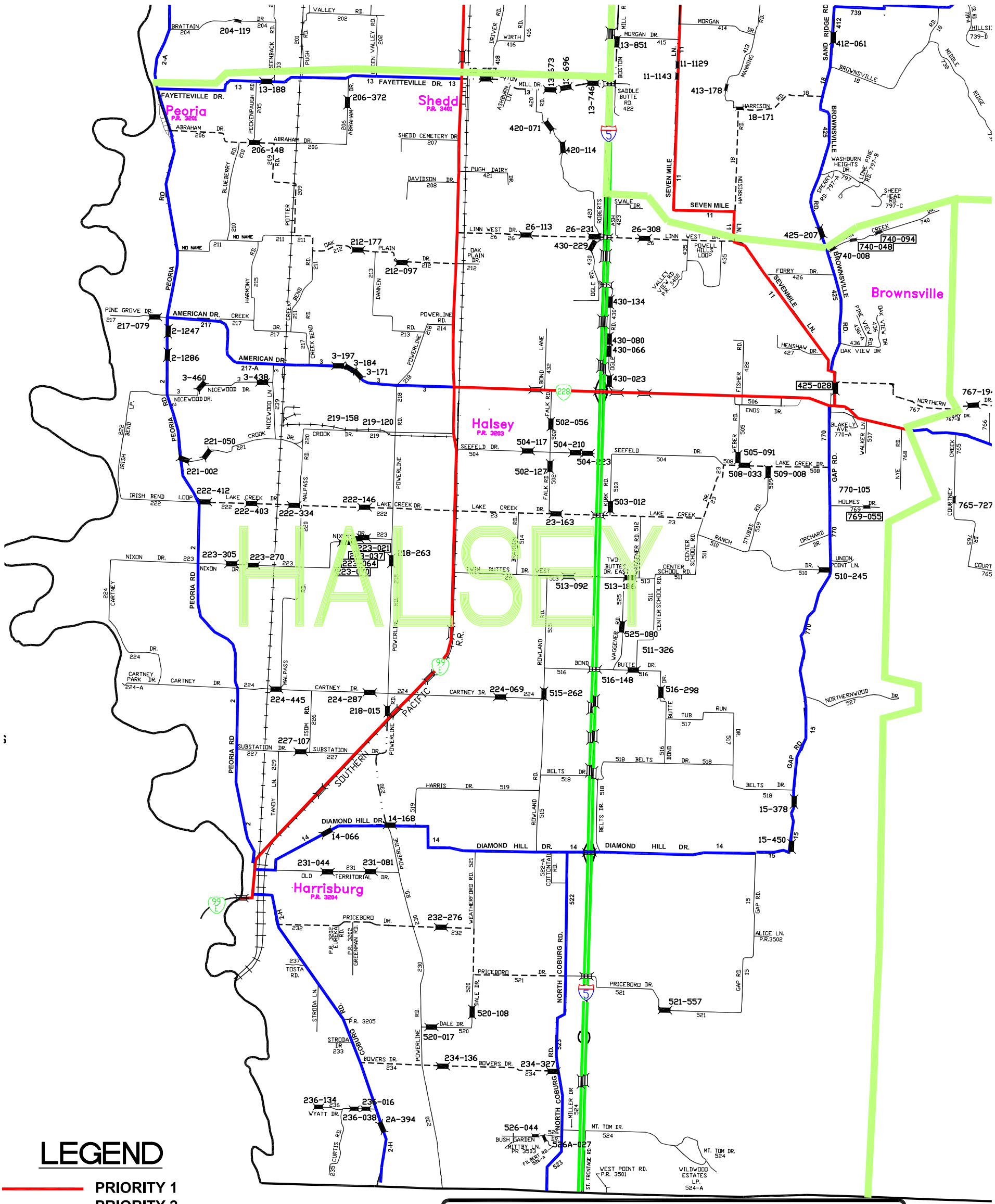


ALBANY DIST
EAST OF I-5



EMERGENCY CONTACT NUMBERS

ALBANY			
PUBLIC WORKS	541-967-2394		ON CALL PUBLIC WORKS SUPERVISOR
POLICE	541-917-7680		EMERGENCY COMMAND CENTER - PHIL McCLEAN
MILLERSBURG			
CITY HALL	541-928-4523		CITY HALL
	541-926-3395	HOME	BARBARA CASTILLO - CITY RECORDER
	541-926-0000	HOME	CLAYTON WOOD - MAYOR
	541-974-1481	CELL	SEAN SHEARER - MAINTENANCE
	541-917-0367	HOME	
	541-967-2394		ALBANY ON CALL PUBLIC WORKS SUPERVISOR
TANGENT			
FIRE DEPT. OFC.	541-928-8722		MIKE PURCELL - FIRE CHIEF
	541-967-3911		LINN COUNTY SHERIFF DISPATCH
LINN COUNTY SHERIFF			
	541-967-3911		LINN COUNTY SHERIFF DISPATCH
OREGON STATE PATROL			
	541-967-2026	OFC	LT. ANDY OLSON
	541-967-2021	24HR	DISPATCH CENTER
ODOT			
	1-800-776-7718		DISPATCH CENTER



LEGEND

- PRIORITY 1
- PRIORITY 2
- PRIORITY 3
- DISTRICT BORDERS
- STATE & FEDERAL HIGHWAYS
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- MAJOR COLLECTORS
- MINOR COLLECTORS
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- RAILROADS
- INTERSTATE HIGHWAYS
- FEDERAL HIGHWAYS
- STATE HIGHWAYS
- 721 — LOCAL ROAD NUMBERS
- 224-287 — COUNTY BRIDGE NUMBERS
- COUNTY BRIDGES
- COVERED BRIDGES
- ALL OTHER BRIDGES

EMERGENCY CONTACT NUMBERS

HALSEY			
CITY HALL	541-369-2522		CITY HALL
CITY RECORDER	541-998-5833	HOME	JUDY CLEETON - CITY RECORDER
	503-969-0438	CELL	
PUBLIC WORKS	541-501-9134	CELL	ANDY RIDINGER - PUBLIC WORKS
	541-466-5421	HOME	
CITY CLERK	541-369-2694	HOME	ERICA METCALF - CITY CLERK
BROWNSVILLE			
PUBLIC WORKS	541-409-3700		PUBLIC WORKS EMERGENCY
HARRISBURG			
CITY HALL	541-995-6655		
PUBLIC WORKS	541-995-6277	HOME	TIM BUNNELL - SUPERINTENDANT
	541-953-0063	CELL	
PUBLIC WORKS	541-461-0307	HOME	RICK NELSON - CREW LEADER
	541-521-4349	CELL	
LINN COUNTY SHERIFF			
	541-967-3911		LINN COUNTY SHERIFF DISPATCH
OREGON STATE PATROL			
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	541-967-2021	24HR	DISPATCH CENTER
ODOT			
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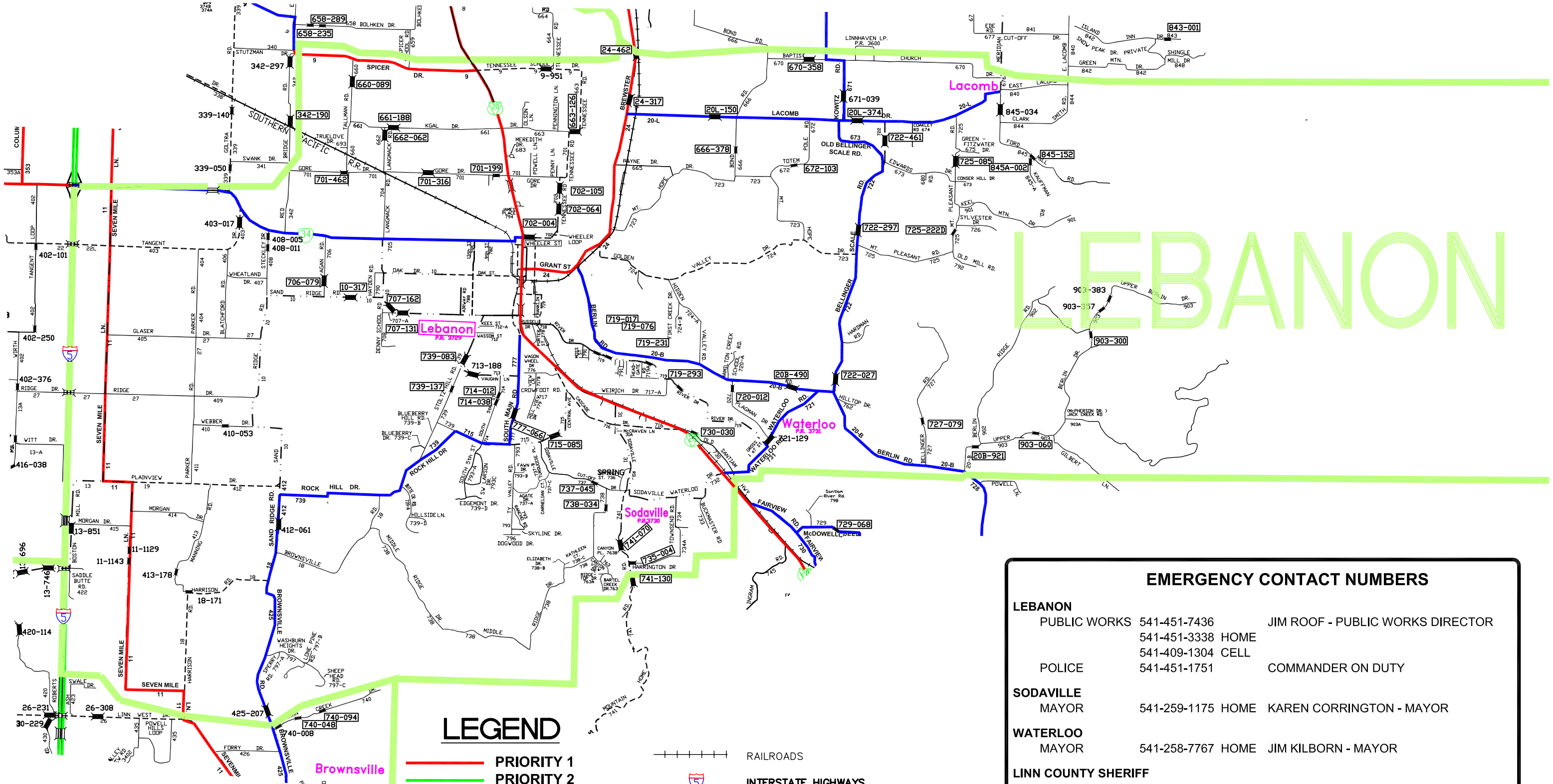

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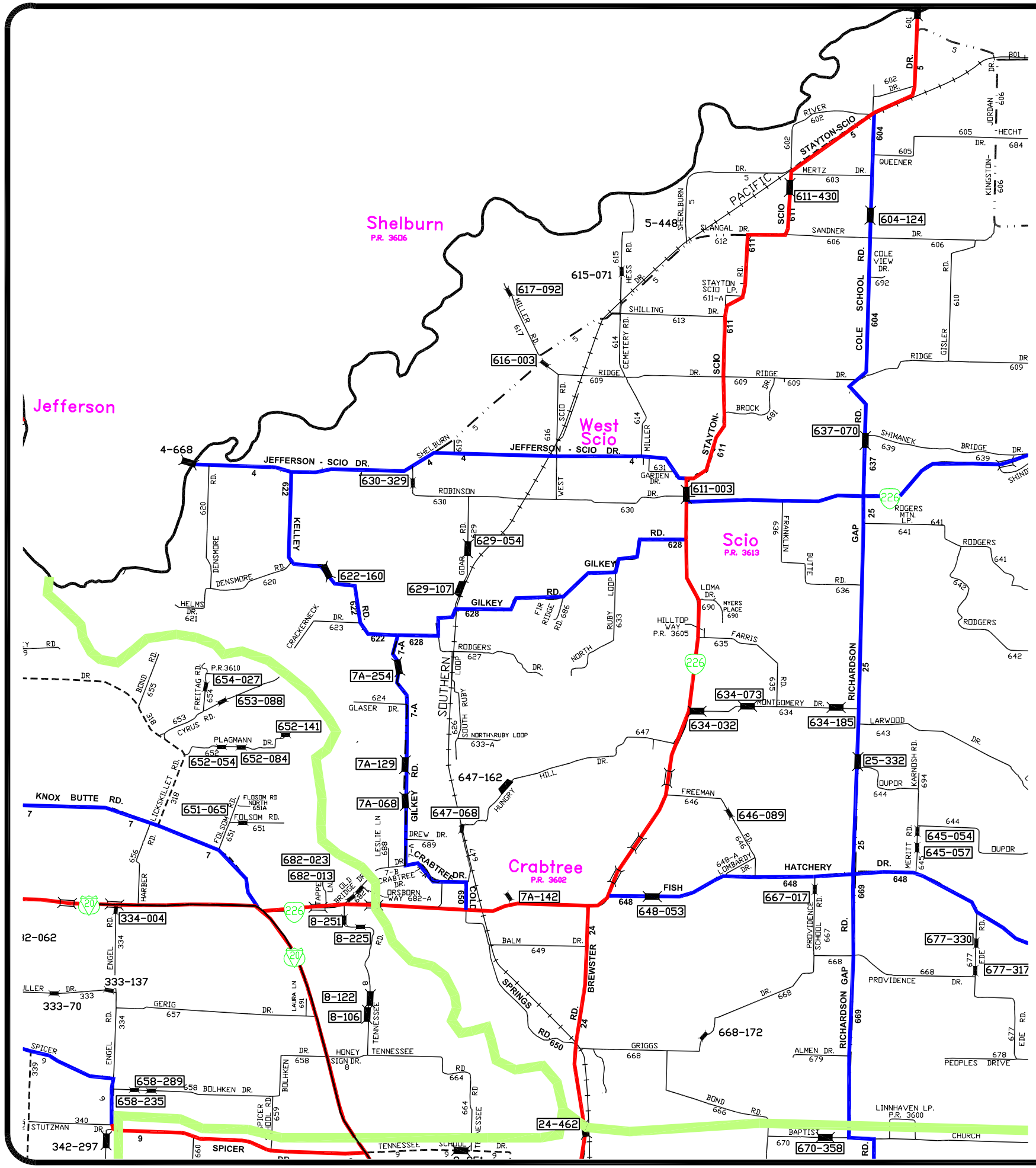
- COUNTY BRIDGES
- COVERED BRIDGES

EMERGENCY CONTACT NUMBERS

LEBANON			
PUBLIC WORKS	541-451-7436		JIM ROOF - PUBLIC WORKS DIRECTOR
	541-451-3338	HOME	
	541-409-1304	CELL	
POLICE	541-451-1751		COMMANDER ON DUTY
SODAVILLE			
MAYOR	541-259-1175	HOME	KAREN CORRINGTON - MAYOR
WATERLOO			
MAYOR	541-258-7767	HOME	JIM KILBORN - MAYOR
LINN COUNTY SHERIFF			
	541-967-3911		LINN COUNTY SHERIFF DISPATCH
OREGON STATE PATROL			
	541-967-2026	OFC	LT. ANDY OLSON
	541-967-2021	24HR	DISPATCH CENTER
ODOT			
	1-800-776-7718		DISPATCH CENTER

SCIO DISTRICT WEST OF RICHARDSON GAP



LEGEND

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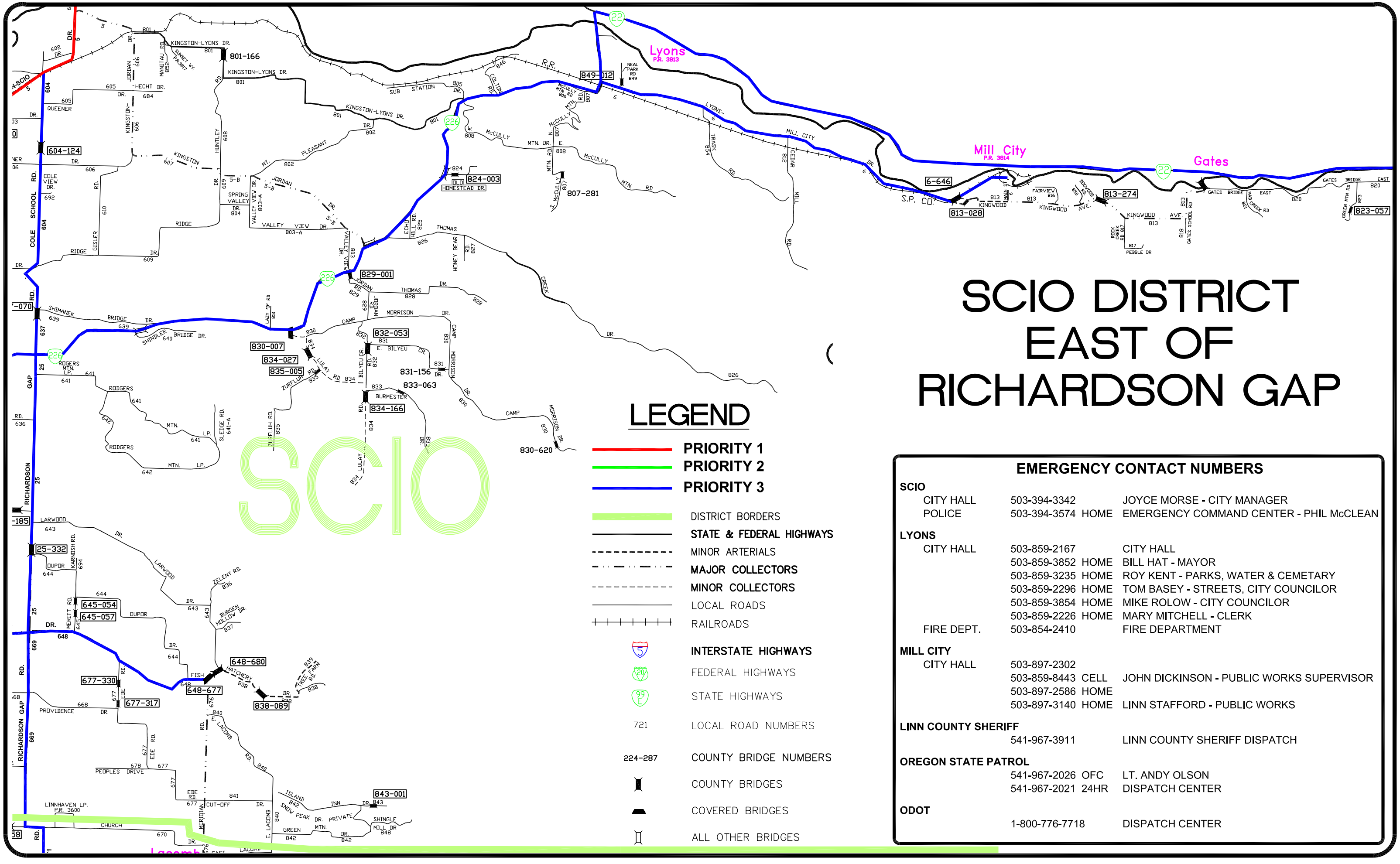
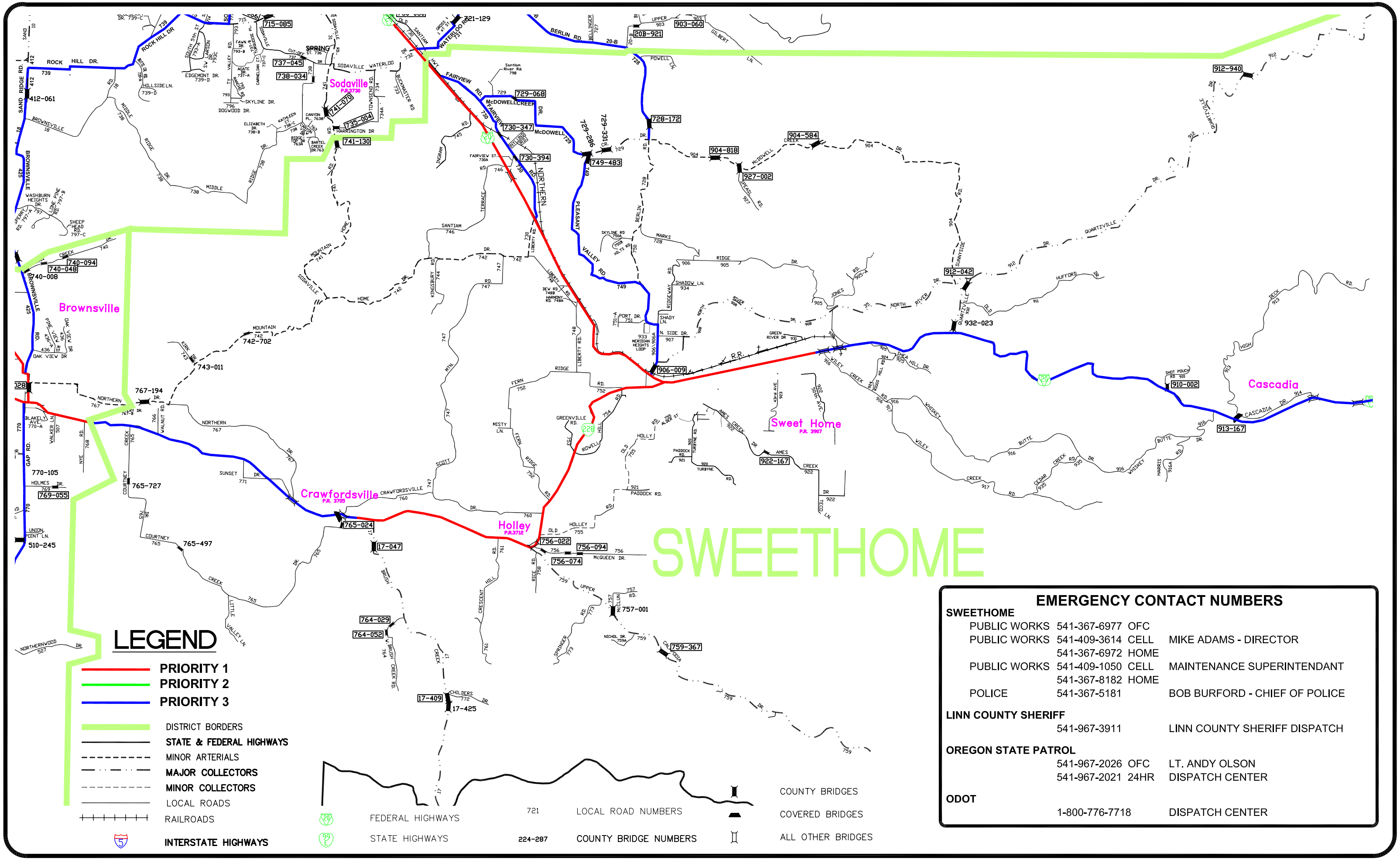


SCIO DISTRICT EAST OF RICHARDSON GAP

EMERGENCY CONTACT NUMBERS

SCIO			
CITY HALL	503-394-3342		JOYCE MORSE - CITY MANAGER
POLICE	503-394-3574	HOME	EMERGENCY COMMAND CENTER - PHIL McCLEAN
LYONS			
CITY HALL	503-859-2167		CITY HALL
	503-859-3852	HOME	BILL HAT - MAYOR
	503-859-3235	HOME	ROY KENT - PARKS, WATER & CEMETARY
	503-859-2296	HOME	TOM BASEY - STREETS, CITY COUNCILOR
	503-859-3854	HOME	MIKE ROLOW - CITY COUNCILOR
	503-859-2226	HOME	MARY MITCHELL - CLERK
FIRE DEPT.	503-854-2410		FIRE DEPARTMENT
MILL CITY			
CITY HALL	503-897-2302		
	503-859-8443	CELL	JOHN DICKINSON - PUBLIC WORKS SUPERVISOR
	503-897-2586	HOME	
	503-897-3140	HOME	LINN STAFFORD - PUBLIC WORKS
LINN COUNTY SHERIFF			
	541-967-3911		LINN COUNTY SHERIFF DISPATCH
OREGON STATE PATROL			
	541-967-2026	OFC	LT. ANDY OLSON
	541-967-2021	24HR	DISPATCH CENTER
ODOT			
	1-800-776-7718		DISPATCH CENTER



EMERGENCY CONTACT NUMBERS

SWEETHOME

PUBLIC WORKS	541-367-6977	OFC	
PUBLIC WORKS	541-409-3614	CELL	MIKE ADAMS - DIRECTOR
	541-367-6972	HOME	
PUBLIC WORKS	541-409-1050	CELL	MAINTENANCE SUPERINTENDANT
	541-367-8182	HOME	
POLICE	541-367-5181		BOB BURFORD - CHIEF OF POLICE

LINN COUNTY SHERIFF

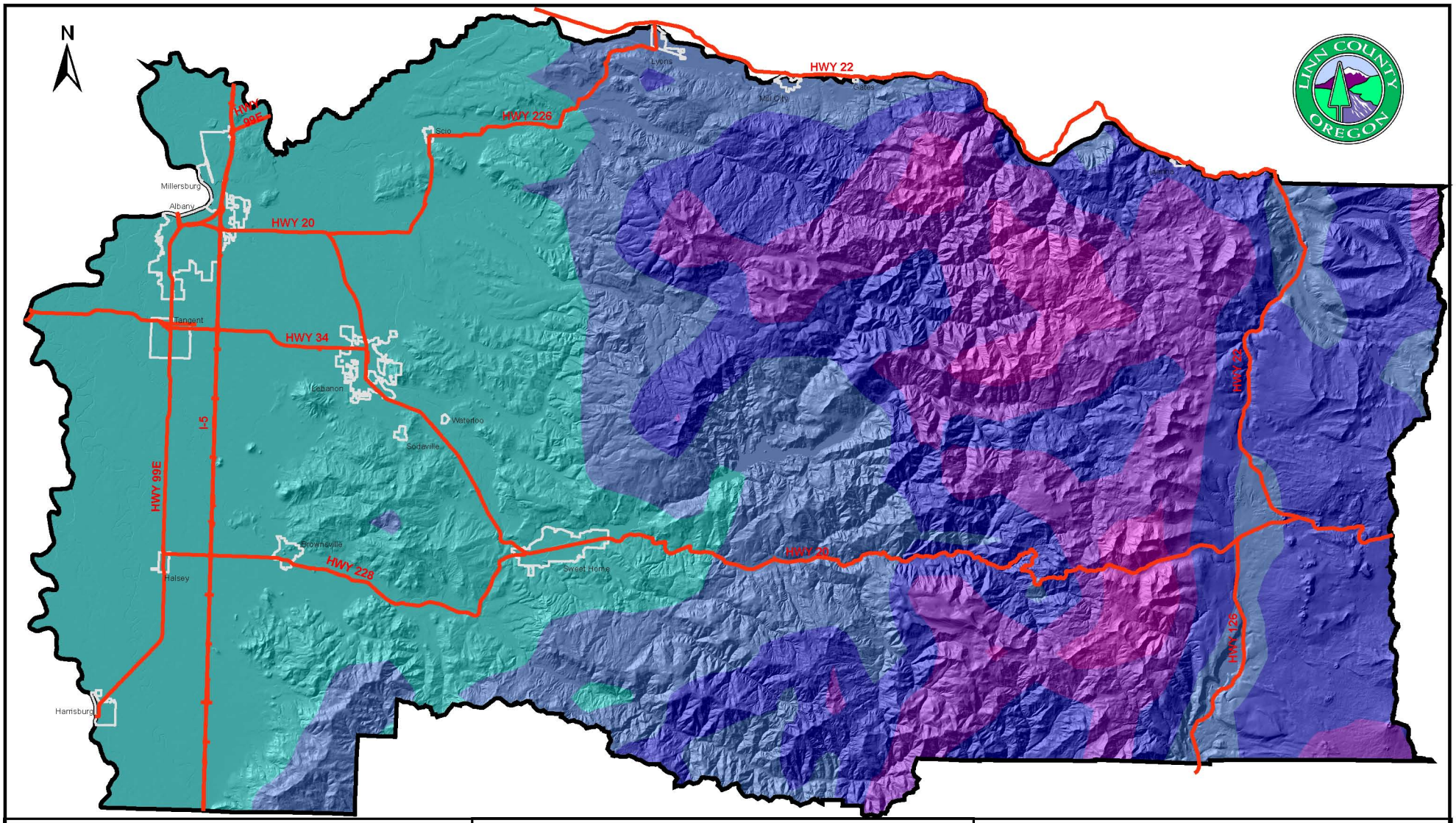
	541-967-3911	LINN COUNTY SHERIFF DISPATCH

OREGON STATE PATROL

	541-967-2026 OFC	LT. ANDY OLSON
	541-967-2021 24HR	DISPATCH CENTER

ODOT

	1-800-776-7718	DISPATCH CENTER



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Map Created by the Linn County GIS Department
Data Provided by Linn County and the
Spatial Climate Analysis Service,
Oregon State University
http://www.ocs.oregonstate.edu/prism

10/21/05

Precipitation Totals
Linn County, Oregon

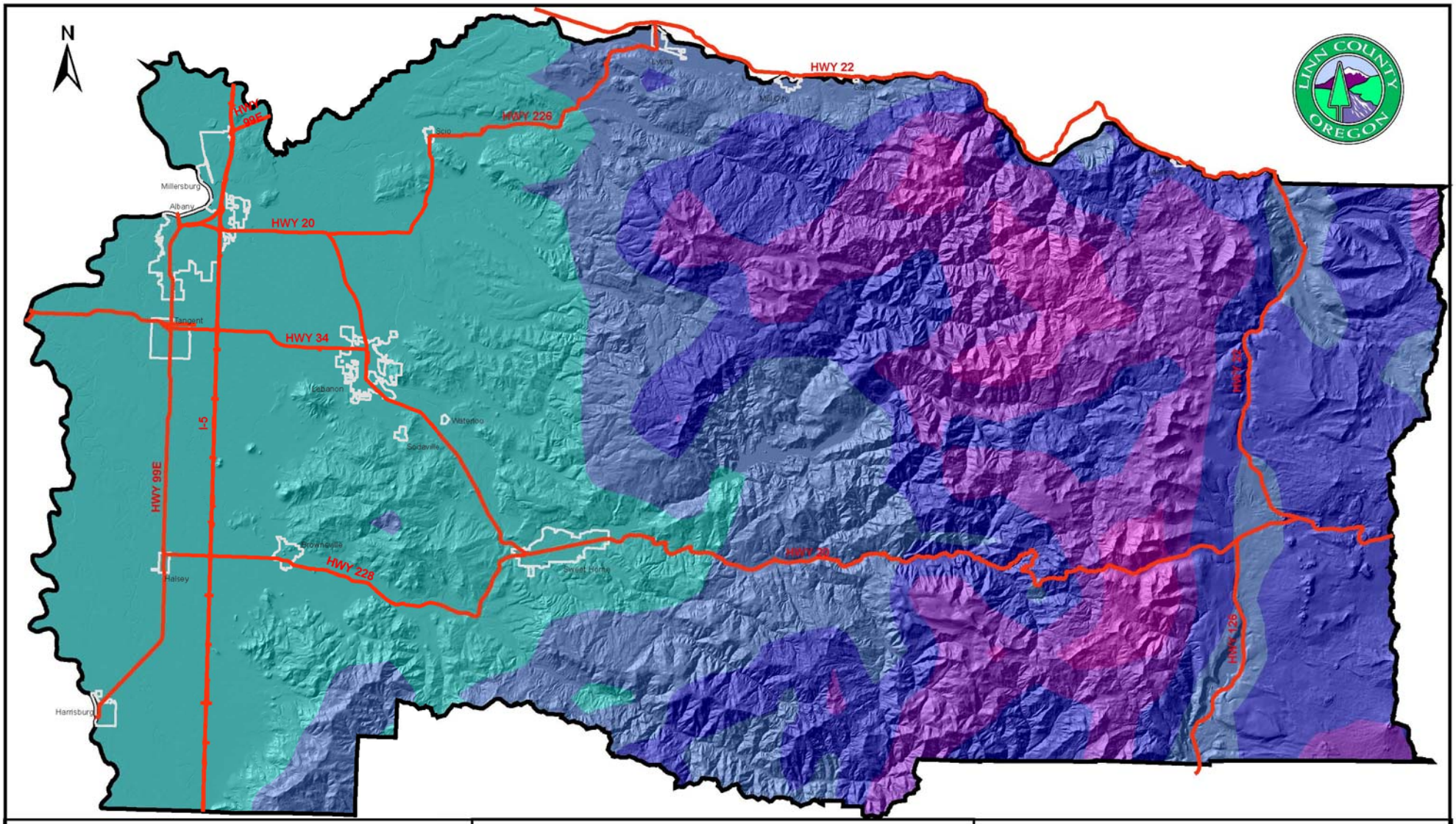
1 inch equals 7.20 miles

Legend

- State Highways
- City Limits
- County Boundary

Precip in Inches

- 41 - 59
- 59.01 - 75
- 75.01 - 87
- 87.01 - 101
- 101.01 - 119



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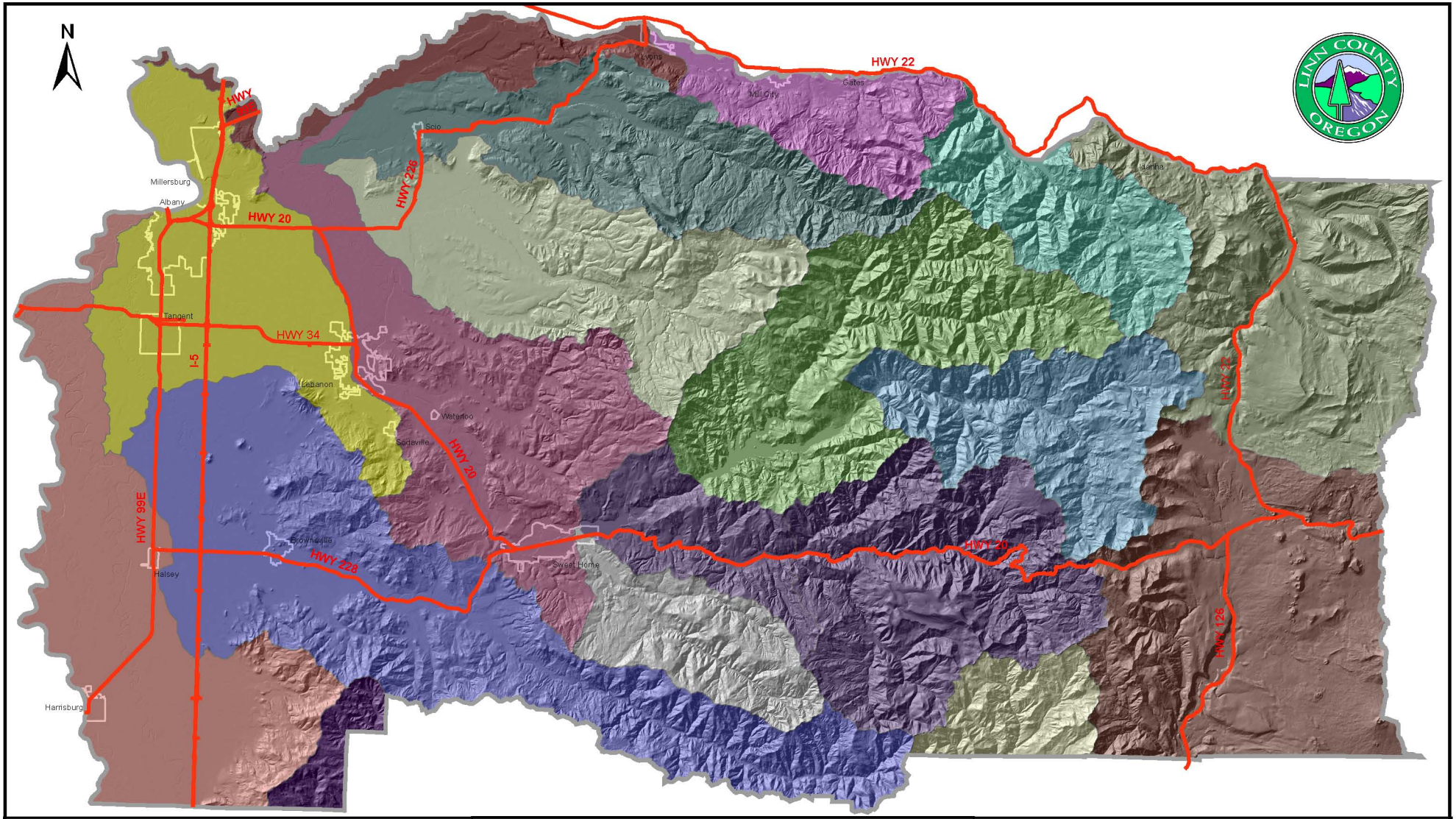

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Map Created by the Linn County GIS Department
Data Provided by Linn County and the
Bureau of Land Management

10/21/05

Fifth Field Watersheds
Linn County, Oregon

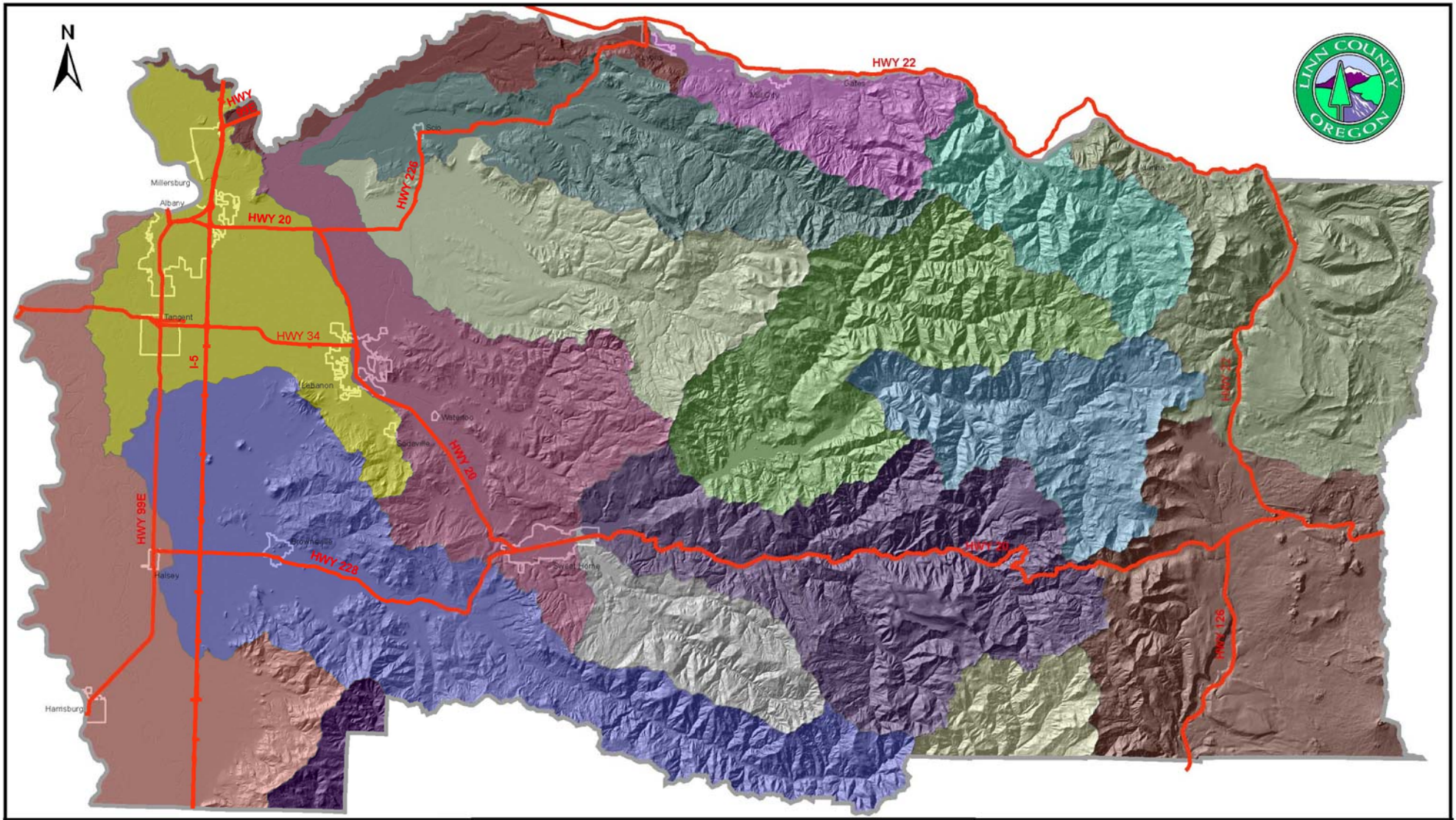
1 inch equals 7.20 miles

Legend

- State Highways
- County Boundary
- City Limits

Watersheds

- BLUE RIVER
- CALAPOOIA RIVER
- CRABTREE CREEK
- DETROIT RESERVOIR/BLOW OUT DIVIDE CREEK
- HAMILTON CREEK/SOUTH SANTIAM RIVER
- LOWER NORTH SANTIAM RIVER
- MIDDLE NORTH SANTIAM RIVER
- MIDDLE SANTIAM RIVER
- MOHAWK RIVER
- MUDDY CREEK
- OAK CREEK
- QUARTZVILLE CREEK
- SOUTH SANTIAM RIVER
- THOMAS CREEK
- UPPER MCKENZIE RIVER
- UPPER NORTH SANTIAM RIVER
- WILEY CREEK



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10/21/05

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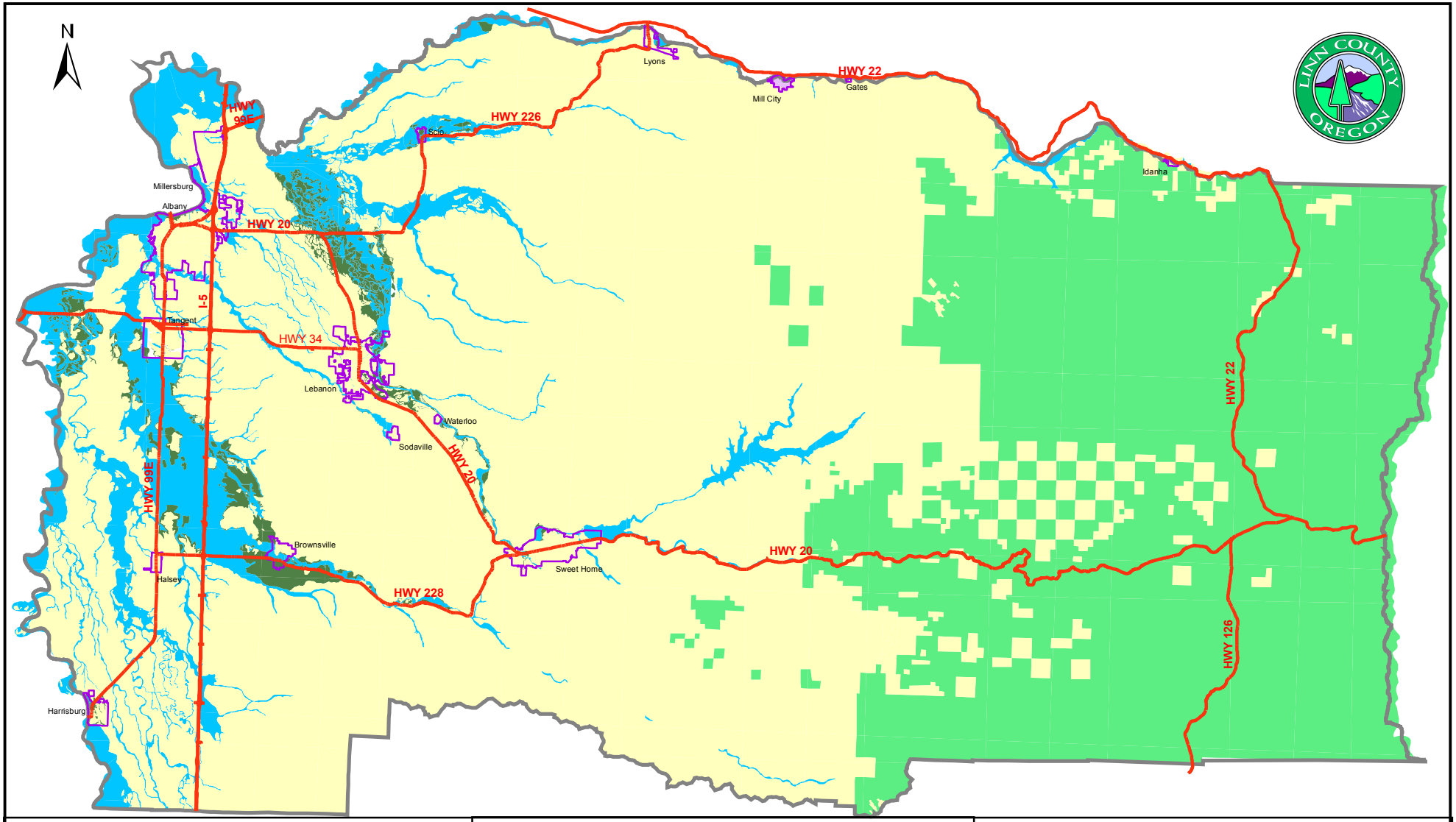

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Data Provided by FEMA and Linn County.

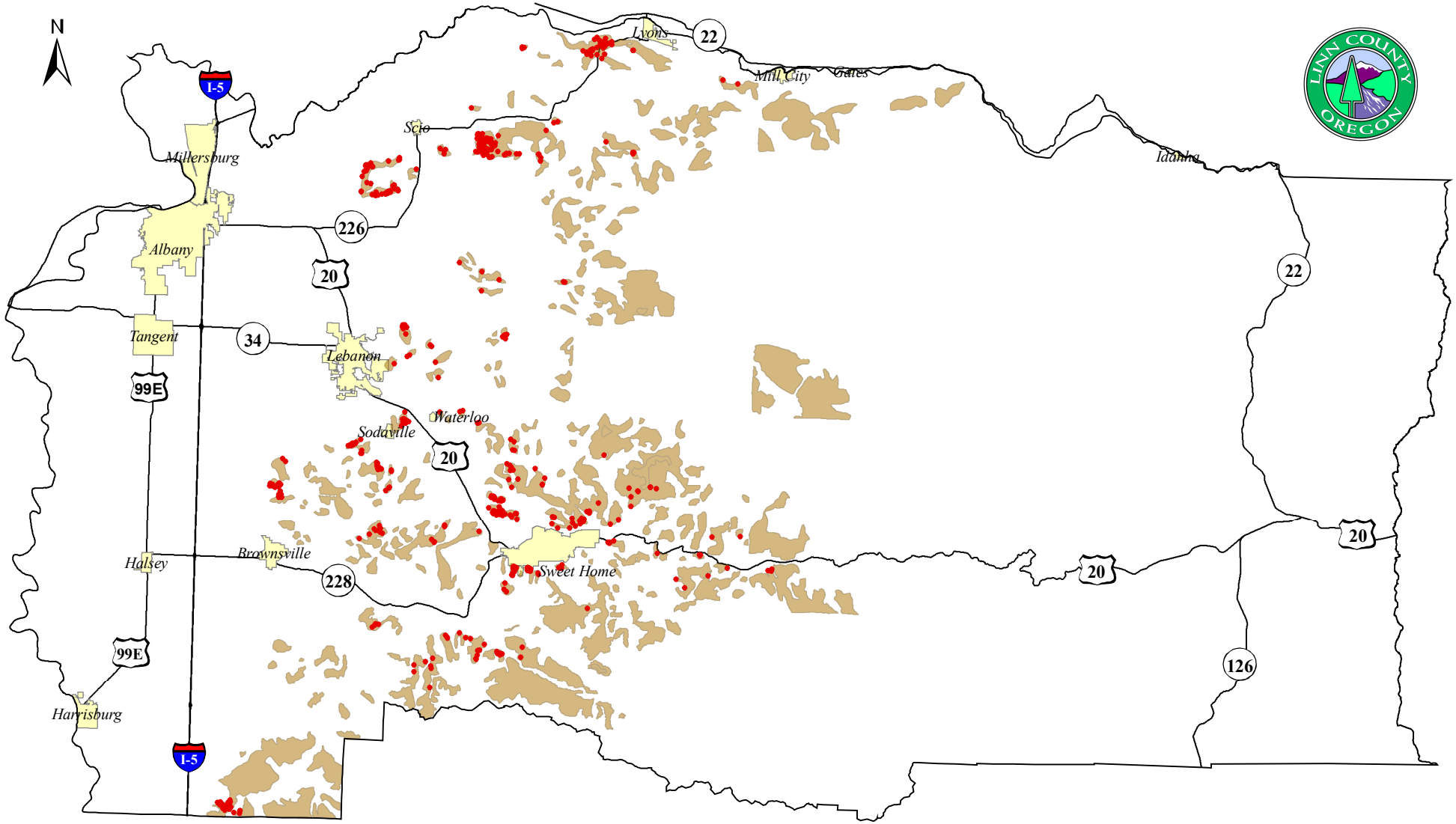
10/21/05

FEMA Flood Plain
Linn County, Oregon

1 inch equals 7.20 miles

Legend

- State Highways
- City Limits
- County Boundary
- A - Inside 100
- ANI - Unmapped area
- B - Inside 500
- D - Undetermined but possible flood Area
- X - Outside 500 Year Floodplain
- X500 - Inside 500 Year



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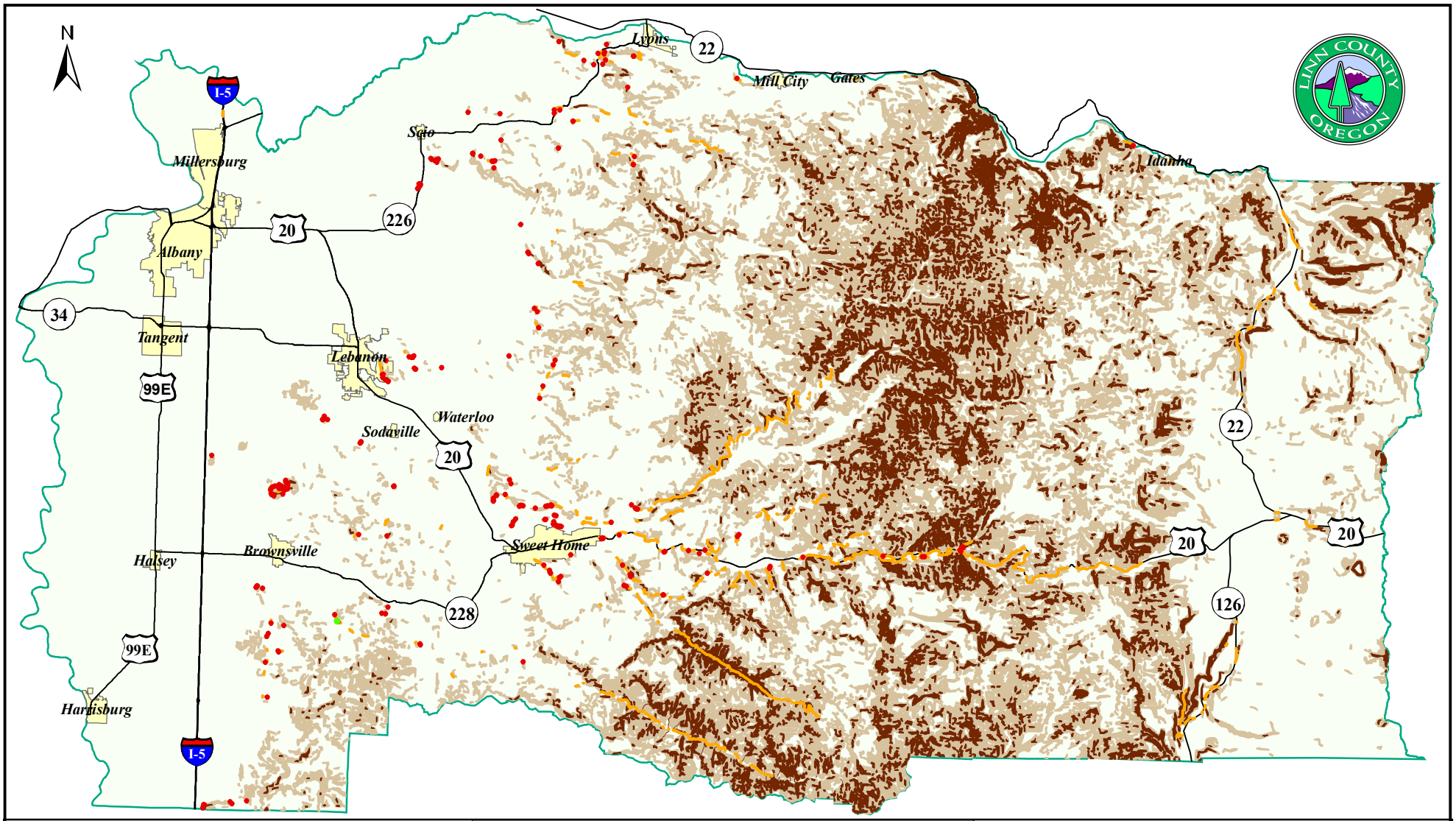
10/24/05

Mass Movement Hazard Areas And Vulnerable Improvements Linn County, Oregon

1 inch equals 7.20 miles

Legend

- Vulnerable Residential Structures
- Vulnerable Roads
- Major Highways
- Mass Movement Areas
- Cities



Debris flow data from the Oregon Department of Forestry.

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10/24/05

Potential Debris Flow Areas And Vulnerable Improvements Linn County, Oregon

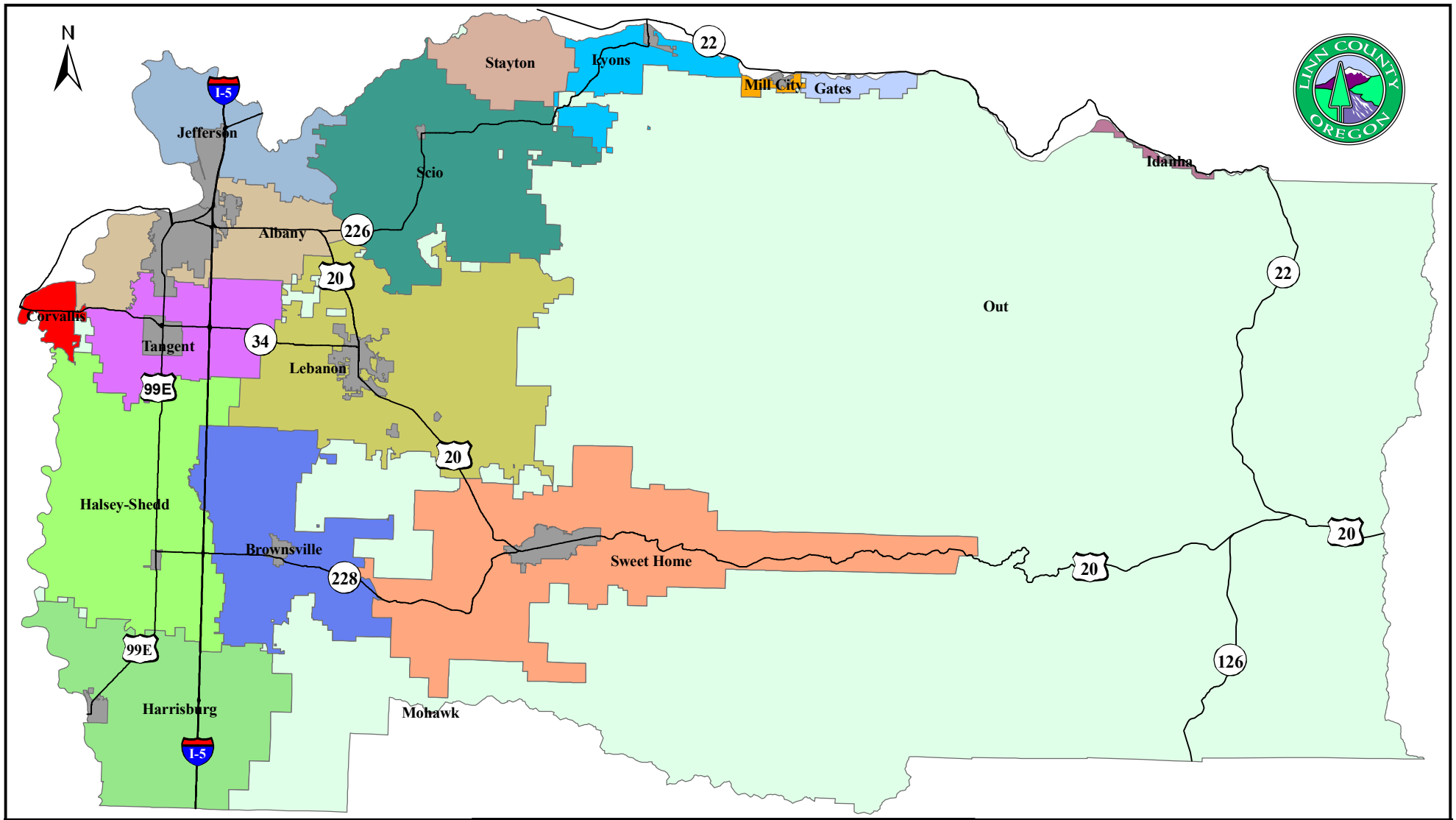
1 inch equals 7.20 miles

Legend

- Residences
- Commercial / Industrial
- Highways/Roads

Debris Flow Hazards

- High
- Moderate



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10/24/05

Rural Fire Districts
Linn County, Oregon

1 inch equals 7.20 miles

Legend

FireDistricts

- Albany
- Brownsville
- Corvallis
- Gates
- Halsey-Shedd
- Harrisburg
- Idanha
- Jefferson
- Lebanon
- Lyons
- Mill City
- Mohawk
- Out
- Scio
- Stayton
- Sweet Home
- Tangent
- City

Section 1:
Introduction

What Is Hazard Mitigation?

"Natural hazard mitigation" refers to developing and implementing actions designed to reduce or eliminate the impacts to life and property resulting from future natural hazard events. The key element in pre-disaster hazard mitigation is risk reduction. For new development, hazard mitigation might include applying specific design standards to minimize damages that may result from natural events such as earthquakes, landslides or floods; or identifying and avoiding certain high hazard areas prior to building site selection. For existing development, hazard mitigation might include elevating homes in repetitive flood loss areas above the 100-year flood level; and retrofitting public buildings and bridges to increase their ability to withstand earthquakes.

Why Develop a Mitigation Plan?

Linn County (the County) developed this Natural Hazard Mitigation Plan to protect life and property and reduce damages resulting from natural disasters by reducing vulnerability to natural hazard risks. Reducing potential damages improves public safety and economic stability. The mitigation plan identifies resources, information, and strategies to reduce risks from natural hazards, and guides the County's mitigation activities. This plan has been written for Linn County and the cities of Lyons,, Tangent, Scio and Sodaville. The four cities are new jurisdictions to the 2010 update.

The Federal Disaster Mitigation Act of 2000 (DMA 2000) and the implementing rules in 44 CFR Part 201.6 requires that the County complete a FEMA-approved natural hazard mitigation plan to be eligible for certain federal assistance programs. The mitigation plan is intended to: (1) identify and prioritize future mitigation activities; (2) establish a framework for coordination among agencies and the public; and (3) meet federal disaster mitigation planning requirements and qualify the County for certain pre-disaster and post-disaster assistance programs.

Primary funding for this plan is from a grant through the federal Pre-Disaster Mitigation Competitive Grant Program for pre-disaster mitigation planning and projects addressing natural hazards. The grant program is administered by the Federal Emergency Management Agency (FEMA). The County contributed additional matching funds.

Who Will Benefit From the Mitigation Plan?

The Linn County Natural Hazard Mitigation Plan (Mitigation Plan) presents strategies and resources to reduce hazard risks within unincorporated Linn County. The mitigation plan identifies and prioritizes a set of action items designed to reduce risks through public education, public improvement projects, and the enhancement of partnerships. Local governments, unincorporated communities, special districts, businesses and rural property owners can all benefit from the Mitigation Plan.

Policy Framework for Natural Hazard Planning in Oregon

Oregon's statewide planning program is founded on a set of 19 statewide planning goals. Statewide Planning Goal 7 provides planning guidelines in areas subject to natural disasters and hazards. The goals and implementing regulations are adopted as a set of administrative rules (Oregon Administrative Rules Chapter 660). The coordination and implementation of the statewide goals is achieved through local comprehensive planning.

Key state and federal agencies involved in developing risk reduction strategies and resources include: Oregon Emergency Management (OEM), Oregon Building Codes Division (BCD), Oregon Department of Forestry (DOF), Oregon Department of Geology and Mineral Industries (DOGAMI), the Department of Land Conservation and Development (DLCD), and the Federal Emergency Management Agency (FEMA).

The Federal Disaster Mitigation Act of 2000 (DMA 2000) established a program for local pre-disaster hazard mitigation planning and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP). The County must have a FEMA approved pre-disaster mitigation plan in place to qualify for mitigation project funding and to qualify to receive post-disaster HMGP funds.

Previous Natural Hazard Mitigation Planning Efforts

Statewide Planning Goal 7 is intended to protect life and property in areas subject to natural disasters and hazards. The Linn County Comprehensive Plan (Comprehensive Plan) was acknowledged in 1985. The Comprehensive Plan at LCC 903.200 through 903.280 includes an inventory of areas subject to certain natural and geologic hazards and a set of Plan policies to guide development within known hazard areas. Risk reduction measures in areas subject to natural disasters and hazards are implemented through application of the County's Land Development and Building Codes.

The Regional All Hazard Mitigation Master Plan for Benton, Lane, Lincoln, and Linn Counties was developed between 1998 and 2002. The Mitigation Master Plan is designed to help local communities gather the data necessary to compete for future FEMA funding of mitigation projects. The Mitigation Master Plan reviews the principles of mitigation planning and presents a seven-step process for conducting a detailed, quantitative evaluation of prospective mitigation projects. Phase one of the Mitigation Master Plan addressed planning for the hazards of flooding, severe winter storms, mud slides and landslides. Phase two addressed earthquakes, wildland/urban interface fires and dam failures. Phase three addressed hazardous materials.

Plan Process and Methodology

The Linn County Natural Hazards Mitigation Plan was created under a collaborative process through the participation of Linn County citizens, private business representatives, public agencies, special districts and private organizations. The planning process was coordinated through the Linn County Planning and Building Department (Department).

Steering Committee

Development of the 2005 Linn County Natural Hazard Mitigation Plan:

The Linn County Planning Commission served as the Natural Hazards Mitigation Plan Steering Committee. The Planning Commission is comprised of a diverse group of Linn County citizens with extensive understanding of the geography, history and issues critical to guiding the development of the natural hazard mitigation plan. The Planning Commission included:

- Robert Bronson
- David Furtwangler
- Scott Mackie
- Jerome Magnuson
- John McKinney
- Gary Metts
- William Tucker
- Mary VanAgtmael
- Robert Walsh

The Steering Committee met a total of five times while developing the plan. The Steering Committee guided the development of the plan by setting plan goals, encouraging public participation, and identifying and prioritizing appropriate mitigation activities and action items. The steering committee will also assist in the implementation and monitoring of the plan.

Since the adoption of the Natural Hazard Mitigation Plan, the Steering Committee did not meet to evaluate the progress of the action items until January 28, 2010.

Development of the 2010 Linn County Natural Hazard Mitigation Plan Update:

In November 2009, Linn County contracted with the Oregon Partnership for Disaster Resilience (the Partnership) at the University of Oregon's Community Service Center to assist with the five year update of the Linn County Natural Hazard Mitigation Plan. The Linn County Planning and Building Department in coordination with the Linn County Emergency Management Division established the 2010 Natural Hazard Mitigation Plan Steering Committee. The following members, organizations and/or professions were represented and served on the Steering Committee during the 2010 update of the Natural Hazard Mitigation Plan:

- Steve Barnett, Linn County GIS
- Mike Beaver, Linn County Fire Defense Board
- Brian Carroll, Linn County Parks
- David Furtwangler, Linn County Planning Commission
- John Hixson, Linn County Building Official
- Jim Howell, Linn County Emergency Management
- Chuck Knoll, Linn County Road Department
- Darrell Tedisch, City of Albany
- Mary VanAgtmael, Linn County Planning Commission
- Robert Wheeldon, Linn County Planning and Building Director

In addition to the Steering Committee the following cities were represented and participated in the development of the 2010 Linn County Natural Hazard Mitigation Plan Update:

- Karen Corrington, City of Sodaville
- Brady Harrington, City of Sodaville
- Seaton McLennan, City of Tangent
- Georgia Edwards, City of Tangent
- Carolyn Neve, City of Scio Planning Commission
- Karla Caudell, City of Halsey
- Ryan Taylor, City of Scio & Mill City

A list of those organizations invited to participate in the process can be found in Appendix A Public Process.

The 2010 Hazard Mitigation Plan Steering Committee attended four hazard mitigation plan update training sessions conducted by Oregon Partnership for Disaster Resilience (OPDR). The Linn County Planning and Building Department facilitated 5 meetings to review and update the plan. The Linn County Planning and Building Department compiled all suggestions made by the Committee and other participants and incorporated final edits into the final version of the 2010 Linn County Natural Hazard Mitigation Plan Update. The public participation documentation can be found in Appendix A of this document.

On ******, 2010, the Committee submitted the plan to the Oregon Office of Emergency Management for submittal to FEMA for pre-approval. The Linn County Board of Commissioners subsequently adopted the 2010 plan update on ****, 2010.

Linn County Communities

The Department contacted each Linn County municipality and invited their participation in the County's mitigation planning process in 2005 and in 2010. Representatives from the City of Albany, the City of Lebanon and the City of Scio contributed to Linn County's 2005 Hazard Mitigation Plan by actively participating in Steering Committee meetings and by providing written information. Representatives from the City of Albany, City of Scio, City of Sodaville, City of Lyons and the City of Tangent participated in the 2010 update.

The city of Sweet Home completed the update of its Hazard Mitigation Plan in August 2009.In January 2006 the City of Albany developed its own hazard mitigation plan using the same process as the County. The City of Albany is currently in the process of updating its plan. The City of Scio completed a natural hazards mitigation plan addendum in April 2006 and is currently updating its addendum to Linn County's plan. Additionally, in 2005 the Linn County Planning and Building Department staff discussed the development of addendum plans with officials from the cities of Brownsville, Harrisburg, Lyons, Mill City and Millersburg. While each of these cities expressed a desire to develop mitigation plans, none were able to do so at that time. The Cities of Sodaville, Scio, Albany, Lyons, Tangent and Halsey participated in the Linn County Natural Hazard Mitigation Plan update. The Cities of Lyons, Tangent and Sodaville are in the process of developing addendums to the Linn County Plan.

Public Participation

2005 Natural Hazard Mitigation Plan:

Public participation was sought throughout the process especially in the identification of hazard risks and the development of plan goals and mitigation action items. The public was notified of the mitigation planning project and the public meetings through published notices, press releases, and mailings to potential stakeholders and interested parties. The public was invited to participate in regularly scheduled Steering Committee meetings and public workshops. Identified stakeholders and interested parties were mailed a focus group survey. The Steering Committee also held an open public workshop to identify the natural hazard mitigation plan mission, objectives, goals and action plan for Linn County.

2010 Natural Hazard Mitigation Plan Update:

Public participation was sought throughout the process of updating each section. The public was notified of the mitigation update process through press releases, notifications of community preparedness survey, announcements on Linn County's website and stakeholder's survey. The public was invited to participate in Steering Committee meetings.

Stakeholder Survey

2005 Natural Hazard Mitigation Plan:

In December 2004 the Department sent out a natural hazard survey letter to 134 Linn County businesses, special districts, public agencies, local governments, governmental agencies, public utilities, emergency services providers, interested citizens and others. The survey questionnaire was also provided to interested parties upon request and at public meetings. The survey provided identified stakeholders and interested parties an opportunity to share knowledge about natural hazards in Linn County and opinions about preparing for and reducing natural disaster risks. The Steering Committee reviewed the compiled survey results to help identify issues, prioritize goals and identify action items. The survey and compiled responses are presented in ***Appendix A***.

2010 Natural Hazard Mitigation Plan Update:

On March 19, 2010, Oregon Partnership for Disaster Resilience sent out a natural hazard survey email to 132 Linn County businesses, special districts, public agencies, local governments, governmental agencies, public utilities, emergency services providers, interested citizens and other identified stakeholders. The survey provided identified stakeholders and interested parties an opportunity to share knowledge about natural hazards in Linn County and opinions about preparing for and reducing natural disaster risks. The survey and compiled responses are presented in Appendix A.

Hazard Specific Research

In 2005 the Linn County Planning and Building Department collected existing demographic, property development and natural hazard data for Linn County. The hazard research included information relating to flood, landslide, severe winter storm, windstorm, wildfire, earthquake, and volcanic hazards. Hazard specific research included materials from previously published plans and reports from the Linn County Planning and Building Department, Linn County Emergency Management, the Department of Geology and Mineral Industries (DOGAMI), the Federal Emergency Management Agency (FEMA), and other State and Federal agencies. Existing mitigation measures and resources are listed in each hazard-specific section.

In 2010 the Linn County Planning and Building Department collected new information published within the past five years to re-evaluate the information relating to flood, landslide, severe winter storm, windstorm, wildfire, earthquake, and volcanic hazards. Information for drought was compiled to add a new Drought Hazard section to the 2010 update. Hazard specific research included materials from recently published plans and reports from the Linn County Planning and Building Department, Linn County Emergency Management, the Department of Geology and Mineral Industries (DOGAMI), the Federal Emergency Management Agency (FEMA), and other State and Federal agencies. Existing mitigation measures and resources are listed in each hazard-specific section.

Hazard Assessment

The Mitigation Plan compiles information for seven types of natural hazards in Linn County and establishes mitigation goals and action items for each hazard. The hazard assessment provides information on the location of the hazard, the land and property characteristics within the hazard area, and an assessment of risks to life and property that may result from a natural hazard event. The three elements of hazard assessment are:

1) ***Hazard Identification*** identifies the geographic extent of the hazard, the potential intensity of the hazard, and its probability of occurrence. This information is presented using hazard maps when available.

2) ***Vulnerability Assessment*** inventories existing and planned property development and populations that are located within a hazard area and are therefore exposed to that hazard.

3) ***Risk Analysis*** estimates the damage, injuries and economic losses that may be sustained within a hazard area over a given period of time. The risk analysis uses mathematical models based on the magnitude of the harm that may result and the likelihood of the harm occurring.

The 2005 hazard assessments were limited by the available hazard-specific data. Linn County has mapped geographic information system (GIS) data for FEMA floodplain information, DOGAMI mass movement (landslide) information, earthquake fault lines. The GIS data also includes location information for rural dwellings and public buildings.

The County conducted a flood hazard vulnerability assessment using GIS data to identify the extent of flood hazard areas and to assess the land, property and economic value at risk from

flooding. The earthquake hazard vulnerability assessment is conducted using the FEMA HAZUS analysis model. There is insufficient data to conduct vulnerability assessments for the other natural hazards in the plan: landslide, severe winter storm, windstorm, wildfire, and volcanic eruption. Risk analyses were not conducted for any of the hazards in the plan due to insufficient data.

The 2010 Mitigation Plan update reviewed and updated the information for the seven natural hazards addressed in the 2005 Linn County Natural Mitigation Plan and included additional information on drought hazards from the Region 3; Mid/Southern Willamette Valley Regional Profile of Oregon's Enhanced Natural Hazard Mitigation Plan.

Plan Organization

The Linn County Natural Hazard Mitigation Plan is organized into three elements.

Volume I contains the executive summary plus five plan sections: Introduction; Community Profile; Risk Assessment; Goals and Action Items; and Plan Maintenance. These sections provide an overview of how the plan was developed and what action items are proposed.

Volume II contains six natural hazard sections. The hazard-specific sections provide background information on each hazard, specific action items, and local, county, and state resources.

Volume III includes five resource appendices. The appendices provide information on the plan development process and other resources and issues.

Volume I: Mitigation Plan

Executive Summary and Five-Year Action Plan

The Executive Summary provides an overview of the mitigation plan goals and action items. The action items address both multi-hazard issues and hazard-specific activities that can reduce risks and losses from future natural hazard events.

Section1: Introduction

The Introduction section describes the background of hazards in Linn County, the purpose of developing the hazard mitigation plan, and the planning process and methodology.

Section 2: Community Profile

The Community Profile section presents the history, geography, demographics and economic profile of Linn County. This section also provides an overview of natural hazard events in the county.

Section 3: Natural Hazards Risk Assessment

The Risk Assessment section provides information on hazard identification, vulnerability and risk associated with natural hazards in Linn County.

Section 4: Action Plan

The Goals and Action Items section provides information on the process used to develop goals and action items for the seven natural hazards addressed in the mitigation plan.

Section 5: Plan Implementation and Maintenance
The Plan Maintenance section provides information on plan implementation, monitoring and evaluation.

Volume II: Hazard-Specific Information

Five chronic hazards and one catastrophic hazard are addressed in this plan. Chronic hazards occur with regularity and may be predicted through historic evidence and statistical modeling. Catastrophic hazards do not occur with the frequency of chronic hazards and are less predictable, but can have devastating impacts on life and property.

Each of the five hazard-specific sections includes information on the history, causes and characteristics of the specific natural hazard. The hazard sections also include goals and action items; and local, state and national mitigation resources.

The five chronic hazards addressed in the plan are:

Section 6: Flood

Section 7: Landslide

Section 8: Wildfire

Section 9: Severe Weather

Section 10: Drought

The catastrophic hazard addressed in the plan is:

Section 11: Earthquake

The plan also includes a section that lists the multi-hazard mitigation action items. Multi-hazard action items are action items that address two or more of the natural hazards addressed in the plan. The multi-hazard action items are identified in:

Section 12: Multi-hazard Mitigation Action Items

Volume III: Resources Appendices

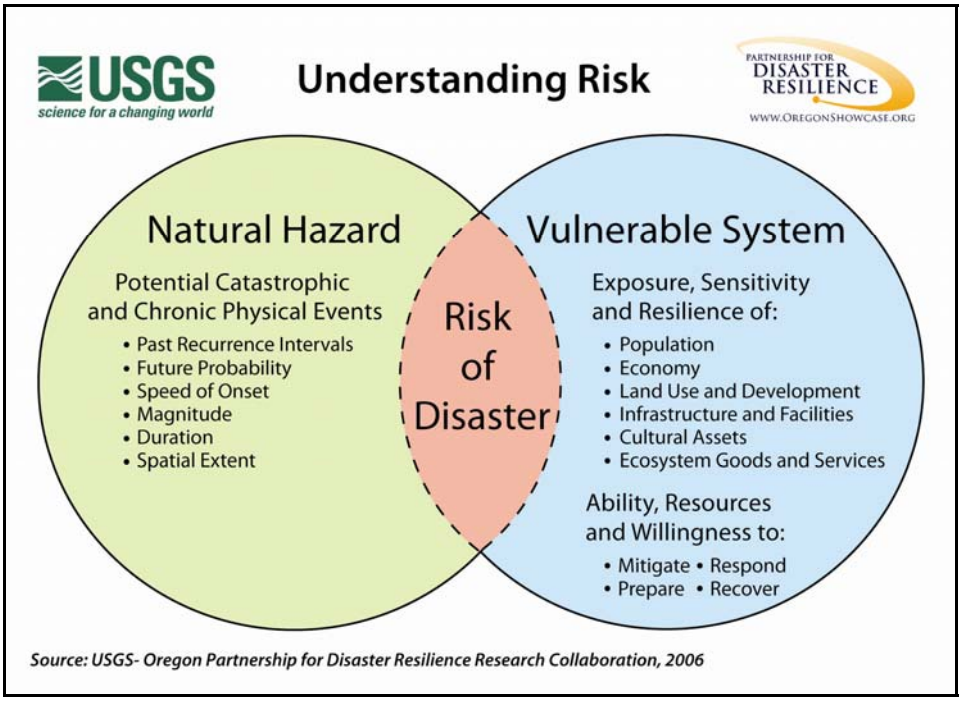
The plan resource appendices include additional information to assist users of the Linn County Natural Hazards Mitigation Plan in understanding the development and contents of the plan. The appendices also include potential resources to assist with plan implementation.

Section 2
Community Profile

Introduction

The following section describes Linn County from a number of perspectives in order to help define and understand the county's sensitivity and resilience to natural hazards. Sensitivity factors can be defined as those community assets and characteristics that may be impacted by natural hazards, such as special populations, economic factors, and historic and cultural resources. Community resilience factors can be defined as the community's ability to manage risk and adapt to hazard event impacts, such as governmental structure, agency missions and directives, and plans, policies, and programs. The information in this section represents a snapshot in time of the current sensitivity and resilience factors in Linn County when the plan was developed. The information documented below, along with the hazard assessments located in the Hazard Annex, should be used as the local level rationale for the risk reduction actions identified in Section 3 – Mission, Goals, and Action Items. The identification of actions that reduce the county's sensitivity and increase its resilience can assist in reducing overall risk. This can be shown as the area of overlap in Figure 2.1 below.

Figure 2.1 Understanding Risk



Community Overview

Linn County is located in the mid-Willamette Valley, in western Oregon, and covers an area of 2,297 square miles.[1] It is bounded to the north by Marion County, to the west by Benton County, to the south by Lane County, to the east by Deschutes and Jefferson Counties, and to the northwest by Polk County. The elevation ranges from 125 feet along the Willamette River in western Linn County to 10,497 feet at the peak of Mt. Jefferson in eastern Linn County.[2]

Linn County is subject to impacts from natural hazard events including floods, severe winter storms, windstorms, landslides (mass movement), and wildfires. The impacts of past hazard events in Linn County have resulted in loss of life and property, economic losses, and damaged infrastructure.

Western Linn County is subject to stream flooding and ponding, such as occurred during the floods of 1964, 1974 and 1996. Linn County experienced severe damage during the Columbus Day wind storm in 1962, and parts of southern and western Linn County were severely impacted by a wind storm in February of 2002. Eastern Linn County is susceptible to landslides, winter storms and wildfire. Most recently, in January 2004 the county was impacted by a severe winter storm that resulted in damage and hazards related to snow and ice.

These types of chronic hazards can be expected to continue to impact the county in the future. The county may also be subject to impacts from future catastrophic hazards such as earthquakes and volcanoes. The risks from future natural disasters and the impacts of future disasters on the population, economy and infrastructure will increase as areas of risk become more heavily developed.

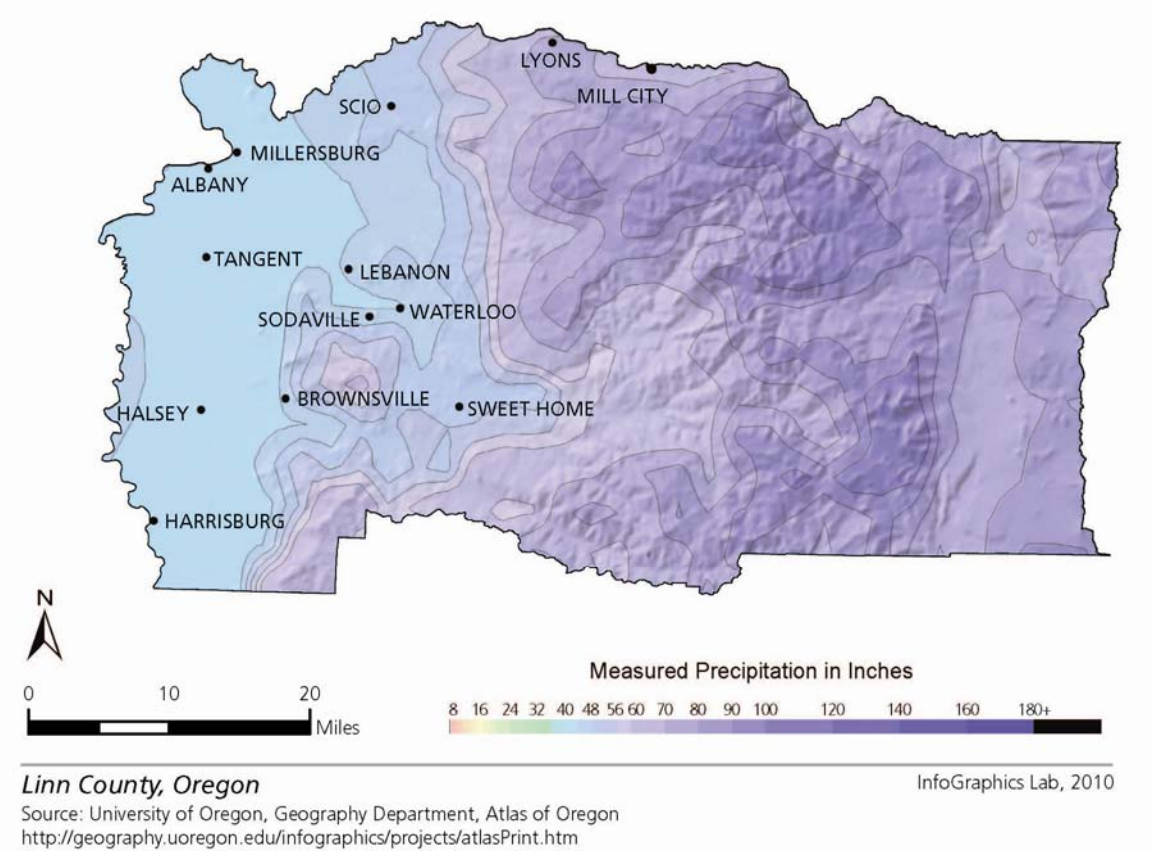
Geography & Climate

Linn County has a diverse climate and geography. It includes broad, fertile bottomlands and terraces throughout the valley floor in the west, varied relief of the Cascade foothills, and the abundant forests and volcanic peaks of the Cascade Range in the east. Western Linn County is characterized by a temperate climate. Summers are warm and dry, but extremely hot days are rare. Winters are cool and rainy, but snow and freezing temperatures are uncommon, except at higher foothill elevations.

Eastern Linn County consists of the higher elevations of the Cascade Range. Winters are colder with much more precipitation, much of it in the form of snow. Summers in the mountains are mostly dry with warm days, cool nights, and occasional lightening storms. Average annual precipitation on the valley floor is around 40 to 45 inches, occurring mostly between the months of October through March. Precipitation increases as the elevation rises east into the Cascade foothills. Annual precipitation at Foster is 54 inches, increasing to 62 inches at Cascadia, and 85 inches at the Santiam Pass.[3]

In most winters, one or two storms bring strong and sometimes damaging winds. Heavy rains often result in localized flooding and ponding on the valley floor. In some years heavy rain storms can combine with rapid snow melt in the mountains to cause serious flooding.

Figure 2.2 Linn County Average Annual Precipitation.



Mountain Ranges

Nearly all of Linn County's population lives in the Willamette Valley between the Willamette River and the Cascade foothills. The eastern half of the county is undeveloped forest land of the Cascade Range. The Cascades were formed by volcanic activity resulting from the convergence of two tectonic plates. Visible landmarks created by past volcanic activity include Snow Peak, Mount Washington, Mount Jefferson, and Three Fingered Jack. The tallest peak in Linn County is Mount Jefferson, at 10,497 feet.

Although mostly uninhabited, the Cascades draw large numbers of recreational visitors throughout the year. The rugged, steep mountains are subject to a variety of natural events, including lightening storms and wildfire during the hot summer months, severe storms during winter, and landslides in winter and spring.

Rivers

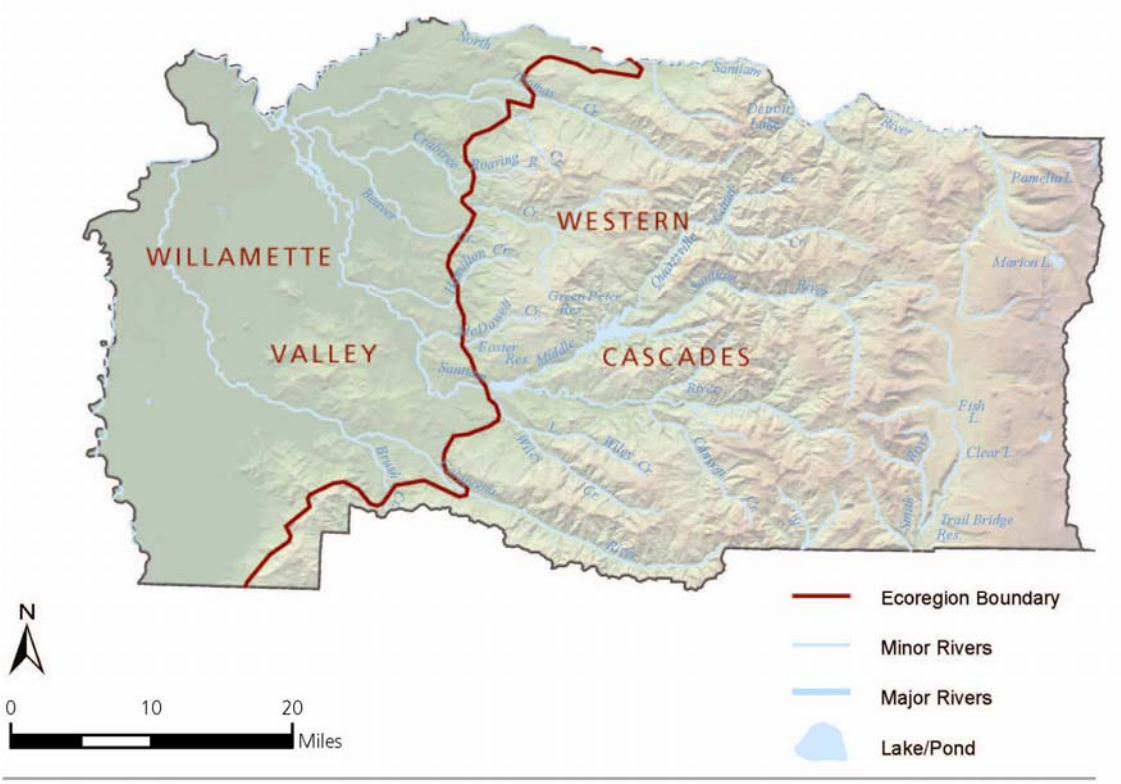
Linn County contains four major rivers and many smaller rivers, creeks and drainages. The largest river in the county is the Willamette River. The Willamette River establishes Linn County's western boundary and flows past the communities of Harrisburg, Peoria, and Albany. The North Santiam River establishes most of the county's northern boundary and flows past the communities of Idanha, Gates, Mill City and Lyons.

The South Santiam River and the Calapooia River watersheds are entirely within Linn County. The South Santiam River begins high in the Cascade Mountains and runs across the valley floor merging with the North Santiam River north of Albany. The South

Santiam river flows through the communities of Cascadia, Sweet Home, Waterloo, and Lebanon. The Calapooia River runs from the Cascade foothills in southeast Linn County through the communities of Holley, Crawfordsville, and Brownsville before entering the Willamette River in Albany.

Other smaller drainages in Linn County include the Middle Fork of the Santiam River, Roaring River, Crabtree Creek, Thomas Creek, Hamilton Creek, McDowell Creek, Wiley Creek, Muddy Creek, Courtney Creek and others. Combined with the many sloughs and low-lying areas on the valley floor, the county is highly susceptible to flood hazards. Linn County's rivers and general physiography are depicted in Figure 2.3 below.

Figure 2.3. Linn County Physiography.



Linn County, Oregon InfoGraphics Lab, 2010

Source: University of Oregon, Geography Department, Atlas of Oregon
http://geography.uoregon.edu/infographics/projects/atlasPrint.htm , Oregon Geospatial Enterprise Office (GEO), http://www.oregon.gov/DAS/EISPD/GEO/alphalist.shtml

Soils and Other Geologic Features

On the broad flood plains along the Willamette River and the lower reaches of the Santiam River system the soils are generally well drained. The soils on terraces and within remnant channels adjacent to the flood plains are sometimes characterized by internal drainage problems which can increase as they broaden and become nearly level to depressional.[4]

Between the broad Willamette Valley terraces to the west and the mountainous uplands of the Cascade Range to the east are low foothills that range in elevation from 300 to 1400 feet. The topography ranges from gently sloping areas on low plateaus to steep side slopes. The soils in these areas formed in material derived from igneous or sedimentary

rock and are often poorly drained. The South Santiam and Calapooia Rivers, and minor streams such as Thomas and Crabtree Creeks, dissect these low foothills forming major and minor valleys that have both narrow flood plains and narrow stream terraces.[5]

The mountainous uplands of the western Cascade Range have elevations up to 5000 feet. The Cascades formed from volcanic material such as hard basalt and soft pyroclastic and sedimentary material. Volcanic ash covers much of the higher areas. The differences in the hardness of these materials accounts for the differing rates of dissection. The mountains are characterized by gently sloping soils on high plateaus and steep to very steep soils on canyon walls and side slopes. Steep headwalls and rolling slump blocks indicate slumping and landslide problems in some areas.

The Cascades are drained by tributaries of the Willamette River system. The upper valleys of the tributaries are narrow and have stream terraces of recent origin. The streams are characterized by waterfalls and numerous rapids until they reach the nearly level areas of the Willamette Valley.

The U.S. Army Corps of Engineers has built flood control dams on the North, South and Middle Forks of the Santiam River. These structures have controlled much of the historical flooding in the lower reaches of the valleys, especially those of the Willamette Valley. Many areas that were active flood plains in the past are no longer subject to periodic flooding.

Population and Demographics

Linn County is undergoing changes in its population. In 2009 the County's population was 110,865. This is a 7.6 percent increase from the 2000 Census population of 103,069.[6] Rapid population growth can occur within hazardous areas if not properly managed. **Table 2.1** shows the estimated population of Linn County for July 1, 2009.

Table 2.1. Linn County Estimated Population (July 1, 2009)

Community	Population	Percent of Total
Unincorporated Linn County	31,988	28.8%
Albany (Linn County Part)	42,102	37.9%
Brownsville	1,780	1.6%
Gates (Linn County Part)	50	<0.1%
Halsey	840	0.8%
Harrisburg	3,455	3.1%
Idanha (Linn County Part)	85	0.1%
Lebanon	15,580	14.1%
Lyons	1,135	1.0%
Mill City (Linn County Part)	1,330	1.2%
Millersburg	1,170	1.1%
Scio	790	0.7%
Sodaville	295	0.3%
Sweet Home	9,050	8.2%
Tangent	1,000	0.9%
Waterloo	215	0.2%
Total Linn County	110,865	100.0%

Source: Population Research Center, Portland State University, March 2010

Linn County is also experiencing demographic changes in terms of age. From 2000 to 2008, the age group under 5 increased 10.9 percent, those 55-59 increased 31.5 percent, those 60 – 64 increased 44.7 percent, and the 85 and over age group increased 30.8 percent. See Table 2.2 below.

Table 2.2. Linn County Population by Age, 2000, 2008

Age Range	2000	2008	% Change
Under 5	7,038	7,808	10.9%
5 to 9	7,337	7,710	5.1%
10 to 14	7,720	7,346	-4.8%
15 to 19	7,514	7,580	0.9%
20 to 24	5,833	6,536	12.1%
25 to 34	12,699	16,288	28.3%
35 to 44	15,131	14,572	-3.7%
45 to 54	14,787	15,764	6.6%
55 to 59	5,647	7,425	31.5%
60 to 64	4,409	6,381	44.7%
65 to 74	7,428	9,364	26.1%
75 to 84	5,574	6,021	8.0%
85 and over	1,952	2,553	30.8%
Total	**103,069**	**115,348**	**11.9%**

Source: U.S. Census 2000 Table P12, and 2008 American Community Survey Table B01001

Disaster impacts (in terms of loss and the ability to recover) vary among population groups following a disaster. A disproportionate burden is placed upon special needs groups, particularly children, the elderly, the disabled, minorities, and low-income persons. Above, Table 2.1 shows that from 2000 to 2008 the elderly population (85 and over) has grown by 30.8 percent. Moreover, the age groups from 55 to 59 and 60 to 64 both grew between 30 and 45 percent in that time, implying that this will translate into much higher elderly growth in a few decades. Elderly individuals may require special consideration due to sensitivities to heat and cold, dependence on others for transportation and comparative difficulty in making home modifications that reduce risk to hazards. Additionally, Table 2.3 shows that 19.8 percent of Linn County's population is between the ages of 0 and 14. In general, children are more vulnerable to extreme heat and cold, have fewer transportation options, and require assistance to access medical facilities.

Table 2.3 Linn County Youth and Senior Populations, 2008

Age Range	Number	% of Population
0-14	22,864	19.8%
65-74	9,364	8.1%
75+	8,574	7.4%

Source: U.S. Census, 2008 American Community Survey, Table B01001

Housing

Much of the housing outside of cities in Linn County is on small acreage home sites clustered together in rural residential exception areas and within the county's eight unincorporated rural communities. In 2002 there were an estimated 5,129 housing units within these types of rural communities in Linn County.[7]

The older a structure is, the greater the risk of damage from a natural disaster. Homes built before the late 1960s normally did not incorporate earthquake resistant designs. The Linn County Building Ordinance began recognizing the importance of developing outside flood prone areas in 1971. The County adopted a floodplain development code in 1980. The Federal Emergency Management Agency did not complete comprehensive floodplain mapping in Linn County until 1986.

The year-built date for homes and the housing unit type is important for assessing risk and developing mitigation strategies. **Table 2.5** shows housing by construction date.

Table 2.5 shows that as of March 2000, 72 percent of housing units in Linn County were constructed prior to 1980. A greater percentage of housing units in unincorporated areas are mobile home units compared to urban areas, while nearly all multi-family units are in incorporated places.

Table 2.5. Linn County Housing Units in 2000 by Year Structure Built

Year Structure Built	Housing Units	Percent of Total
Before 1960	10,035	35%
1960 to 1979	9,892	34%
1980 to 2000	6,933	24%
2001-2009	1,959	7%
Total	28,819	100%

Source: U.S. Bureau of the Census, Profile of Housing Characteristics 2000

Housing type and age are important factors in hazard mitigation planning. Certain housing types tend to be less disaster resistant and warrant special attention: mobile homes, for example, are generally more prone to wind and water damage than standard stick-built homes. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. In Oregon, for example, building codes that incorporated current seismic risks weren't adopted until the 1990s.[8] In addition, FEMA began assisting communities with floodplain mapping during the 1970's, and communities developed ordinances that required homes in the floodplain to be elevated to one foot above Base Flood Elevation[9] [10].

As seen in Table 2.5 below, 68.9 percent of Linn County homes were single-family residences in 2007, 15.5 percent were multi-family homes, 14.4 percent were mobile homes, and 0.2 percent were boats/ RVs, vans, etc.

Table 2.5. Linn County Housing Characteristics

Single Family	Multi-Family	Mobile Homes	Boat, RV, Van, etc.
68.9%	16.5%	14.4%	0.2%

Source: US Census, American Community Survey 2005-2007 Table B25024

Employment and Economics

Linn County's economy is relatively diversified. According to the Oregon Employment Department, Linn County's 2005 economic diversity rating was nine (with one being the most diverse, and 36 being the least).[11] An economy that is heavily dependent upon a few key industries may have a more difficult time recovering after a natural disaster than one with a more diverse economic base.

Economic resilience to natural disasters is particularly important for the major employment sectors in the region. If, these sectors are negatively impacted by a natural hazard, such that employment is affected, the impact will be felt throughout the regional economy. In Linn County, as shown in Table 2.6 below, Trade, Transportation, and Utilities is the largest employer, and provides 21 percent of the county's jobs. Government is the second largest source of employment in the county. In the event of a natural disaster, the government sector may not be as vulnerable as other sectors, since employees will be called upon to provide support and structure for their communities and will have outside funding sources.

Table 2.6 Linn County Employment by Major Industry, 2008

NAICS	Jobs per Industry	% of Industry
Natural Resources & Mining	**2,172**	**5%**
Construction	**2,520**	**6%**
Manufacturing	**8,052**	**18%**
Trade, Transportation, & Utilities	**9,281**	**21%**
Wholesale	1,558	4%
Retail	4,743	11%
Transportation, Warehousing & Utilities	2,980	7%
Information	**465**	**1%**
Financial Activities	**1,274**	**3%**
Finance & Insurance	858	2%
Real Estate Rental & Leasing	416	1%
Professional & Business Services	**3,474**	**8%**
Professional, Scientific & Technical Svcs	834	2%
Management of Companies	341	1%
Admin & Support, Waste Mgmt & Remediation Svcs	2,299	5%
Education & Health Services	**4,414**	**10%**
Education	368	1%
Health & Social assistance	4,046	9%
Leisure & Hospitality	**3,129**	**7%**
Arts, Entertainment & Recreation	311	1%
Accommodations & Food Services	2,818	6%
Other Services	**1,515**	**3%**
Total All Government	**7,488**	**17%**
Total Employment	43,792	

Source: Oregon Employment Department: Covered Employment and Wages: Linn County, 2008

An organization is considered part of the manufacturing sector if its primary business is to transform raw materials into new products through mechanical, physical, or chemical processes. Manufacturing covers many separate industries, including aerospace, apparel, computers, automobiles, pharmaceuticals, printing, steel, and textiles, among others, and

provides products that contribute and support all other economic sectors.[12] The industry relies on an open transportation network for both customers and supplies and is particularly sensitive to road closures (e.g., from winter storms or flooding). The dependency of other sectors on the manufacturing sector for goods may result in shortages in critical times of need. However, this is dependent on the type of good and whether the population considers it necessary for daily life. There may be a lack of demand for luxury items, which may negatively impact the manufacturing sector.

The trade, transportation, & utilities super sector is comprised of wholesale and retail trade, transportation and warehousing, and utilities. The challenges that the manufacturing sector faces in a natural disaster are also relevant to the trade, transportation, & utilities sector. One of the more vulnerable parts of this sector is utilities. Utilities are used in most aspects of everyday life and services are easily disrupted following a natural disaster. This will place an increased demand on utility workers to restore needed utilities post disaster.

Median income can be used as an indicator of the strength of the region's economic stability. In 2005, the median household income in Linn County was $39,305. This is about 15 percent below the 2005 national median household income of $46,242. Similarly, in 2008, the County's median household income was about 14 percent below the nation's median income. The County's median household income changed between 2005 and 2008, however, it increased at the same rate as the nation's 13% rate (see Table 2.7 below). Although median household income can be used to compare areas as a whole, this number does not reflect how income is divided among area residents.

Table 2.7 Linn County Median Household Income, 2005 and 2008

Area	2005	2008	% Change
United States	$46,242	$52,029	13%
Oregon	$42,944	$50,169	17%
Linn County	$39,305	$44,571	13%

Source: U.S. Census Bureau, 2005 and 2008 American Community Survey

While Linn County's population and income are increasing, Table 2.7 shows the poverty rate is decreasing among all ages. However, a significant portion of the population is still in poverty. Low income populations may require additional assistance following a disaster because they may not have the savings to withstand economic setbacks, and if work is interrupted, housing, food, and necessities become a greater burden. Additionally, low-income households are more reliant upon public transportation, public food assistance, public housing, and other public programs, all of which can be impacted in the event of a natural disaster.

Table 2.8 Linn County Poverty, 2005 and 2008

	2005		2008	
Ages	Total Persons	% of Population	Total Persons	% of Population
All Ages in Poverty	17,267	16.0%	16,264	14.1%
Under 18 in Poverty	25,361	23.5%	22,839	19.8%

Source: U.S. Census Bureau, 2005 and 2008 American Community Survey

Historic and Cultural Resources

Historic and cultural resources such as historic structures and landmarks can help to define a community and may also be sources of tourism dollars. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important. As an important historical and cultural resource, the Willamette River offers natural beauty, abundant wildlife, and diverse recreational opportunities.[13] In addition to natural resources, Linn County also has nearly 70 structures on the National Register of Historic Places[14]:

- Aegerter, David and Maggie, Barn, Scio, Oregon
- Albany Custom Mill (Water Street Station), Albany, Oregon
- Albany Downtown Commercial Historic District, Albany, Oregon
- Albany Municipal Airport, Albany, Oregon
- Angell-- Brewster House, Lebanon, Oregon
- Archibald, Steven and Elizabeth, Farmstead (Archibald-Ropp Farmstead), Tangent, Oregon
- Barber, Granville H., House, Albany, Oregon
- Baker, Hiram, House, Lebanon, Oregon
- Booth, Dr. J.C., House, Lebanon, Oregon
- Boston Flour Mill (Thompson Flouring Mill), Shedd, Oregon
- Brown, Hugh Leeper, Barn, Brownsville, Oregon
- Brown, John and Amelia, Farmhouse (Atavista Farm), Brownsville, Oregon
- Cascadia Cave (35 LIN 11), Cascadia, Oregon
- Chamberlain, George Earle, House, Albany, Oregon
- Chambers, Matthew C., Barn, Albany, Oregon
- Cochran, William, Barn (Eggleston, Mattie and Wingo, Barn), Brownsville, Oregon
- Cooley, George C., House, Brownsville, Oregon
- Crabtree Creek—Hoffman Covered Bridge, north of Crabtree, Oregon
- Crandall, Louis A., House, Lebanon, Oregon
- Crawfordsville Bridge, Crawfordsville, Oregon
- Dawson, Alfred, House, Albany, Oregon
- Elkins Flour Mill, Lebanon, Oregon
- Fields, Hugh, House, Brownsville, Oregon
- First Baptist Church of Brownsville, Brownsville, Oregon
- First Evangelical Church of Albany, Albany, Oregon
- Flinn Block, Building, Albany, Oregon
- Hackleman Historic District, Albany, Oregon
- Hamilton, Joseph, Farm Group, Albany, Oregon
- Hannah Bridge, Scio, Oregon
- Harrisburg Odd Fellows Hall, Harrisburg, Oregon
- Hochstedler, George, House, Albany, Oregon
- Howe, C.J., Building, Brownsville, Oregon
- Independence Prairie Ranger Station, Willamette National Forest, Marion Forks, Oregon
- Larwood Bridge, east of Crabtree, Oregon
- Lebanon Pioneer Cemetery, Lebanon, Oregon

- Lebanon Southern Pacific Railroad Depot, Lebanon, Oregon
- Macpherson, Hector and Margaret, Barn, Albany, Oregon
- Maurer, Joseph and Barbar, House, Lebanon, Oregon
- Methodist Episcopal Church South (Bethesda Heritage Church), Albany, Oregon
- Milde, Gottlieb and Della, Barn, Brownsville, Oregon
- Monteith Historic District, Albany, Oregon
- Monteith, Thomas and Walter, House, Albany, Oregon
- Moore, John and Mary, House, Brownsville, Oregon
- Moyer, John M., House, Brownsville, Oregon
- Mt. Pleasant Presbyterian Church, Stayton, Oregon
- Parker, Moses, House, Albany, Oregon
- Perry, E.C., Building, Scio, Oregon
- Porter-Brasfield House, Shedd, Oregon
- Ralston, John and Lottie, Cottage, Lebanon, Oregon
- Ralston, John, House, Albany, Oregon
- Rock Hill School, Lebanon, Oregon
- Ross- - Averill House, Brownsville, Oregon
- Ryan, Michael and Mary, Barn, Scio, Oregon
- Short Bridge, Cascadia, Oregon
- Smith, James Alexander and Elmarion, Barn and Lame – Smith House, Halsey, Oregon
- St. Mary's Roman Catholic Church, Albany, Oregon
- Starr and Blakely Drug Store, Brownsville, Oregon
- Stellmacher, Gus and Emma, Farmstead, Tangent, Oregon
- Thomas Creek – Gilkey Covered Bridge, north of Crabtree, Oregon
- Thomas Creek – Shimanek Covered Bridge, east of Scio, Oregon
- United Presbyterian Church and Rectory, Albany, Oregon
- United Presbyterian Church of Shedd (Valley Rose Chapel), Shedd, Oregon
- Weddle Bridge, northwest of Crabtree, Oregon
- Wesely, Joseph, House and Barn, Scio, Oregon
- Wigle Cemetery, Harrisburg, Oregon
- Wigle, Abraham and Mary, House, Harrisburg, Oregon
- Wigle, Jacob and Maranda K., Farmstead, Brownsville, Oregon
- Z.C.B.J. Tolstoj Lodge No. 224, Scio, Oregon

Transportation and Commuting Patterns

The communities of Linn County are linked together and to other regions of the state by Interstate 5, U.S. Highway 20, State Highway 34, State Highway 99E, and a well developed and maintained network of regional and local rural highways and county roads. Growth in the county will increase the number of vehicles on the roads. A high number of workers driving alone to work will increase traffic congestion and the risk of accidents. Increasing numbers of vehicles can place stress on roads, bridges and infrastructure in rural areas where traffic is confined to fewer transit roads.

According to the 2000 U.S. Census, 79 percent of Linn County workers drive to work alone, and the average commute time is 22 minutes each way. **Table 2.9** shows the commuting patterns for Linn County workers.

Table 2.9 Linn County Commuting Patterns by Transportation Type

Commute Type	Number	Percent
Drove Alone: Car, Truck or Van	35,991	79.3
Carpooled: Car, Truck or Van	5,373	11.8
Public Transportation	128	0.3
Walked	1,321	2.9
Other Means	511	1.1
Worked at Home	2,049	4.5
Total (Workers 16 years and over)	45,373	100
Mean Travel Time to Work (Minutes)	22.2	--

Source: U.S. Census Bureau, Census 2000 Profile of Selected Economic Characteristics

Most employed residents of the county remain in the area to work. **Table 2.10** shows that more Linn County workers commute from Linn County to counties outside the Linn/Benton/Lincoln County region to work than the number of workers who commute to Linn County from outside the county.

Table 2.10 Linn County Commuting Patterns by County of Origin

Percent of Linn County Residents That Work, Who Work:		
In Linn County	In Benton or Lincoln Counties	Outside Linn, Benton, or Lincoln Counties
73.6%	11.6%	14.8%
Percent of Linn County Jobs Held by Workers Living:		
In Linn County	In Benton or Lincoln Counties	Outside Linn, Benton, or Lincoln Counties
77.2%	11.2%	11.6%

Source: Oregon Employment Department, 2002 Regional Economic Profile

Hazards such as localized flooding can render roads unusable. A severe winter storm such as occurred in Linn County in January 2002 can disrupt the daily driving route of thousands of people or make driving prohibitively hazardous. A natural disaster or emergency that cuts off access on a rural road or highway can shut down the local or regional transit system, making evacuations difficult, increasing commuting time and distances, impacting the local or regional economy, and in some cases completely isolating a local area or economy.

Bridges and Highways

Bridges that are not seismically retrofitted that are in areas subject to earthquakes can create significant risks. Damaged bridges can disrupt or cut off traffic flow and lead to economic losses when commuters and consumers have difficulty reaching their destinations and when businesses are unable to deliver products and services to their clients.

Linn County currently owns 329 bridges. Inspection is provided by the Oregon State Highway Division. Bridges less than 20 feet in length are inspected by Linn County. All

Linn County bridges are inspected at two year intervals. Bridges that are found to be in critical condition during an inspection are prioritized for immediate replacement. Continued repair, maintenance and widening of bridges will be necessary over the next 20 years. Linn County is working closely with the Oregon Department of Transportation to inventory and rank all the County's bridges with respect to earthquake response.[15]

Three bridges in the county are considered too narrow. These are the Brownsville Bridge, the Scio Bridge and the Mill City Bridge. Linn and Benton counties are separated by the Willamette River so there are no land connections between the two counties. There are only two bridge crossing points linking the two counties, comprising five total bridges. Two are on Highway 20 in Albany and three are on Highway 34 at Corvallis.

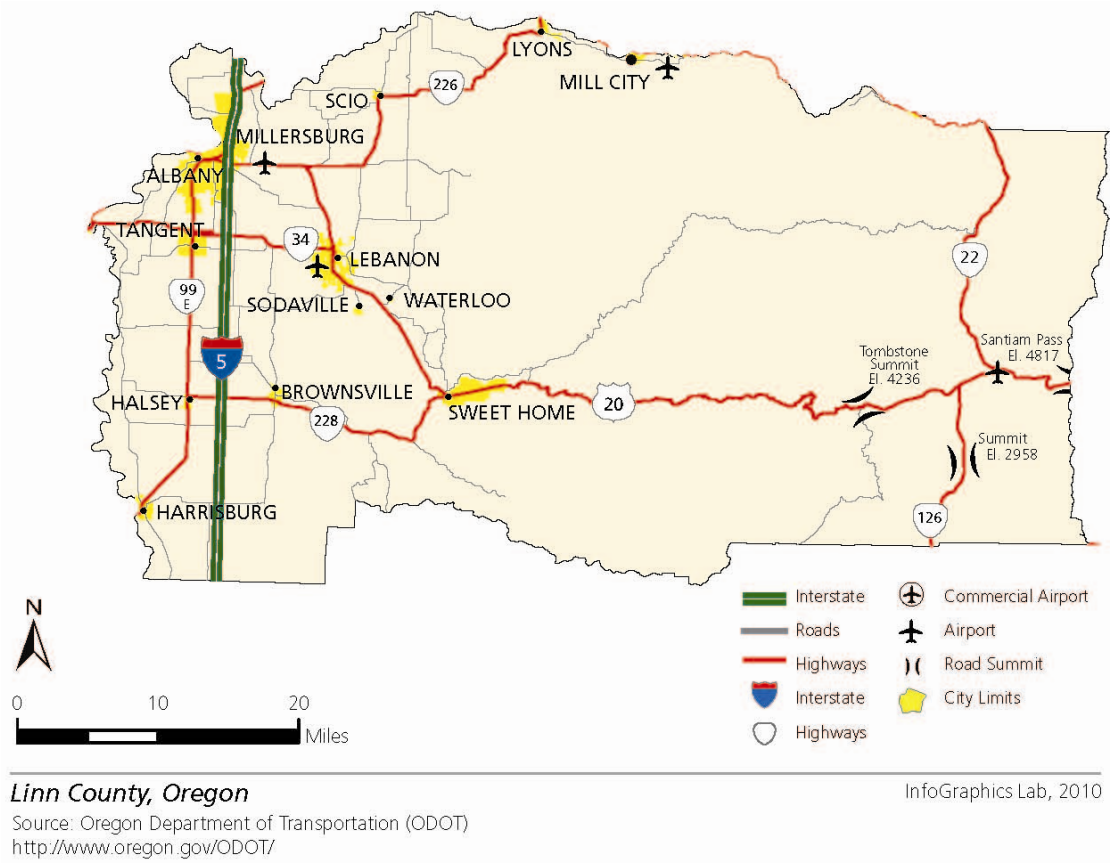
The Van Buren Street Bridge linking Linn County and the City of Corvallis on Highway 34 is in need of improvement or replacement. Damage to any of these crossings could impact the economies of the two counties. These inter-county routes may become strained with increased development and commuting traffic.

A well developed network of local rural highways and county roads connects the Linn County communities to each other and to the region. Interstate 5 (I-5) is the major north-south freeway through Linn County and is the main route for vehicles traveling between Eugene and Portland and between Washington and California. Highway 99E runs parallel to I-5 and serves the communities of Harrisburg, Halsey, Shedd, Tangent, and Albany, as well as providing a backup route to the freeway. Other state highways the serve Linn County include:

- US Route 20 -- Runs from Newport at the Oregon Coast east through Corvallis, Albany, Lebanon, Sweet Home and then continues beyond eastern Oregon;
- State Highway 34 – Runs from Waldport at the Oregon Coast east through Corvallis, Albany and Lebanon;
- State Highway 226 – Runs from US Route 20 near Crabtree northeasterly through Scio and Lyons to Marion County; and
- State Highway 228 – Runs from Halsey east across I-5 to Brownsville and Sweet Home.

Figure 2.4 below shows the major transportation routes in Linn County.

Figure 2.4 Linn County Transportation Routes



Lifeline Routes

Lifeline routes are critical transportation routes that are vital to continued pubic safety, mobility and commerce in the event of a natural disaster. The ODOT has identified state highways and important secondary lifeline routes in Linn County. The County designates the ODOT lifeline routes in Linn County as Priority 1 routes. Priority 1 routes receive the highest priority for emergency road maintenance in the event of road closures.

The Linn County Road Department is divided into five maintenance districts. The lifeline route priority maps are attached to the end of this section. The lifeline route maps are organized by maintenance district and show the emergency maintenance classification for Priority 1, Priority 2, and Priority 3 routes.

Infrastructure & Critical Facilities

Transportation networks, systems for power transmission, and critical facilities such as hospitals and police stations are all vital to the functioning of the region. Due to the fundamental role that infrastructure plays both pre-and post-disaster it deserves special attention in the context of creating more resilient communities. The information documented in this section of the profile can provide the basis for informed decisions about how to reduce the vulnerability of Linn County's infrastructure to natural hazards. During an emergency, local transit systems can be shut down, affecting evacuations. In addition, roads may become unusable from localized flooding and severe winter storms can potentially disrupt the daily driving routine of county residents.

It is important to understand the transportation network and commuting characteristics of your community in order to maintain an effective response system to natural hazards. The communities of Linn County are linked together and to other regions of the state by Interstate 5, U.S. Highway 20, State Highway 34, State Highway 99E, and a network of regional and local rural highways and county roads. The average annual daily traffic volumes on I-5 within Linn County are currently estimated at 94,900 vehicles per day.[16] Highway 99E runs north to south, providing connections to Tangent and Albany. Highway 20 and Highway 22, run east to west, providing the main access for the rural areas of Linn County. Highway 20 has an average daily traffic count of 22,700 vehicles per day.[17] According to the U.S. Census, 88 percent of Linn County's population commutes by personal vehicle; 77 percent drive alone and 11 percent carpool. About 0.4 percent of the commuters use public transit.[18]

The major providers of public transportation include Linn-Benton Loop Bus, and Albany and Corvallis Transit Systems. Railroads and airports provide other modes of transportation in the county. Linn County is served by the Burlington Northern & Santa Fe (BNSF), Union Pacific (UP), Portland & Western (P&W), and Albany & Eastern (A&E) railroads[19]. Facilities that support air travel include 4 public airports, 20 private airstrips, and one helipad.[20]

The condition of bridges in the County is also a factor that affects risk from natural hazards. Most bridges are not seismically retrofitted, which is a particularly important issue because of the County's risk from earthquakes. Impacted bridges can disrupt traffic and exacerbate economic losses because of the inability of industries to transport services and products to clients. Refer to Table 2.11 for a complete listing of bridges located within Linn County. The county owns 336 bridges.

Table 2.11 Bridges Located in Linn County

Bridges within Linn County	
State	219
County	336
City	32
Historical Covered Bridges	8
Total	**595**

Source: Oregon State Natural Hazard Risk Assessment, Region 3, 2009.

Linn County bridges are inspected at two-year intervals or more frequently if special conditions exist. Bridges that are found to be in critical condition during an inspection are prioritized for immediate replacement. The County bridge inspection program addresses all National Bridge Inspection Standards. The Linn County maintenance force makes routine bridge repairs.[21] The Willamette River separates Linn and Benton County. There are no land connections between the two counties. Five bridges provide linkages between Linn and Benton County. Two of these bridges are located along Highway 20 in Albany and three are located along Highway 34 in Corvallis.

Critical facilities are those facilities that are essential to government response and recovery activities. These facilities include local police and fire stations, public works facilities, sewer and water facilities, hospitals, and shelters. Table 2.12 provides a list of Linn County's critical facilities and structures.

Table 2.12 Critical Facilities in Linn County

Facility	Number
Hospitals (beds)	2 (131)
Police Stations	4
Fire & Rescue	7

Source: State Hospital Licensing Department, Local Sheriff Offices, Oregon State Fire Marshal.

Other critical and necessary facilities vital to the efficient delivery of key governmental services, or that may significantly impact the public's ability to recover from emergencies, include correctional institutions, public services buildings, law enforcement centers, courthouses, and juvenile service buildings.

Dam failures can occur at any time and are quite common. While most result in minor damage and pose little threat, some have the potential for severe damage where fatalities exist. The National Inventory of Dams has developed a listing of High Threat Potential Hazard dams for the nation. Table 2.13 lists the dams in these inventories for Linn County.

Table 2.13 National Inventory of Dams, Linn County

County	Power Plants	Dams	High Threat Dams
Linn	1-93 MW	11	7

Source: Oregon Department of Energy, National Inventory of Dams.

Emergency Facilities

Emergency facilities include law enforcement, fire and ambulance facilities, and emergency operations center (EOC) sites. The following tables list emergency facilities in Linn County. Figure 2.5 shows the location of major critical facilities in Linn County.

Table 2.14 Law Enforcement Facilities

Facility Description	Facility Address
Linn County Sheriff's Office:	1115 Jackson St. SE, Albany
Main office, Jail, 911/Dispatch Center, EOC	
Civil Division Substation	300 4th Ave. SW, Albany
Sheriff's Brownsville Substation	255 N. Main St., Brownsville
Sheriff's Harrisburg Substation	354 Smith St., Harrisburg
Sheriff's Lyons Substation	242 Fifth St., Lyons
Sheriff's Mill City Substation	274 SW Cedar St., Lyons
Sheriff's Millersburg Substation	4310 NE Woods Rd., Albany
Sheriff's Scio Substation	38957 N. Main St., Scio
Sheriff's Sweet Home Substation	1951 Main St., Sweet Home
Sheriff's Sweet Home Substation	3225 Hwy. 20, Sweet Home
Albany Police Department:	1117 Jackson St. SE, Albany
Also secondary PSAP & dispatch for police	
Lebanon Police Department:	40 E. Maple St., Lebanon

Also secondary PSAP & dispatch for police

Sweet Home Police Department: 1950 Main St., Sweet Home
Also PSAP/Dispatch for police & fire

Oregon State Police: Albany state police barracks 3400 Spicer Dr., Albany

Source: Linn County Emergency Management; May 15, 2004

Table 2.15 Fire and Ambulance Facilities

Facility Description	Facility Address
Albany Fire Department	
Headquarters	333 Broadalbin, Albany
Station 11 – fire & ambulance	110 Sixth Ave SE
Station 12 – fire & ambulance	120 34th Ave. SE
Station 13 – fire & ambulance	1980 Three Lakes Rd. SE
Station 14 – fire & ambulance	1850 Gibson Hill NW
Brownsville Fire District	
Station 61	255 N. Main St. Brownsville
Halsey/Shedd/Peoria Fire District	
Halsey Fire Station 51	740 W. Second St., Halsey
Shedd Fire Station 52	31922 B St., Shedd
Peoria Fire Station 53	29399 Abraham Dr., Peoria
Oakville Fire Station 54	31919 Oakville Dr., Oakville
Harrisburg Fire District	
Station 41	500 Smith, Harrisburg
Jefferson Fire District	
Station 630	4310 NE Woods Rd., Albany
Lebanon Fire District	
Station 31 – fire & ambulance, joint w/City EOC	1050 W. Oak St., Lebanon
Station 32 – fire	34128 E. Lacomb Dr., Lacomb
Station 33 – fire	30570 Fairview Rd., Lebanon
Lyons Fire & Ambulance District	
Station 550 – fire & ambulance	1114 Main St., Lyons
Station 570 - fire	39079 Jordan Rd., Lyons

Mill City Fire District	
Station 790	400 S. First, Mill City
Scio Fire District	
Station 90, Admin., joint city/fire district EOC	38975 SW Sixth Ave.
Station 91	39023 Second Ave.
Station 92	37587 Crabtree Dr., Crabtree
Station 93	43042 Burmester Dr., Scio
Sweet Home Fire & Ambulance	
Station 21 – fire & ambulance	1099 Long St., Sweet Home
Station 22	1390 47th Ave., Foster
Station 23	25995 First Ave., Crawfordsville
Station 24	Hwy. 20, Cascadia
Tangent Fire District	
Station 71	32053 Birdfoot Dr., Tangent

Source: Linn County Emergency Management; May 15, 2004

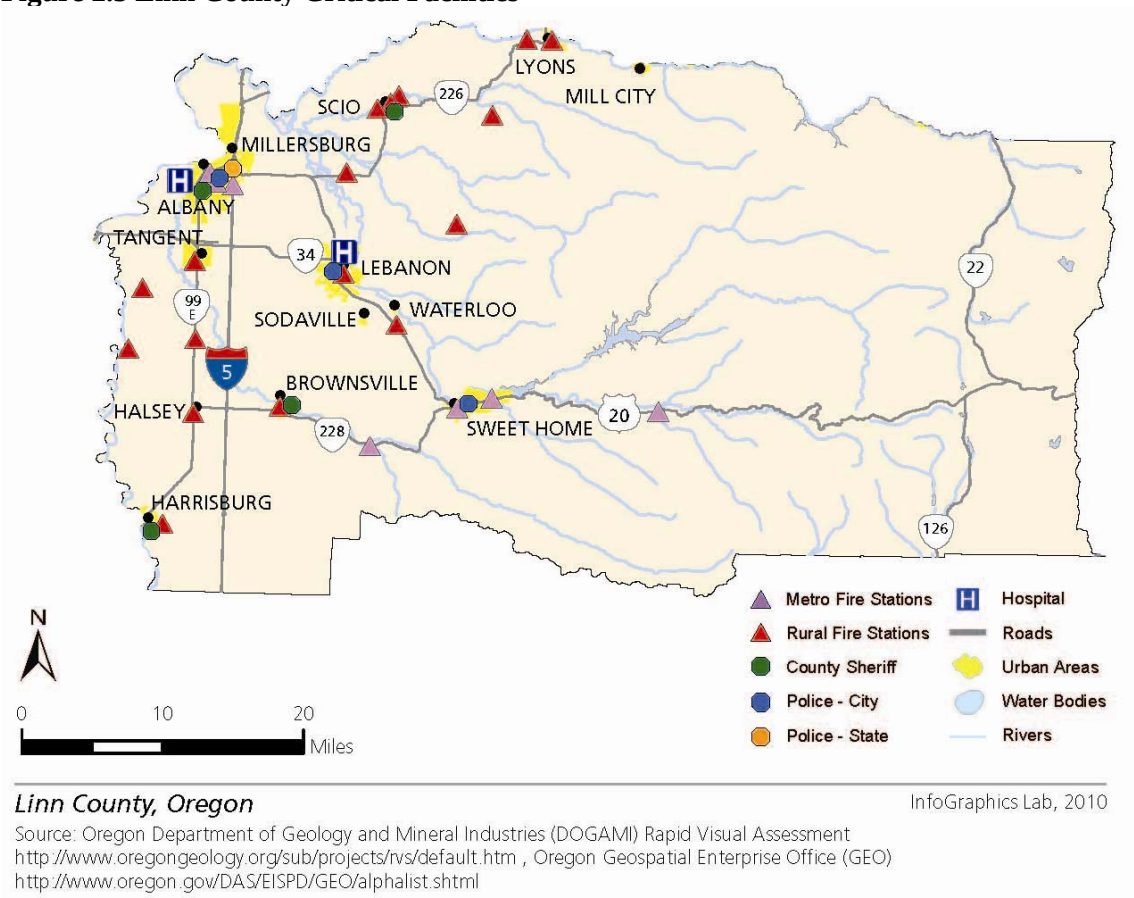
Table 2.16 Emergency Operations Center Sites

Facility Description	Facility Address
Linn County Courthouse: alternate EOC, principal seat of county government, critical site for county information technology & GIS, sheriff's substation for the civil division	300 4th Ave. SW, Albany
Albany City Hall: principal seat of city government/ city EOC	333 Broadalbin, Albany
Brownsville City Hall: principal seat of city government/ EOC	255 N. Main St., Brownsville
Halsey City Hall: principal seat of city government, city EOC	773 W. First St., Halsey
Harrisburg City Hall: principal seat of city government/ EOC	354 Smith St., Harrisburg
Lyons City Hall: principal seat of city government	449 Fifth St., Lyons
Lebanon City Hall: principal seat of city government	925 Main St., Lebanon
Mill City Hall: principal seat of city government	252 SW Cedar St., Mill City
Millersburg City Hall: principal seat of city government/ EOC	4222 Old Salem Rd, Albany
Scio City Hall: principal seat of city government, city	38957 NW 1st Ave., Scio

	EOC	
Sodaville City Hall:	principal seat of city government/ EOC	30723 Sodaville Rd., Sodaville
Sweet Home City Hall:	principal seat of city government/ EOC	140 12th Ave., Sweet Home
Tangent City Hall:	principal seat of city government, city EOC	32166 Old Oak Dr., Tangent

Source: Linn County Emergency Management; May 15, 2004

Figure 2.5 Linn County Critical Facilities

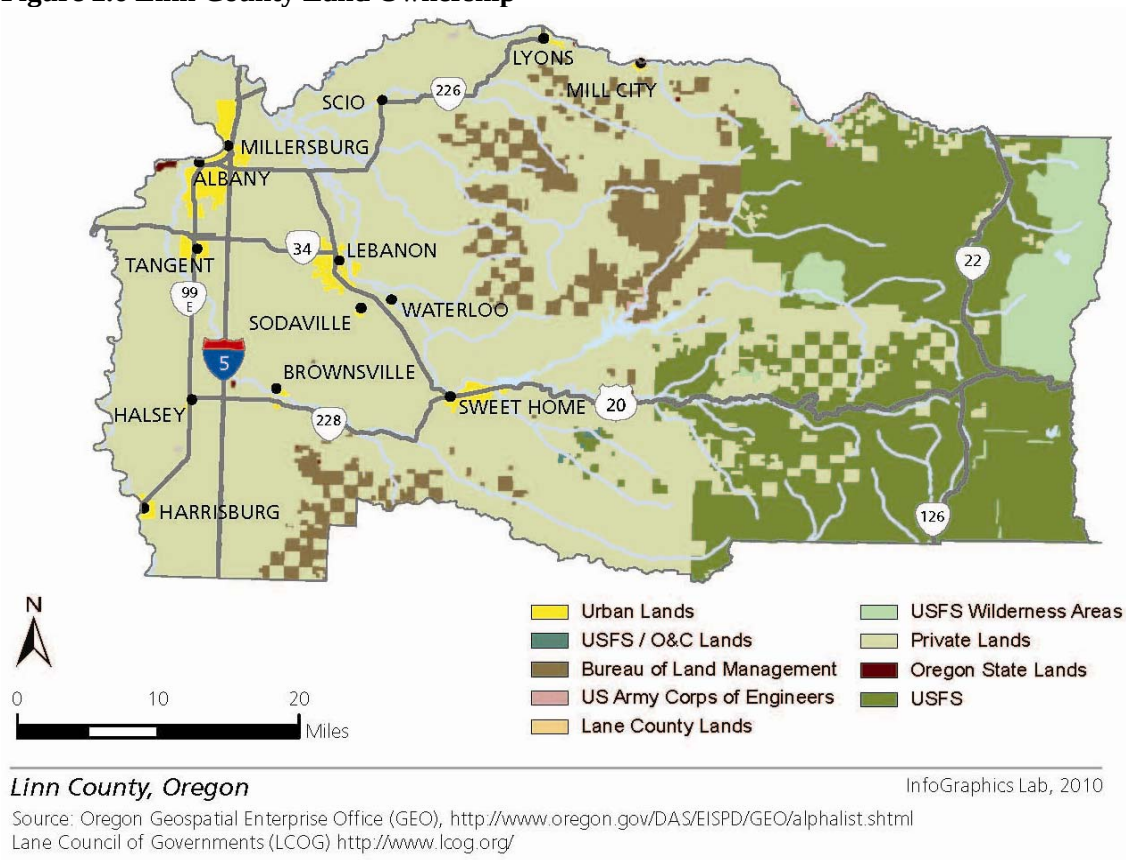


Land Use & Development

Linn County encompasses both the rich agricultural lands of the Willamette Valley and the productive forested mountainsides of the Cascade Range. Much of the area in the eastern portion of Linn County is classified as Forest Resource in the *Comprehensive Plan* with the majority of this in the Cascade mountain range. The topography, sparse population and high precipitation of this region make it a prime location for forestry. Over 900,000 acres, nearly 65 percent of Linn County, is forested.[22] Much of the forested land is held in large-acre ownership with the Willamette National Forest managed by the U.S. Forest Service as one of the largest holdings. The Bureau of Land Management (BLM) in the U.S. Department of the Interior administers lands under its jurisdiction[23]. Agricultural activity occurs throughout the valley region and in the foothills of the

county. Between the farmlands in the west and the mountainous forests in the east is an area that blends the character of the two major geographic regions of Linn County. In the foothills of the Cascade Range, spanning from the northern to the southern border of the county are hilly lands with many streams. Rural residential development has occurred within these areas. These lands are designated Farm/Forest, a hybrid of the agricultural lands and the forestlands and comprise approximately seven percent of Linn County. Land ownership is depicted in Figure 2.6 below.

Figure 2.6 Linn County Land Ownership



Linn County is a large, predominately rural county characterized by a dispersed settlement pattern and three main population centers — Albany, Lebanon and Sweet Home. Linn County consists of 15 incorporated cities and six unincorporated communities. Unincorporated communities are settlements located outside urban growth boundaries and include a mixture of land uses, specifically at least three commercial, industrial or public land uses.[24] In 2008, it was estimated that 110,185 people were living in Linn County. About 78,300 reside within the incorporated boundaries of the 15 communities in Linn County. There are about 31,800 people living in the unincorporated area of the county.[25] Most of the projected growth of Linn County will occur within the Urban Growth Boundary (UGB). Most new residential, commercial, and industrial development will occur on UGB lands surrounding the major populous areas.[26] Currently, it appears as if growth with Linn County come to a halt. The decline of residential development is an indicator of this occurrence. From 2005 to 2008 the amount of building permits issued in Linn County decreased by 67 percent.[27] Table 2.17 gives a detailed breakdown of the types and quantities of issued residential building permits.

Table 2.17: Issued Building Permits in Linn County, 2005 and 2008.

	2005		2008	
	Buildings	**Units**	**Building**	**Units**
Single Family	865	865	260	260
Two Family	18	36	6	12
Three and Four Family	3	11	1	4
Five or More Family	4	103	23	264
Total	**890**	**1,015**	**290**	**540**

Source: US Census Bureau, "Building Permits: Annual 2005 & 2008." 2008.

Government Structure

Local governments and their departments can encourage natural hazard mitigation at the county level by integrating mitigation strategies into existing plans, policies, and programs. If mitigation strategies are successfully integrated, mitigation becomes part of a government's daily activities. This section describes Linn County's county government departments that can be useful for hazards mitigation.

Linn County's governing jurisdiction includes all areas not governed by the Bureau of Land Management, Willamette National Forest, or State owned land. Linn County has 3 County Commissioners, elects an assessor, county clerk, district attorney, sheriff, treasurer, and consists of the following departments.

Business Development: provides business planning and counseling, financial counseling, loan packaging, and financial assistance to local business. This department can provide information to local businesses about incorporating hazard mitigation into their business practices

Circuit Court: provide fair and accessible justice services that protect the rights of individuals, preserve community welfare and inspire public confidence.

County Attorney: responsible for responding to legal issues of Linn County. Serves as a legal resource center for county departments and personnel.

Extension Services: The Linn County Office of the Oregon State University Extension Service provides research-based educational information and programs in agriculture, forestry, 4-H/youth and Family and Community Development for the citizens of Linn County. Extension services can assist in disseminating information about natural hazards mitigation to the public.

Fair & Expo Services: responsible for assuring the long-term viability of the Linn County Fairgrounds, presenting an exceptional Annual Fair which celebrates the heritage and diversity of Linn County, and providing year-round opportunities for facility usage. The fair and expo services department can incorporate mitigation activities into their buildings and operations to reduce the impact of hazards to the Linn County Fairgrounds.

GIS: Geographic Information System (GIS) is designed for developing, maintaining, analyzing and displaying digital spatial data. The GIS department can play a role in identifying areas vulnerable to natural hazards.

Health Services: responsible for providing health related programs and services to citizens of Linn County. Programs and services include; Alcohol, drug, and problem

gambling prevention and treatment; Commission on Children and Families; Development Disabilities programs; Environmental Health programs; and Mental Health Services. Health services can play a role in mitigation by informing the public about natural hazards that Linn County faces.

Justice Courts: responsible for carrying out legal processes regarding certain civil and criminal actions that arise outside city limits of any municipality. Linn County Justice Courts are located in Harrisburg, Lebanon, and Sweet Home.

Juvenile: increase public safety by coaching youth and families to make positive choices through education, skill building and community partnerships.

Law Library: legal research library serving citizens and legal professionals.

Museums: holds historical information representing all of Linn County.

Parks: responsible for maintaining or developing public recreational areas. This includes but is not limited to hiking trails, camping and swimming areas, boat access points, and other points of interest included in the 22 county parks. Parks can be a partner in implementing mitigation action items to reduce the impact of hazards on local parks.

Planning and Building: responsible for planning and building tasks such as permitting, code enforcement, examination of plans and buildings, code violations, and implementation of the county comprehensive plan. Planning and building departments play an important role by creating and/or implementing policies related to hazards mitigation.

Roads: responsible for the maintenance of approximately 1,139 miles of roadway and 325 bridges, as well as hundreds of culverts and other minor structures. The road department can integrate action items related to mitigating hazards to road infrastructure.

Surveyor: responsible for providing the citizens of Linn County with professional surveying expertise and advice, and carry out the surveying duties required by the Oregon Revised Statutes.

Tax Collector: responsible for collecting property taxes from each property owner in Linn County.

Existing Plan & Policies

Communities often have existing plans and policies that guide and influence land use, land development, and population growth. Such existing plans and policies can include comprehensive plans, zoning ordinances, and technical reports or studies. Plans and policies already in existence have support from local residents, businesses and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can adapt easily to changing conditions and needs.

The Linn County multi-jurisdictional Natural Hazards Mitigation Plan includes a range of recommended action items that, when implemented, will reduce the county's vulnerability to natural hazards. Many of these recommendations are consistent with the goals and objectives of the county's existing plans and policies. Linking existing plans and policies to the Natural Hazards Mitigation Plan helps identify what resources already exist that can be used to implement the action items identified in the Plan. Implementing

the natural hazards mitigation plan's action items through existing plans and policies increases their likelihood of being supported and getting updated, and maximizes the county's resources.

The following is a list of active plans and policies in Linn County that are relevant to natural hazards mitigation.

Name: Linn County Comprehensive Plan[28]

Date of Last Revision: 2001

Author/Owner: Linn County

Description: Provides a general path for the course of growth and development of Linn County. The Comprehensive Plan is charted by the map, goals, and policies of this Comprehensive Plan in conjunction with the comprehensive plans of the cities in Linn County.

Relationship to Natural Hazard Mitigation Planning: The Linn County Comprehensive Plan guides land use within the county. Goals of preserving resources and protecting life from hazards can be linked to action items that guide development to reduce the county's risk to natural hazards. Hazard mitigation can be linked to action items for how the County will implement Oregon Statewide Planning Goal 7 requirements.

Name: Linn County Community Wildfire Protection Plan[29]

Date of Last Revision: 2007

Author/Owner: EcoNorthwest/Linn County

Description: This plan describes Linn County's risk from wildfires as well as the specific steps that it will take to reduce that risk now and in the future. It is a Community Wildfire Protection Plan (CWPP), a collaborative effort to reduce the potential for future loss of life and property resulting from wildfire. This CWPP is intended to assist Linn County in reducing its risk from WUI wildfire hazards by identifying resources, information, and strategies for risk reduction. It will also help to guide and coordinate mitigation activities throughout the County.

Relationship to Natural Hazard Mitigation Planning: Action items contained within this wildfire protection plan are efforts intended to mitigate losses from future wildfires.

Name: Linn County Floodplain Management Code[30]

Date of Last Revision: 2003

Author/Owner: Linn County

Description: Regulations which apply to all areas of special flood hazard within the jurisdiction of Linn County, except areas within incorporated cities.

Relationship to Natural Hazard Mitigation Planning: Provisions of the Floodplain Management Code are to promote public safety and welfare and minimize flood related losses.

Name: Linn County Transportation Plan Code[31]
Date of Last Revision: 2005

Author/Owner: Linn County

Description: The Transportation Plan contains brief background descriptions of facilities and issues followed by the complete list of adopted County transportation policies. In addition, sections of the Plan list and prioritize proposed transportation projects.

Relation to Natural Hazard Mitigation Planning: Transportation systems assist in evacuation and response in the event of a natural hazard. Action items in the County's Natural Hazard Plan that are aimed at making the County's transit system more disaster resistant to reduce potential damage and risk can be linked to this Plan.

Name: Lebanon Area Emergency Management Plan[32]

Date of Last Revision: 2007

Author/Owner: City of Lebanon, Lebanon Fire District/City of Lebanon

Description: This plan establishes authority for emergency operations, sets the emergency policy of the City, establishes a concept of emergency operations, and assigns emergency roles to City departments.

Relation to Natural Hazard Mitigation Planning: This plan provides a framework within which all agencies and offices of the City and community can plan and carry out their respective emergency functions and responsibilities during a disaster or other emergency situations.

Community Organizations and Programs

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

The following table highlights organizations that are active within the community and may be potential partners for implementing mitigation actions. The table includes information on each organization or program's service area, types of services offered, populations served, and how the organization or program could be involved in natural hazard mitigation. The three involvement methods are defined below.

- Education and outreach – organization could partner with the community to educate the public or provide outreach assistance on natural hazard preparedness and mitigation.
- Information dissemination – organization could partner with the community to provide hazard-related information to target audiences.
- Plan/project implementation – organization may have plans and/or policies that may be used to implement mitigation activities or the organization could serve as the coordinating or partner organization to implement mitigation actions.

Name and Contact Information	Description	Service Area	Populations Served						Involvement with Natural Hazard Mitigation
			Businesses	Children	Disabled	Elders	Families	Low Income	
Albany Area Chamber of Commerce 435 1st Avenue West, Albany Phone: (541) 926-1517	Provide economic development assistance to local businesses.	Albany	x						• Education and outreach • Information dissemination • Plan/project implementation
Albany Downtown Association 240 2nd Ave. SW Suite 120, Albany Phone: (541) 928-2469	As a city, we pride ourselves on historic preservation and our commitment to responsible development in Downtown	Albany	x						• Information dissemination
Albany-Millersburg Economic Development Corp. 435 1st Ave. W, Albany Phone: (541) 926-1519	A non-profit economic development corporation, established by the vision of community leaders interested in strengthening a stagnating economy.	Albany - Millersburg	x						• Information dissemination
Albany Senior Services Office 1400 Queen Ave. Ste. 206, Albany Phone: (541) 967-8630	Provides member governments and the people living within the region a broad range of programs and services, including senior and disability services.	Linn County			x	x			• Education and outreach • Information dissemination
American Legion Post 10 1215 Pacific Blvd. S.E. Albany Phone: (541) 926-0127	Condensed Mission Statement: to inculcate a sense of individual obligation to the community, state and nation; to combat the autocracy of both the classes and the masses; to make right the master of might; to promote peace and goodwill on earth; to safeguard and transmit to posterity the principles of justice, freedom and democracy; to consecrate and sanctify our comradeship by our devotion to mutual helpfulness.	Linn County		x	x	x	x	x	• Information dissemination

Name and Contact Information	Description	Service Area	Populations Served						Involvement with Natural Hazard Mitigation
			Businesses	Children	Disabled	Elders	Families	Low Income	
American Legion Post 51 480 South Main Street, Lebanon Phone: (541) 451-1351	Condensed Mission Statement: to inculcate a sense of individual obligation to the community, state and nation; to combat the autocracy of both the classes and the masses; to make right the master of might; to promote peace and goodwill on earth; to safeguard and transmit to posterity the principles of justice, freedom and democracy; to consecrate and sanctify our comradeship by our devotion to mutual helpfulness.	Linn County		x	x	x	x	x	• Information dissemination
Boys and Girls Club of Albany 1215 SE Hill Street, Albany Phone: (541) 926-6666	To inspire and enable all young people, especially those from disadvantaged circumstances, to realize their full potential as productive, responsible, and caring citizens.	Albany		x				x	• Education and outreach • Information dissemination
Boys and Girls Club of Lebanon 305 S 5th Street, Lebanon Phone: (541) 258-7105	To inspire and enable all young people, especially those from disadvantaged circumstances, to realize their full potential as productive, responsible, and caring citizens.	Lebanon		x				x	• Education and outreach • Information dissemination
Cascade Pacific Council - Boy Scouts of America 4395 Liberty 425 SW 2nd Ave. Albany Phone: (541) 928-6694	To provide numerous volunteer services to community members in addition to preparing boys and young men for active participation in community life.	Linn County		x	x	x	x	x	• Education and outreach • Information dissemination
Eagles Lodge of Albany 127 Brodablin St, Albany Phone: (541) 926-6622	Social lodge for members and their guests. Supporters of many national, state, and local charities.	Linn County		x	x	x	x	x	• Education and outreach • Information dissemination

Name and Contact Information	Description	Service Area	Populations Served						Involvement with Natural Hazard Mitigation
			Businesses	Children	Disabled	Elders	Families	Low Income	
Family Support and Connections 6500 Pacific Blvd. SW, Albany Phone: (541) 917-4881	To inspire and enable all young people, especially those from disadvantaged circumstances, to realize their full potential as productive, responsible, and caring citizens.	Linn County		x			x	x	• Education and outreach • Information dissemination
First United Methodist Early Learning 1115 28th Ave, Albany Phone: (541) 928-4363	Provides a setting where children have the opportunity for developing basic skills and appropriate social behavior, in a cheerful, success-oriented environment. Our emphasis will be upon creative, individualized learning experiences as well as the group living experiences that are important to the child at this stage.	Linn County		x			x		• Education and outreach • Information dissemination
Girl Scouts 1221 SW 14th Ave. Albany Phone: (541) 928-4238	To provide numerous volunteer services to community members in addition to preparing girls and young women for active participation in community life.	Linn County	x	x	x	x	x	x	• Education and outreach • Information dissemination
Lebanon Area Chamber of Commerce 1040 Park Street, Lebanon Phone: (541) 258-7164	Provide economic development assistance to local businesses.	Lebanon	x						• Education and outreach • Information dissemination • Plan/project implementation
Lebanon ELKS Lodge #1663 633 Park Street, Lebanon Phone: (541) 258-3211	Mission Statement: the benevolent and protective order of Elks of the United States of America will serve the people and communities through benevolent programs, demonstrating that Elks Care and Elks Share.	Lebanon		x	x	x	x	x	• Education and outreach • Information dissemination

Name and Contact Information	Description	Service Area	Populations Served						Involvement with Natural Hazard Mitigation
			Businesses	Children	Disabled	Elders	Families	Low Income	
Linn- Benton Food Share 545 SW 2nd, Suite A, Corvallis Phone: 541-752-1010	Part of a statewide network of hunger relief agencies dedicated to reaching both those in need and to educate the larger community about the problem of hunger and its root causes.	Linn and Benton Counties					x	x	• Education and outreach • Information dissemination
Linn County Assisted Living Facilities	Complete listing of all facilities is available at: http://www.google.com/search?hl=en&q=Linn+County+Oregon+%2B+Assisted+Living&aq=f&aqi=&oq=	Linn County			x	x			• Education and outreach • Information dissemination
Linn County OSU Extension Services 104 4th Ave SW/PO Box 765, Albany Phone: (541) 967-9169	The Linn County Office of the Oregon State University Extension Service provides research-based educational information and programs in agriculture, forestry, 4-H/youth and Family and Community Development for the citizens of Linn County.	Linn County	x	x			x	x	• Education and outreach • Information dissemination
Linn County Sheriff's Office Search and Rescue 1115 Jackson St. SE, Albany Phone: (541) 967-3950	It is the ongoing mission of the Linn County Sheriff's Office Search and Rescue to save the lives of those lost or injured in the remote wildland areas of Linn County.	Linn County		x	x	x	x	x	• Education and outreach • Information dissemination • Plan/project implementation
Rotary Club of Albany P.O. Box 453, Albany Email: rich.horton@linnbenton.edu	Rotary is a worldwide organization of business and professional leaders that provides humanitarian service, encourages high ethical standards in all vocations, and helps build goodwill and peace in the world.	Albany	x	x	x	x	x	x	•Education and outreach •Information dissemination

Name and Contact Information	Description	Service Area	Populations Served						Involvement with Natural Hazard Mitigation
			Businesses	Children	Disabled	Elders	Families	Low Income	
Salvation Army Social Service Office 345 SE. Columbus St. Albany Phone: (541) 928-4774	Provides emergency assistance to people in need	Linn County		x	x	x	x	x	• Education and outreach • Information dissemination
Samaritan Health Services Locations in Albany and Lebanon Albany Phone: (541) 812-4000 Lebanon Phone: (541) 258-2101	Samaritan Health Services is a network of not-for-profit hospitals and physicians serving the close-knit Oregon communities of the mid- Willamette Valley and central Oregon Coast.	Linn County		x	x	x	x	x	• Education and outreach • Information dissemination
South Santiam Watershed Council 4431 Highway 20, Sweet Home Phone: (541) 367-5564	The S. Santiam Watershed Council represents a broad range of stakeholders who live, work, and recreate in the South Santiam Watershed. Stakeholders participating on the SSWC include rural and urban residents, private landowners, private timber industry, agricultural interests, local businesses, community organizations, schools, and city, county, state, and federal governments.	Linn County		x			x		• Education and outreach • Information dissemination
Sweet Home Area Chamber of Commerce 1575 Main Street, Sweet Home Phone: (541) 367-1621	Provide economic development assistance to local businesses.	Sweet Home	x						• Education and outreach • Information dissemination • Plan/project implementation

Name and Contact Information	Description	Service Area	Populations Served						Involvement with Natural Hazard Mitigation
			Businesses	Children	Disabled	Elders	Families	Low Income	
Sweet Home Boys and Girls Club 890 18th Avenue, Sweet Home Phone: (541) 367-6421	To inspire and enable all young people, especially those from disadvantaged circumstances, to realize their full potential as productive, responsible, and caring citizens.	Sweet Home		x				x	• Education and outreach • Information dissemination
Sweet Home Economic Development Group 1331 Main Street Suite B Phone: (541) 367-3061	Formed in 1989 to provide leadership in creating an economic development plan to overcome severe reductions in timber revenues.	Sweet Home	x						• Information dissemination
Takena Kiwanis P.O. Box 276, Albany Email: takena.kiwanis@gmail.com	Worldwide, Kiwanis clubs assist children, young adults, the aging and the needy in improving communities and encouraging international understanding	Linn County		x	x	x		x	• Education and outreach • Information dissemination
United Way of Linn County 1127 Hill St. SE. Albany Phone: (541) 926-0660	United Way focuses on the collaboration of people and resources to build healthier communities. United Way diagnoses community problems and partners with 26 community based agencies to tackle tough issues.	Linn County		x	x	x	x	x	• Education and outreach • Information dissemination • Plan/project implementation

[1] The Oregon Blue Book. http://bluebook.state.or.us/local/counties/counties22.htm

[2] Linn County Natural Hazards Mitigation Plan. January 2006. p.2-1

[3] Western Regional Climate Center. www.wrcc.dri.edu

[4] Source: USDA, Soil Conservation Service (SCS). Soil Survey of Linn County Area Oregon, Issued July 1987; pp. 2-3

[5] Ibid.

[6] Portland State University Population Research Center. "Certified Population Estimates for Oregon and Oregon Counties." http://www.pdx.edu/prc/

[7] Source: Linn County Rural Residential Buildable Lands Inventory, 2002

[8] Wang Yumei and Bill Burns. "Case History on the Oregon Go Bond Task Force: Promoting Earthquake Safety in Public Schools and Emergency Facilities." National Earthquake Conference. January 2006. oregongeology.org/sub/projects/rvs/EERI-GO-Bond-text.pdf

[9] "Save Your Home From Floods- Consider Elevating It." Federal Emergency Management Agency, October 2004. http://www.fema.gov/news/newsrelease.fema?id=7072

[10] Hayes, Thomas and Randall Jacobson. "Actuarial Rate Review." National Flood Insurance Program. November 2001.

[11] Moore, Eric, "Measuring Economic Diversification," Oregon Employment Department, (2001), http://www.qualityinfo.org/olmisj/ArticleReader?itemid=00002037&print=1, accessed January 20, 2010

[12] Read more: Economic Sectors - Manufacturing, Naics 31–33 http://www.libraryindex.com/pages/1271/Economic-Sectors-MANUFACTURING-NAICS-31-33.html#ixzz0fDhKPRd0, accessed February 11, 2010

[13] Oregon State Marine Board & Oregon State Parks, "1998 Willamette River Recreation Guide," http://www.oregon.gov/OSMB/library/docs/WillametteGuide.pdf, accessed January 23, 2010

[14] National Register of Historic Places, "2006 State Listings: Oregon-Linn County," http://www.nationalregisterofhistoricplaces.com/or/Linn/state2.html, accessed February 6, 2010

[15] Source: Linn County Transportation Plan (LCC 907.360)

[16] Oregon Department of Transportation. "Seismic Vulnerability of Oregon State Highway Bridges." 2009.

[17] Oregon Department of Transportation. "Seismic Vulnerability of Oregon State Highway Bridges." 2009.

[18] U.S. Census Bureau. American Community Survey. "Table S0801. Commuting Characteristics By Sex." 2008.

[19] Albany Transportation System Plan, 2009.

[20] Federal Aviation Administration, "Airport Facilities Data," Airport Data (5010) and Contact Information, http://www.faa.gov/airports_airtraffic/airports/, accessed February 2, 2010.

[21] Linn County Comprehensive Plan, 2005.

[22] Linn County. "Land Use Element Code." 2005.

[23] Linn County. "Land Use Element Code." 2005.

[24] Land Concervation and Development Department. "Oregon Administrative Rules Compilation." 2003.

[25] Population Research Center, PSU. "Population Estimates for Oregon, Its Counties, and Incorporated Cities." 2008.

[26] Linn County. "Land Use Element Code." 2005.

[27] US Census Bureau, "Building Permits: Annual 2005 & 2008," http://censtats.census.gov/bldg/bldgprmt.shtml, accessed February 6, 2010.

[28] http://www.co.linn.or.us/cc/LCC%20900%20%20Comp%20Plan%20Generally.pdf

[29] http://www.co.linn.or.us/Planning/wildfire/final_plan.pdf

[30] www.co.**linn**.or.us/cc/LCC%20870%20-%20**Floodplain**%20**Management**.pdf

[31] http://www.co.linn.or.us/cc/LCC%20907%20%20Transportation%20Plan.pdf

[32] Lebanon Area Emergency Management Plan url: http://www.ci.lebanon.or.us/node/273

Section 3:
Risk Assessment

This Section describes the natural hazard risk assessment process. It provides general information on what a risk assessment entails and lists the hazard vulnerability maps that are included in the Mitigation Plan. Risk assessment information for each of the hazards identified in this plan can be found in the hazard specific sections listed below.

- Section 6: Flood
- Section 7: Landslide
- Section 8: Wildfire
- Section 9: Severe Weather (Ice/Snow/Wind Storm)
- Section 10: Drought
- Section 11: Earthquake

The 2005 Steering Committee determined that since many of the identified impacts and potential mitigation activities associated with severe winter storms (ice and snow) and windstorms are similar, those hazards would be combined into a single section. The 2005 Committee also determined that volcanic hazards present a low probability of impact to the community and therefore are not in the 2005 plan. The 2010 Steering Committee revaluate all identified hazards and determined that many of the identified impacts and potential mitigation activities associated with sever winter storms (ice and snow) and windstorms are still similar and should stay in the same section. The 2010 Steering Committee also determined that volcanic hazards are still a low probability of impact to the community and therefore are not addressed at this time. The Steering Committee will revaluate volcanic hazards and determine if there is a need to include volcanic hazards in the plan when the plan is updated in five years.

What is a Risk Assessment?

The risk assessment process identifies natural hazard threats and vulnerabilities that exist within the community. A risk assessment provides information on the location of hazards; the value of existing land and property in hazard locations; and an analysis of the risk to life, property, and the environment that may result from natural hazard events. The major elements of a risk assessment are as follows:

1. **Hazard Identification** describes the hazard's geographic extent, intensity, and probability of occurrence. Maps are used when available to display major hazards that consistently affect the geographic area. In 2005 Linn County identified five major hazards that consistently affect the area. These hazards – Floods, Landslides, Wildfires, Winter Storms, and Wind Storms – were identified through the hazards analysis. Earthquakes, although infrequent in this area, were also determined to be a significant hazard due to their projected intensity and impact. During the 2010 update Linn County identified drought to be added to the six major hazards identified during the 2005 process.
2. **Profiling Hazard Events** describes the causes and characteristics of each hazard; how it has affected the county in the past; and what elements of the county's population, infrastructure, and environment have historically been vulnerable to each specific

hazard. Each hazard section of this plan includes a hazard profile. Please refer to the appropriate hazard section for a full description of the history of hazard specific events.

3. **Vulnerability Assessment/Asset Inventory** combines hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard. Critical facilities are of particular concern because they provide essential products and services to the public that are necessary to preserve the welfare and quality of life in the county. Critical facilities also fulfill important public safety, emergency response, and/or disaster recovery functions. Critical facilities such as hospitals, police stations, schools, major roads and bridges, have been identified and are shown on the map at the end of this section. The hazards sections also identify known vulnerability areas, including critical facilities and other public and private property.
4. **Risk Analysis/Potential Losses Estimate** 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. Describing vulnerability in terms of dollar losses provides the community and the state with a common framework in which to measure the effects of hazards on assets. For each hazard where data was available, quantitative estimates for potential losses are included in the hazard assessment.
5. **Assessing Vulnerability/Analyzing Development Trends** provides a general description of land uses and development trends within the community so that mitigation options can be considered in land use planning and future land use decisions. The Community Profile section of this Plan provides a comprehensive description of the vital characteristics of Linn County. The community profile describes the geography and environment; population and demographics; land use and development; housing and community development; employment and industry; and transportation and commuting patterns within the county. Analyzing these characteristics helps in identifying potential problem areas and serves as a guide for incorporating goals and ideas contained in this mitigation plan into other community development plans.

Hazard Assessment

There are three phases of hazard assessment: 1) Hazard Identification; 2) Vulnerability Assessment; and 3) Risk Analysis. Hazard identification and 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 plan includes a section on hazard identification using available data and information from county, state or federal agency sources.

Linn County conducted a vulnerability assessment for the flood hazard using FEMA and County Geographic Information System (GIS) data and tools to identify the geographic extent of the hazard and assess the land use and property value at risk from the flood hazard. Landslide hazards were estimated using available state landslide models and county GIS data. The vulnerability assessment for the earthquake hazard is derived in part from Department of Geology and Mineral Industries (DOGAMI) estimates using FEMA's HAZUS analysis model. Insufficient data exists to conduct vulnerability assessments and risk analyses for the other hazards addressed in the plan.

Even though hazard assessment information may be incomplete, there are numerous strategies the county can take to reduce risk. These strategies are described in the action items detailed in each hazard section of this Plan. Mitigation strategies can reduce disruption of critical services, reduce the risk to human life, and alleviate damage to personal and public property and infrastructure. Action items throughout the hazard sections provide recommendations to collect further data to map hazard locations and conduct hazard assessments.

Federal Risk Assessment Requirements

Federal regulations for hazard mitigation plans outlined in CFR Part 201 include a risk assessment requirement. The Federal criterion for risk assessment and information on how Linn County's Natural Hazard Mitigation Plan meets those criteria is outlined in **Table 3-1** below.

Table 3-1
Federal Criteria for Risk Assessment

Section 322 Requirement	How is this addressed?
Identifying Hazards	Each hazard section identifies hazard areas using the best available data. To the extent GIS data are available, the County developed maps identifying the location of the hazard. The Executive Summary and the Risk Assessment sections of the plan include a list of the hazard maps.
Profiling Hazards Events	Each hazard section includes documentation of the history, causes and characteristics of the hazard within the county.
Assessing Vulnerability: Identifying Assets	Where data is available, the vulnerability assessment for each hazard includes an inventory of publicly owned property within hazard areas. Each hazard section provides information on vulnerable areas in the Community Issues section. Each hazard section also identifies potential mitigation strategies.
Assessing Vulnerability: Estimating Potential Losses	The Risk Assessment Section of the mitigation plan includes a map of key critical facilities and lifelines in the county. Vulnerability assessments have been completed for the hazards addressed in the plan, and quantitative estimates were made for each hazard where data were available.
Assessing Vulnerability: Analyzing Development Trends	The Community Profile describes the development trends in the county, including the geography and environment, population and demographics, land use and development, housing and community development, employment and industry, and transportation and commuting patterns.

The risk assessment requirement is intended to provide information that will help communities identify and prioritize mitigation activities that will reduce losses from the identified hazards. There are six hazards profiled in five sections of this mitigation plan, including: floods, landslides, wildfire, severe winter storms, wind storms, and earthquakes.

Critical Facilities and Infrastructure

Critical and essential facilities are those facilities that are vital to the continued delivery of key government services or that may significantly impact the public's ability to recover from an emergency. These facilities include public services buildings such as the courthouse, jail, sheriff's office, community corrections center, and other public facilities such as schools. Critical and emergency facilities in Linn County are shown on the critical facilities map at the end of Section 2. Emergency facilities are listed in Table 2-9 in Section 2.

Facilities critical to government response and recovery activities (i.e., life, safety and property) include: emergency operations centers; police and fire stations; public works facilities; road department facilities; bridges and roads; sewer and water facilities; hospitals; and shelters. Facilities that, if damaged, could cause serious secondary impacts may also be considered "critical." A facility storing hazardous material is one example of this type of critical facility. The maps at the end of this section illustrate the critical facilities, essential facilities, public infrastructure, and critical transportation routes within the county.

Summary

Natural hazard mitigation strategies can reduce the impacts of natural hazard events on private property, public infrastructure, critical facilities, and vulnerable populations. Natural hazard mitigation by businesses, private groups and public agencies may include developing relationships with emergency management services before disaster strikes, and establishing joint mitigation strategies. Collaboration among the public and private sector to create mitigation plans and actions can reduce the impacts of natural hazards.

The County lacks sufficient information to estimate the number and type of buildings, infrastructure, and critical facilities located in all of the hazard areas within the county or to estimate the potential losses. The steering committee crafted action items and identified necessary resources to address this deficiency in the future.

Section 4:
Action Plan

This section provides information on the process used to develop the mission, goals and action items addressed in the mitigation plan. It also describes the framework that focuses the plan on developing successful mitigation strategies. The framework is made up of four parts – Mission, Objectives, Goals and Action Items*:*

- *Mission* – The mission statement is a philosophical or value statement that answers the question "Why develop a plan?" In short, the mission states the purpose and defines the primary function of the Linn County Natural Hazards Mitigation plan. The mission is an action-oriented statement of the plan's reason to exist. It is broad enough that it need not change unless the community environment changes.
- *Objectives* – Objectives link goals and action items. Objectives are the direction, methods, processes or steps used to accomplish or achieve the goals.
- *Goals* – Goals are designed to drive actions and they are intended to represent the general end toward which the County effort is directed. Goals identify how the area intends to work toward mitigating risk from natural hazards. They should not specify how the community is to achieve the level of performance. The goals are guiding principles for the specific recommendations that are outlined in the action items.
- *Action Items* – The action items are detailed recommendations for activities that local departments, citizens and others could engage in to reduce risk (See Section 5 for information on the plan's action items).

The mission, goals, objectives and actions for the Linn County plan were developed over a series of two Steering Committee meetings held on April 12th and May 17th, 2005. The Steering Committee completed an exercise on community values and issue identification to help guide the development of the action plan. On April 15, 2010 the 2010 Steering Committee reviewed the mission, goals, objectives and actions when updating the Linn County Plan. The mission, goals and objectives were reviewed and continue to reflect the community's intent to reduce or avoid the effects of natural hazards. The Action Items were further refined during Steering Committee meeting held on May 5th, 2010.

Natural Hazard Mitigation Plan Mission

In order to develop the mission statement for the plan, the Steering Committee reviewed sample mission statements from existing FEMA-approved plans and completed an exercise that answered the following three questions: 1) Who does the plan serve? 2) What does the Plan do? 3) What can the plan accomplish? The Steering Committee developed and adopted the following Plan Mission:

> *The mission of the Linn County Natural Hazard Mitigation Plan is to reduce the impact of natural hazards on the community through planning, communication, coordination and partnership development.*

Mitigation Plan Goals

To develop the Linn County plan goals, the Steering Committee reviewed sample goals from existing FEMA-approved mitigation plans and held a discussion of appropriate goals for the County. ONHW provided the Steering Committee with draft goals based on their discussions and their responses to the community values and issues identification exercises. Linn County's mitigation plan goals are:

Goal #1: Enhance coordination and communication among Linn County stakeholders to implement the Plan

Goal #2: Protect life, the built environment and natural systems through County policies, procedures and services

Goal #3: Protect life, the built environment, the economy and natural resources through community-wide partnerships

Mitigation Plan Objectives

The Linn County plan objectives were developed by the 2005 Steering Committee and reviewed in 2010. Linn County's mitigation objectives are:

Objective 1.1 Establish and maintain methods to ensure plan Implementation.

Objective 1.2 Provide leadership to promote, communicate, and support disaster safety messages and activities.

Objective 2.1 Incorporate mitigation into planning and policy development.

Objective 2.2 Support the enhancement of County vulnerability assessment activities.

Objective 2.3 Ensure continuity of County emergency service functions

Objective 2.4 Implement structural and non-structural mitigation of publicly owned facilities and infrastructure.

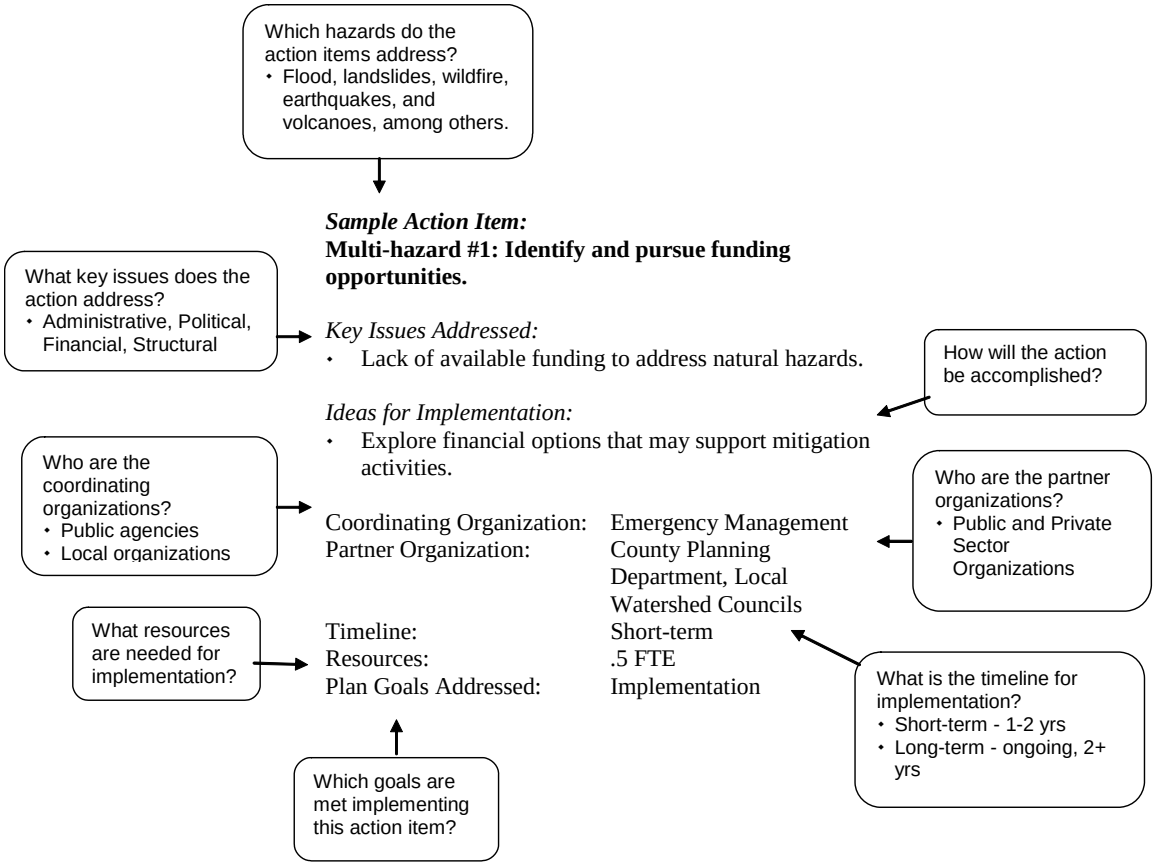
Objective 3.1 Increase citizen awareness and promote risk reduction activities through education and outreach.

Objective 3.2 Develop collaborative programs that encourage local businesses to plan for disasters.

Objective 3.3 Develop partnerships with external partners for hazard specific mitigation projects.

Mitigation Plan Action Items

Figure 4-1
Sample Action Item Documentation



Source: Oregon Natural Hazards Workgroup 2004: Oregon Pre-Disaster Mitigation Program Training Manual

A sample action item is diagramed in **Figure 4-1** above. The mitigation plan identifies short-term and long-term action items developed through data collection and research. Mitigation plan activities may be considered for funding through state and federal grant programs, including the Federal Emergency Management Agency's Hazard Mitigation Grant Program and Pre-Disaster Mitigation Competitive Grant Program, as funds are made available. Action items address both multi-hazard (MH) and hazard specific issues for the hazards addressed in this plan. To facilitate implementation, each action item includes information on timeline, coordinating and partner organizations, key issues addressed, ideas for implementation, and plan goals addressed.

Key Issues Addressed:

Each action item includes a list of the key issues that the activity will address. Action items should be fact based and tied directly to issues or needs identified throughout the planning process. Action items can be developed from a number of sources including participants of the planning process, noted deficiencies in local capability, or issues identified through the risk assessment.

Ideas for Implementation:

Appendix B contains the final Action Item Proposal Forms. Each action item form includes ideas for implementation and potential resources. This information offers a transition from theory to practice. The ideas for implementation serve as a starting point for this plan. This component of the action items is dynamic as some ideas may not be feasible and new ideas can be added during the plan maintenance process. Section 5, Plan Maintenance provides more information on how the plan will be implemented and evaluated.

The action items are suggestions for ways to implement the plan goals only. Some of these items may prove to be unrealistic and other more refined ideas may be identified and added to the plan. Ideas for implementation include things such as collaboration with relevant organizations, grant programs, tax incentives, human resources, education and outreach, research, and physical manipulation of buildings and infrastructure. A list of potential resources outlines what organization or agency will be most qualified and capable to perform the implementation strategy. Potential resources often include utility companies, non-profits, schools, and other community organizations.

Implementation through Existing Programs

The Linn County multi-jurisdictional Natural Hazard Mitigation Plan includes a range of action items that, when implemented, will reduce loss from hazard events in the county. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. Where relevant, each action items lists existing plans and programs that might be used to implement the action. Linn County currently addresses statewide planning goals and legislative requirements through its comprehensive land use plan, capital improvements plan, mandated standards and building codes. To the extent possible, Linn County will work to incorporate the recommended mitigation action items into existing programs and procedures.

Many of the Linn County multi-jurisdictional Natural Hazards Mitigation Plan's recommendations are consistent with the goals and objectives of the county's existing plans and policies. Where possible, Linn County will implement the multi-jurisdictional natural hazard mitigation plan's recommended actions through existing plans and policies. Plans and policies already in existence have support from local residents, businesses, and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can adapt easily to changing conditions and needs. Implementing the natural hazard mitigation plan's action items through such plans and policies increases their likelihood of being supported and implemented.

Coordinating Organization:

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

Internal Partners:

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

External Partners:

External partner organizations can assist the coordinating organization in implementing the action items in various functions and may include local, regional, state, or federal agencies, as well as local and regional public and private sector organizations. The internal and external partner organizations listed in the Mitigation Plan are potential partners recommended by the project steering committee, but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and or resources towards completion of the action items.

Plan Goals Addressed

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

Timeline:

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

Methodology for Prioritizing Plan Action Items

To prioritize the plan's action items Linn County utilized a multi-tiered approach. First the plan goals were prioritized. Second, the natural hazards identified in the County were prioritized based on the hazard risk assessments. Third, using the outcome of these two activities each action item was scored according to a point system to determine its relative priority in the plan.

The prioritized list of action items serves only as a starting point for the implementation of mitigation activities. Linn County has the option to implement any of the action items at any time. This allows the County to consider mitigation strategies as new opportunities arise, such as funding for action items 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 1: Prioritizing Plan Goals

To accomplish this task the Hazard Mitigation Steering Committee examined and voted on the importance of each of the plan's three goals. The steering committee members used a "dot prioritization" exercise to determine the relative priority of each goal. Committee members were given three different colored adhesive "dots". Each "dot" had a number assigned to it ranging

from 3 points to 1 point (three being the highest value). They were asked to place a single "dot" on each of the plan goals, thereby ranking the importance of each goal in making Linn County more disaster resilient. The steering committee members ranked the goals regardless of how easy each goal would be to accomplish. After the vote their priorities, the "dots" and their associated points were tallied. The 2005 results are as follows:

Highest Priority (14 Points) – Goal 2: Protect Life, the Built Environment and Natural Systems Through County Policies, Procedures and Services

2nd Highest Priority (12 Points) – Goal 3: Protect Life, the Built Environment, the Economy and Natural Resources through Community-Wide Partnerships

3rd Highest Priority (10 Points) – Goal 1: Enhance Coordination and Communication Among Linn County Stakeholders to Implement the Plan

The Steering Committee was asked to repeat the same exercise above for the 2010 update. The results are as follows:

Highest Priority (24 Points) – Goal 2: Protect Life, the Built Environment and Natural Systems through County Policies, Procedures and Services

2nd Highest Priority (22 Points) – Goal 1: Enhance Coordination and Communication among Linn County Stakeholders to Implement the Plan

3rd Highest Priority (20 Points) – Goal 3: Protect Life, the Built Environment, the Economy and Natural Resources through Community-Wide Partnerships

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. The Steering Committee ranked the hazards based on the history of hazard events in the county and the hazard-specific risk assessments in Section 6 through Section 10 of the mitigation plan. In ranking the hazards, the Steering Committee considered the hazard impact, probability, speed of onset, and duration.

To rank the hazards, the Steering Committee again used the "dot prioritization" exercise to determine the relative priority of each of the natural hazards addressed in the plan. Committee members were given five different colored adhesive "dots". Each "dot" had a number assigned to it ranging from 5 points to 1 point (five being the highest value). They were asked to place a single "dot" next to each of the five plan hazards, thereby ranking the importance of each goal in making Linn County more disaster resilient. After the vote, their rankings and their associated points were tallied. In 2005 According to this analysis, the hazards identified in the plan were ranked in the following order of priority: Severe Weather; Earthquake; Flood; Landslide; and Wildfire. In 2010 the hazards identified in the plan were ranked in the following order of priority: Flood, Earthquake; Severe Weather; Wildfire; Landslide; and Drought

Step 3: Tallying the Priorities of Plan Goals and Hazards

A prioritized list of action items was developed based on how the goals and hazards were ranked in Steps 1 and 2. In the first step, action items were assigned the following number of points for addressing each goal.[i]

3 Points – Goal 2: Protect Life, the Built Environment and Natural Systems Through County Policies, Procedures and Services

2 Points – Goal 1: Enhance Coordination and Communication among Linn County Stakeholders to Implement the Plan

1 Point – Goal 3: Protect Life, the Built Environment, the Economy and Natural Resources through Community-Wide Partnerships

In the second step, the following point system was assigned to each hazard:

8 Points – Multi-Hazard

6 Points – Flood Hazard

5 Points – Earthquake Hazard

4 Points – Severe Weather Hazard

3 Points – Wildfire Hazard

2 Point – Landslide Hazard

1 Point – Drought Hazard

Points were then assigned to each action item based on the ranking of the hazard they address. Multi-Hazard action items are assigned the most points because they address multiple hazards. The points assigned to each action item in the goal prioritization step were combined with the points assigned to each action item in the hazard prioritization step to arrive at the Action Item Priority Score. The Action Item Priority Score is noted in the Action Item Matrix included in the Executive Summary. Higher scores indicate higher priorities.

Step 4: Action Item Implementation

Linn County's Natural Hazard Mitigation Plan Steering Committee, with the assistance of Linn County Emergency Management will administer the implementation of action items with the overall guidance of the Linn County Board of Commissioners. 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.

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[i] The Hazard Mitigation Plan Steering Committee had previously identified which goals were covered by which action items.

Section 5:
Plan Implementation and Maintenance

This section details the formal process that will ensure that the Linn County multi-jurisdictional Natural Hazards Mitigation Plan remains an active and relevant document. The plan implementation and maintenance process includes a schedule for monitoring and evaluating the Plan annually and for producing an updated plan every five years. Finally, this section describes how the County and participating jurisdictions will integrate public participation throughout the plan maintenance and implementation process.

Implementing the Plan

The Linn County Planning and Building Department Director and Linn County Emergency Management Coordinator will serve as co-conveners to over see the plan's implementation and maintenance. After the Plan is locally reviewed and deemed complete, the Linn County Planning Director and Linn County Emergency Management Coordinator submit it to the State Hazard Mitigation Officer at Oregon Emergency Management. Oregon Emergency Management submits the plan to the Federal Emergency Management Agency (FEMA--Region X) for review. This review addresses the federal criteria outlined in the FEMA Interim Final Rule 44 CFR Part 201. Upon acceptance by FEMA, the County will adopt the plan via resolution. At that point the County will gain eligibility for the Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program funds, and Flood Mitigation Assistance program funds. Following County adoption, the participating jurisdictions should adopt their addendums.

Co – Convener

Linn County Emergency Management and Linn County Planning and Building Department will serve as co-conveners to oversee the plan's implementation and maintenance. They will co-chair the Steering Committee and fulfill the chair's responsibilities. These two entities will be responsible for call meetings to order and schedule times or when issues arise.

Emergency Management Coordinator roles:

- Coordinate Steering Committee meeting dates, times, locations, agendas, and member notification;
- Document outcomes of Committee meetings;
- Serve as a communication conduit between the Steering Committee and key plan stakeholders;

- Identify emergency management-related funding sources for natural hazard mitigation projects;

Planning and Building Director roles:

- Serve as gatekeeper to the project prioritization process;
- Incorporate, maintain, and update the County's natural hazard risk GIS data elements; and
- Utilize the Linn County Risk Assessment as a tool for prioritizing proposed natural hazard risk reduction projects.

Coordinating Body

The Steering Committee serves as the coordinating body for the mitigation plan:

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

Members

The following organizations were represented and served on the Steering Committee during the development of the Linn County multi-jurisdictional Natural Hazards Mitigation Plan:

- Linn County Emergency Management
- Linn County Planning and Building Department
- Linn County Road Department / County Engineer
- Linn County Parks Department
- Linn County Planning Commission Members
- Linn County Fire Defense Board
- City of Albany

To make the coordination and review of the Linn County multi-jurisdictional Natural Hazard Mitigation Plan as broad and useful as possible, the Steering Committee will engage additional stakeholders and other relevant hazard mitigation organizations and agencies to implement the identified action items. Specific organizations have been identified as either internal or external partners on the individual action item forms found in Appendix A.

Plan Maintenance

Plan maintenance is a critical component of the natural hazard mitigation plan. Proper maintenance of the plan ensures that this plan will maximize the County's and city's efforts to reduce the risks posed by natural hazards. This section was developed by the University of Oregon's Partnership for Disaster Resilience and includes a process to ensure that a regular review and update of the plan occurs. The Steering Committee and local staff are responsible for implementing this process, in addition to maintaining and updating the plan through a series of meetings outlined in the maintenance schedule below.

Annual Meetings

The Committee will meet on an annual basis to complete the following tasks. During the meeting the Committee will:

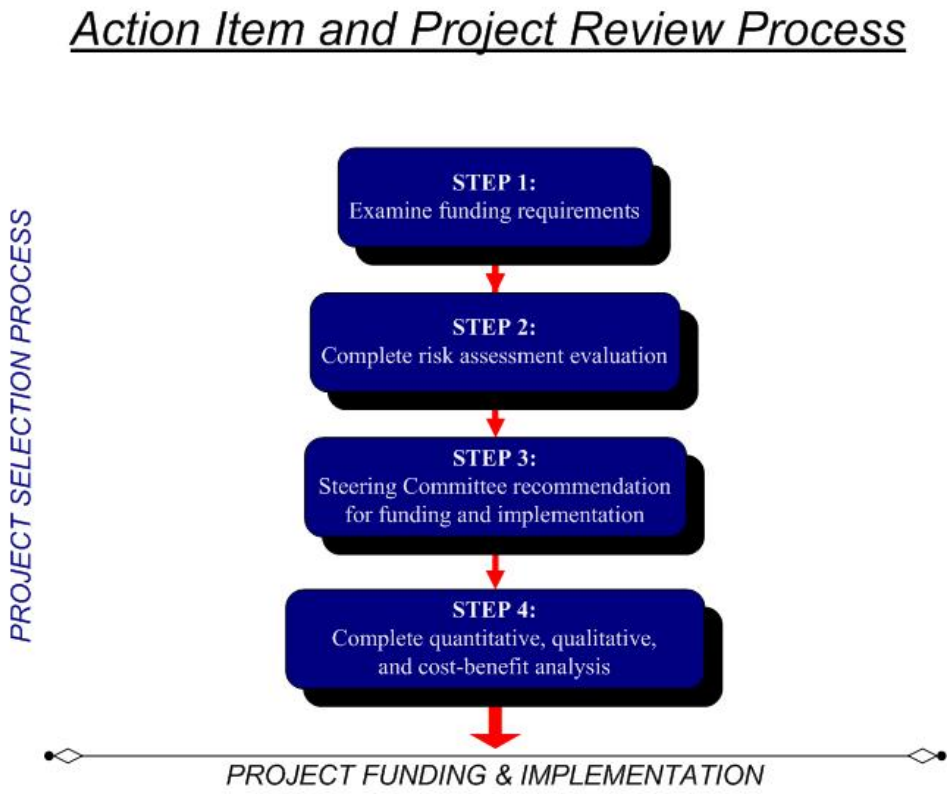
- Review existing action items to determine appropriateness for funding;
- Educate and train new members on the plan and mitigation in general;
- Identify issues that may not have been identified when the plan was developed; and
- Prioritize potential mitigation projects using the methodology described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

The convener will be responsible for documenting the outcome of the annual meeting in Appendix B. The process the Committee will use to prioritize mitigation projects is detailed in the section below. The plan's format allows the County and participating jurisdictions to review and update sections when new data becomes available. New data can be easily incorporated, resulting in a natural hazards mitigation plan that remains current and relevant to the participating jurisdictions.

Project Prioritization Process

The Disaster Mitigation Act of 2000 (via the Pre-Disaster Mitigation Program) requires that jurisdictions identify a process for prioritizing potential actions. Potential mitigation activities often come from a variety of sources; therefore the project prioritization process needs to be flexible. Projects may be identified by committee members, local government staff, other planning documents, or the risk assessment. Figure 4.1 illustrates the project development and prioritization process.

Figure 4.1: Project Prioritization Process



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

Step 1: Examine funding requirements

The Steering Committee will identify how best to implement individual actions within the appropriate existing plans, policies, or programs. The committee will examine the selected funding stream's requirements to ensure that the mitigation activity would be eligible through the funding source. The Committee may consult with the funding entity, Oregon Emergency Management, or other appropriate state or regional organizations about the project's eligibility.

Depending on the potential project's intent and implementation methods, several funding sources may be appropriate. Examples of mitigation funding sources include, but are not limited to: FEMA's Pre-Disaster Mitigation competitive grant program (PDM), Flood Mitigation Assistance program (FMA), National Fire Plan (NFP), Community Development Block Grants (CDBG), local general funds, and private foundations.

Step 2: Complete risk assessment evaluation

The second step in prioritizing the plan's action items is to examine which hazards they are associated with and where these hazards rank in terms of community risk. The Committee will determine whether or not the plan's risk assessment supports the implementation of the mitigation activity. This determination will be based on the location of the potential activity and the proximity to known hazard areas, historic

hazard occurrence, vulnerable community assets at risk, and the probability of future occurrence documented in the plan.

Step 3: Committee Recommendation

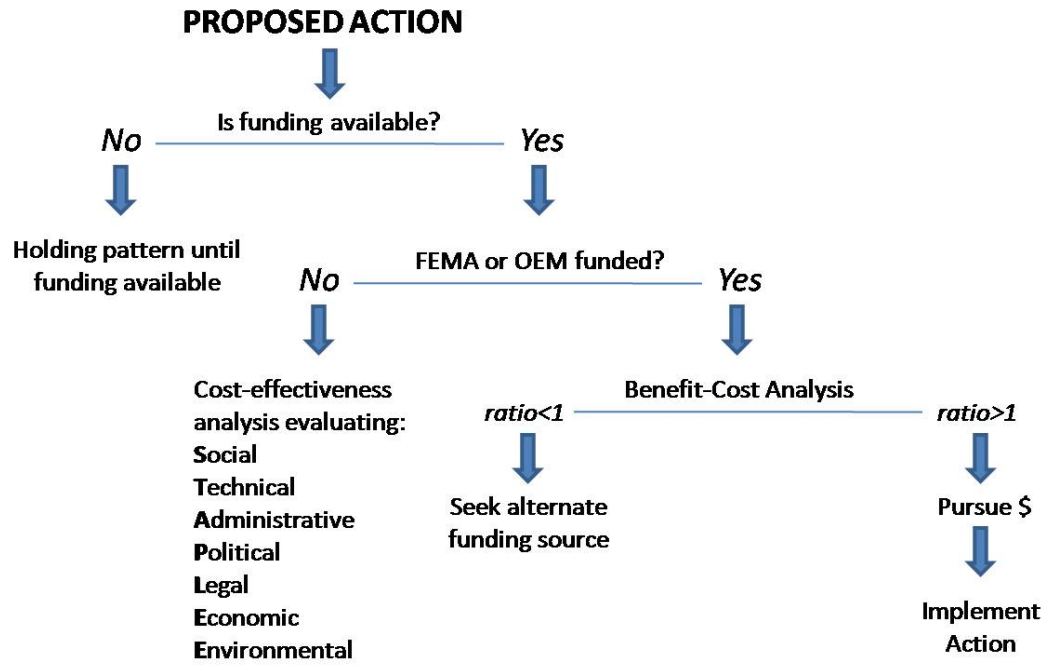
Based on the steps above, the committee will recommend whether or not the mitigation activity should be moved forward. If the committee decides to move forward with the action, the coordinating organization designated on the action item form will be responsible for taking further action and, if applicable, documenting success upon project completion. The Committee will convene a meeting to review the issues surrounding grant applications and to share knowledge and/or resources. This process will afford greater coordination and less competition for limited funds.

The Committee and the community's leadership have the option to implement any of the action items at any time, (regardless of the prioritized order). This allows the Committee to consider mitigation strategies as new opportunities arise, such as funding for action items that may not be of the highest priority. This methodology is used by the Committee to prioritize the plan's action items during the annual review and update process.

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

The fourth step is to identify the costs and benefits associated with natural hazard mitigation strategies, measures or projects. Two categories of analysis that are used in this step are: (1) benefit/cost analysis, and (2) cost-effectiveness analysis. Conducting benefit/cost analysis for a mitigation activity assists in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating natural hazards provides decision makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects. Figure 4.2 shows decision criteria for selecting the appropriate method of analysis.

Figure 4.2: Benefit Cost Decision Criteria



Source: Community Service Center's Partnership for Disaster Resilience at the University of Oregon, 2010.

If the activity requires federal funding for a structural project, the Committee will use a Federal Emergency Management Agency-approved cost-benefit analysis tool to evaluate the appropriateness of the activity. A project must have a benefit/cost ratio of greater than one in order to be eligible for FEMA grant funding.

For non-federally funded or nonstructural projects, a qualitative assessment will be completed to determine the project's cost effectiveness. The committee will use a multivariable assessment technique called STAPLE/E to prioritize these actions. STAPLE/E stands for Social, Technical, Administrative, Political, Legal, Economic, and Environmental. Assessing projects based upon these seven variables can help define a project's qualitative cost effectiveness. The STAPLE/E technique has been tailored for use in natural hazard action item prioritization by the Partnership for Disaster Resilience at the University of Oregon's Community Service Center. See Appendix C for a description of the STAPLE/E evaluation methodology.

Continued Public Involvement & Participation

The participating jurisdictions are dedicated to involving the public directly in the continual reshaping and updating of the Linn County multi-jurisdictional Natural Hazard Mitigation Plan. Although members of the Steering Committee represent the public to some extent, the public will also have the opportunity to continue to provide feedback about the Plan. Linn County will implement the following public involvement strategies:

- Publicize Steering Committee Meetings
- Press Release for Steering Committee Meetings
- Linn County website modifications requesting information on hazards, action items, new data or general comments on NHMP

Steering Committee meetings were open to the public, press release was developed and published, and the Linn County main website requested the public provide feedback on the current plan and the development of the update. To ensure that these opportunities will continue, the County and participating jurisdictions will hold at least two public meetings, post the draft on the main website and request feedback from the public, have hard copies of the draft in local libraries, and conduct outreach.

In addition to the involvement activities listed above, the County's multi-jurisdictional Natural Hazard Mitigation Plan has been archived and posted on the Partnership website via the University of Oregon Libraries' Scholar's Bank Digital Archive.

Five-Year Review of Plan

This plan will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. In the year prior to the Plan's expiration, the Committee's annual meeting will focus on plan update activities. The following questions will be asked to determine what actions are necessary to update the plan.

- Are the plan's goals still applicable?
- Are there new partners that should be brought to the table?
- Are there new local, regional, state or federal policies influencing natural hazards that should be addressed?
- Has the community successfully implemented any mitigation activities since the plan was last updated?
- Have new issues or problems related to hazards been identified in the community?
- Are the actions still appropriate, given current resources?
- Have there been any changes in development patterns that could influence the effects of hazards?
- Are there new studies or data available that would enhance the risk assessment?
- Has the community been affected by any disasters? Did the plan accurately address the impacts of this event?

The convener will be responsible for organizing the Committee to address plan update needs. The Committee will be responsible for updating any deficiencies found in the plan, and for ultimately meeting the Disaster Mitigation Act of 2000's plan update requirements.

Section 6:
Flood

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Why Are Floods a Threat to Linn County?

Linn County has several large rivers and numerous smaller tributaries that are susceptible to flooding. Flooding poses a threat to life and safety and can cause severe damage to public and private property. It is necessary to evaluate past floods and the damages sustained from them in order to realize the potential impact of future floods.

Annual flooding occurs on all major and minor drainages in Linn County. Most flooding occurs during the months of December or January, although the actual flood season extends from October to April. During past floods, the worst flood damage occurred in the Tennessee District bottom lands; the Knox-Butte-Crabtree and Dever-Conner areas; and the Calapooia River drainage. The city of Scio is also vulnerable to severe flood impacts. Flood damage has occurred to commercial buildings in the cities of Albany, Lebanon and Sweet Home, however agricultural lands have suffered the most damage. The Soil Conservation Service has estimated that 140,000 acres are inundated during river and stream flooding each year in Linn County.[1]

History of Floods in Linn County

Linn County has a lengthy flood history. The most serious flooding in Linn County occurs in December and January. These events are often associated with La Nina conditions that result in prolonged rain and rapid snow melt on saturated or frozen ground. The resultant sudden impact of water swells rivers, causing tributary streams to overflow their banks and flood communities.

Annual intense rainfalls combined with snow pack in the Cascade Foothills, and the flat topography of the Willamette Basin, creates a setting for a history of floods in Linn County. Spring snowmelt sometimes causes problematic flooding. Water flows more quickly over logged forestland, transmitting more rainwater into streams and rivers more quickly. Sheet flooding that originates from agricultural land that is far from a source river or stream may not be predicted on federal Flood Insurance Rate Maps.

Table 6-1 below provides information on the previous occurrences of flooding in the mid-Willamette Valley region of Western Oregon.

Table 6-1
Significant Western Oregon Floods

Date	Location	Characteristics	Flood Type
Dec. 1861	Willamette Basin and Coastal Rivers	Proceeded by two weeks of heavy rain. Every town on the Willamette flooded or washed away.	Rain on snow; snow melt
Feb. 1890	Willamette basin and Coastal Rivers	Second largest known flood in the Willamette Basin. Almost every large bridge was washed downstream.	Rain on snow
Dec. 1937	Western Oregon	Flooding followed heavy rains. Considerable highway flooding; Landslides.	Rain on snow
Jan. 1953	Western Oregon	Widespread flooding in western Oregon accompanied by windstorm.	Rain on snow

Dec. 1964-Jan. 1965	Willamette Basin	Record flooding throughout Willamette Basin. Two intense storms. Near-record early season snow Depths. Largest flood in Oregon since dam construction on upper Willamette (1940s-50s).	Rain on snow
Jan. 1974	Western Oregon	Flooding followed heavy wet snow and freezing rain. Nine counties received Disaster Declaration	Rain on snow
Dec. 1978	Western Oregon	Intense heavy rain, snowmelt, saturated ground. 1 fatality in Region 3 (Benton County)	Rain on snow
Feb. 1986	Entire State	Severe statewide flooding. Rain and melting snow. Numerous homes flooded and highways closed.	Snowmelt
Feb. 1987	Western Oregon	Willamette River and tributaries. Mudslides; damaged highways and homes.	Rain on snow
Dec. 1995 to Feb. 1996	Entire State	Deep snow pack, warm temperatures, record-breaking rains. Flooding, landslides, power-outages. (FEMA-1099-DR-OR)	Rain on snow
Nov. 1996	Entire State	Record-breaking precipitation; local flooding / landslides. (FEMA-1149-DR-OR)	Rain on snow
December 2005	Polk, Marion, Linn, Lane, Benton Counties	Heavy rains causing rivers to crest above flood stage in Polk, Marion, Linn, Lane and Benton Counties as well as other counties in the Willamette Valley	Riverine
January 2006	Willamette Valley	Heavy rains caused many rivers to crest above flood stage in the Willamette Valley, causing road closures and damage to agricultural lands.	Riverine
December 2007	Yamhill	South Yamhill River flooded near McMinnville, causing damage to roads and bridges, 120 homes in Sheridan along with a few businesses and churches, and causing minor damage in Willamina. Total county wide dam estimates at $9.6 million.	Riverine
December 2007	Polk	Major flooding in Suver and other areas in Polk County. Total losses equal 1 million for entire county.	Riverine

Source: Oregon Natural Hazards Plan, from Taylor, George and Raymond Hatton, 1999, *The Oregon Weather Book*, p.77-103.

The most recent significant floods in Linn County occurred in 1996, causing widespread damage in both rural and urban areas of the county and throughout the region. The February 1996 flood was caused by prolonged heavy precipitation that contributed to an early snowmelt. Many rivers and creeks throughout the Willamette River watershed rose to the mapped 100-year flood level inundating surrounding areas including cities. As the rivers and tributaries overflow, runoff from farm land also backed up causing flooding across the floor of the Willamette Valley, flooding farmland and rural communities. A Presidential Declaration of Emergency was declared and three lives were lost in Linn County as a direct result of the flood. Another major storm hit the area in November 1996, again causing urban and riverine flooding.

The two 1996 floods caused a combined $400 million in damages statewide, as 26 major rivers reached flood stage. More than 100 Red Cross and Salvation Army shelters were opened and

23,000 residents evacuated their homes. Seven casualties were reported and 50 people were injured. An estimated 1,700 Oregonians lost their jobs due to flooding and the Small Business Association (SBA) loaned Oregon businesses over $40.5 million to assist with recovery efforts.[2]

The February 1996 flood resulted in property losses in Linn County of over $8 million. Most significantly, three residents of Linn County lost their lives in the flood, including an eight year old girl.[3]

Although the 1996 floods created a major disaster across the region, the floods of 1861, 1890 and 1964 were larger. The Christmas flood of 1964 caused over $157 million in damage statewide and twenty people lost their lives. The floods destroyed hundreds of homes and businesses, forced the evacuation of thousands of people, destroyed at least thirty bridges and washed out hundreds of miles of roads and highways.[4]

Causes and Characteristics of Flood Hazards

Flooding occurs when climate, geology and hydrology combine to create conditions where water flows outside of its usual course. Linn County's geography and climate combine to create chronic seasonal flooding conditions.

Precipitation

Linn County spans a wide range of climatic and geologic regions. The elevation in Linn County ranges from 125 feet above sea level along the Willamette River in western Linn County to 10,497 feet at the peak of Mt. Jefferson in eastern Linn County. The elevation changes cause significant differences in precipitation. Average annual precipitation ranges from 40 inches of rain on the valley floor to more than 85 inches of rain and snow at the Santiam Pass. Precipitation occurs primarily (79 percent) between the months of October through March, with very little precipitation falling between mid-June and mid-September.

Flooding is most common from November through March when Pacific storms bring intense rainfall to the area. The larger floods are more common between December and February when heavy rains lasting several days can combine with snowmelt and saturated soils from previous rains. Linn County's annual precipitation can be found in the Executive Summery, M-10 (Maps).

Geography and Geology

Approximately one-half of the land area and almost all of the population of Linn County lie within the Willamette River Basin, either on the valley floor or in the western Cascade foothills. The broad valley floodplain can be easily inundated by floodwaters from the Willamette River and its tributaries or by ponding and sheet flooding across the open farm fields. The valley floor consists of fine-grained deposits of Willamette silt, sand and gravel and includes many fine silts and clays of poor permeability.

According to the National Flood Insurance Program (NFIP), Oregon has 256 flood prone communities including all 36 counties. Flooding typically results from large-scale weather

systems generating prolonged rainfall and from "rain on snow" events that cause large amounts of snowmelt. Other sources of flooding include flash floods associated with locally intense thunderstorms, ice jams, and dam failures.[5]

Many of Oregon's flood records were set in December 1964 and January 1965 during the "Christmas Flood." From December 20th through 24th, 1964, the most severe rainstorm to occur in Central Oregon and one of the most severe west of the Cascades left many areas with two-thirds their normal annual rainfall in five days. A similar flood event occurred in February 1996. Following an extended period of unseasonably cold weather and heavy snowfall in the Pacific Northwest, warming temperatures and rain began thawing the snowpack and frozen rivers throughout Oregon. On February 6, a strong subtropical jet stream or "pineapple express" reached Oregon. This warm, humid air mass brought record rainfall amounts, quickly melting the snow pack.[6]

Types of Flooding

There are three primary types of flooding in Linn County: riverine flooding, urban area flooding, and shallow area flooding or ponding. Some areas of Linn County within the western Cascades or possessing steep topography may also be subject to flash floods. Linn County FEMA flood plain, 100-year flood zone map can be found in the executive summery, M-12.

Riverine Floods

Riverine flooding is the most common flood hazard in Linn County. It is caused by the passage of a large quantity of water that cannot be contained within the normal stream channel. The increased stream flow is usually caused by extensive rainfall over a period of several days. The most severe flooding conditions generally occur when rainfall is augmented by snowmelt. If the ground is saturated or frozen, stream flow can be increased even more by the inability of the soil to absorb additional precipitation. Examples of riverine events are the flooding in February 1996 and December 1964 to January 1965.[7]

Riverine floods generally develop from large-scale weather systems that generate prolonged rainfall over a wide geographic area over a period of days, thus providing some level of advance warning. Riverine flooding occurs mainly during the winter months, with the onset of persistent, heavy rainfall, and during the spring, with the melting of snow in the Cascade Range.
The principal riverine flood sources for Linn County are the Willamette River and its tributaries, especially[8]:

- The Calapooia River
- The North Santiam River
- The South Santiam River
- Thomas Creek
- Crabtree Creek
- Ames Creek
- Oak Creek
- Peavey Ditch
- Truax Creek

The most significant flooding to affect Linn County is related to the unregulated Calapooia River and creeks. Flood damage has occurred in the Scio area from Thomas Creek and the related drainage basin; from Crabtree Creek; in the area surrounding Oak Creek running between Albany and Lebanon; from Courtney Creek in the Brownsville-Halsey area; and from the Calapooia River, which extends from south central Linn County through Holley, Crawfordsville, Brownsville and the northwest corner of Albany, where it empties into the Willamette River. Property damage to homes and damage to crops and loss of livestock are the primary loss due to flooding in these areas. Transportation routes within the county can be disrupted from hours to days during a flood event. While technically not considered flooding, water from heavy rainfall generated in the Cascade foothills and within the valley annually causes road closures as it flows across the roads.[9]

Flash Floods

Flash floods are a major cause of weather-related deaths in the United States. Flash flooding is caused by extremely intense rainfall over a short period of time, commonly within a single drainage. Flash floods can occur with little or no warning and can reach full peak runoff in only a few minutes. Flash floods are most common in arid and semi-arid areas where there is steep topography.[10]

Central and Eastern Oregon are the areas of the state that are most susceptible to flash flooding. Flash floods usually occur in the summer during the thunderstorm season. The key contributors to flash flooding are rainfall intensity and duration. Topography, soil conditions and ground cover also impact flooding. Flash floods, because of their intensity, often pick up large loads of sediment and other solid materials. In these situations, a flash flood may arrive as a fast moving wall of debris, mud and water. Linn County does not have any areas currently identified as being susceptible to flash floods.

Occasionally, floating debris or ice can accumulate at a natural or man-made obstruction and restrict the flow of water. Water held back by the ice jam or debris dam can cause flooding upstream. Subsequent flash flooding can occur downstream if the obstruction suddenly releases. Areas subject to flash floods are not as obvious as a typical riverine floodplain. However, flash floods may be associated with recognizable locations such as canyons or arroyos. The most notorious flash flood in Oregon is the June 1903 event in Heppner.[11]

Shallow Area Flooding

Some areas are characterized by FEMA as being subject to shallow flood hazards with flood depths of only one to three feet. These floods are usually low velocity events characterized by “sheet flows” of water, and are common in some areas of the Willamette Valley floor.

Urban Flooding

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. The transition from pervious surfaces to impervious surfaces results in more water running off instead of infiltrating into the ground. The water also runs off into watercourses more quickly. 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 flooding.[12]

Development also contributes to the severity of normal stream cycles. Urbanization and storm water runoff have had a significant impact on Willamette Valley flooding. Undersized culverts, bridge clearance, substandard dikes and levees, and debris dams also cause or exacerbate flooding problems.[13]

Dam Failure Flooding

The National Inventory of Dams (NID) identifies 26 Linn County dams in its inventory. The NID also identifies seven dams considered to be High Hazard Potential dams. A major failure to one of these High Hazard Potential dams would almost certainly cause loss of life, and may also cause damage to structures, roads, utilities and crops, and result in economic losses.

Because dam failure can have severe consequences, FEMA requires dam owners to develop Emergency Action Plans (EAP) for warning, evacuation, and post-flood actions. According to the Oregon Water Resources Department (WRD) three of Linn County's High Hazard Potential dams – Smith River, Trail Bridge, and the Willamette National Log Pond – do not have emergency action plans filed. These three are privately owned dams.

Flood Terminology

Floodplain

A floodplain is a land area 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 flood water. The floodplain is made up of two sections: the floodway and the flood fringe.[14]

100-Year Flood

The "100-year" floodplain (or base flood) is that area where there is a 1% chance of a flood of that magnitude or greater in any given year. The 100-year floodplain is the area adjoining a river, stream, or watercourse covered by water during a 100-year flood event.

Floodway

A floodway is the channel of a river and the portion of the floodplain that carries most of the flood flow. Floodways are usually the area where water velocities and forces are the greatest and most destructive. The NFIP definition of floodway 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." NFIP regulations, adopted in local ordinances, require that the floodway be kept open so that flood flows are not obstructed or diverted onto other properties.[15]

Flood Fringe

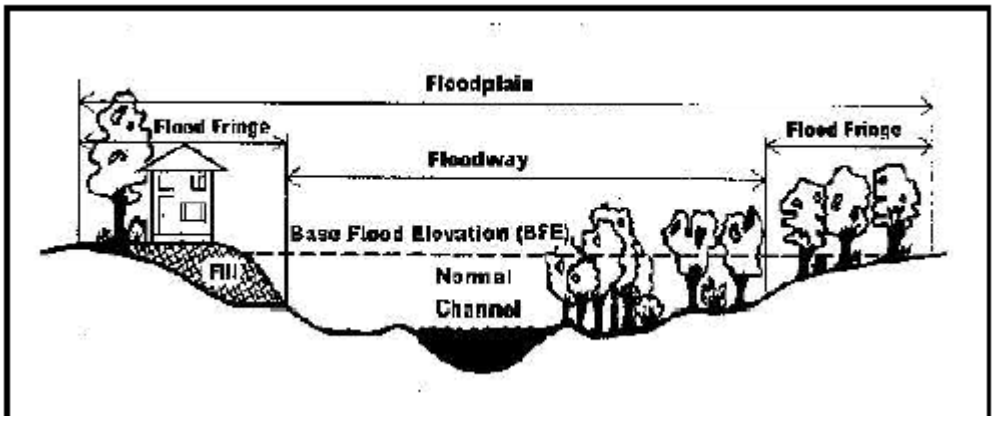
The flood fringe refers to the outer portions of the floodplain, beginning at the edge of the floodway and continuing outward. The Linn County Floodplain Management Code (Linn County Code (LCC) 870.050(M)) defines the "flood fringe" as: "that portion of the

floodplain that lies beyond the floodway and serves as a temporary storage area for flood waters during a flood."

Base Flood Elevation (BFE)
The term "Base Flood Elevation" refers to the elevation (measured in feet above sea level) that the base flood (100-year flood) is expected to reach.

Development
The Linn County Floodplain Management Code (LCC 870.050(H)) defines "development" as: "any manmade change to improved or unimproved real estate including but not limited to buildings or other structures, partitioning or subdividing, mining, dredging, filling, grading, paving, excavation or drilling operations.

Figure 6-1
Flood Hazard Schematic



Source: Oregon State Natural Hazard Mitigation Plan, June 2000, FL-5

Flood Risk

Flood risk or probability is generally expressed by frequency of occurrence. It is measured as the average recurrence interval of a flood of a given size and is stated as the percent chance that a flood of a certain magnitude or greater will occur in any given year. The Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP) is based on the risk associated with a "100-year" or base flood. This is a flood that has a 1% chance of occurring in any year or a 26% chance of occurring during the life of a 30-year home mortgage.[16]

Information regarding the probability of flooding at a given location is provided by Flood Insurance Studies (FIS) and Flood Insurance Rate Maps (FIRMs) produced for the NFIP. Many of the flood studies in Oregon were conducted in the late 1970s and early 1980s. The Linn County FIRMs were published on September 29, 1986.

These studies and maps represent flood risk at a point in time and don't reflect changing conditions in the watershed. For example, many urban areas, rural communities and rural residential areas have had significant population increases during the past twenty years. Increased development changes the hydrology of urban streams as increased impervious surface results in greater runoff volumes and velocities.

Although many communities rely exclusively on FEMA's flood insurance maps to characterize the risk of flooding in their area, some jurisdictions have developed their own flood hazard maps. For example, several jurisdictions in Oregon have used high water marks from the February 1996 flood events in conjunction with the FEMA maps to better reflect the true flood risk. Some communities have used aerial photos taken during the 1996 and 1997 floods to serve as a benchmark for predicting flood impacts.[17]

There is insufficient data to fully determine the probability of future flood occurrence and severity at specific locations across the county. However, based on past flood events and Linn County's flood history the probability is high that portions of the county will experience severe flooding at some point in the future.

Recent data has become available that could be used to better predict the probability of future flood occurrence and severity in Linn County. This data specifically pertains to LIDAR data that has been obtained to generate more accurate topographical maps. A hydraulic model could be developed using predicted rainfall intensity curves for a 50 to 100 year rainfall event combined with the LIDAR data. The resulting model could generate more accurate Flood Maps than are presently provided by FEMA. Linn County currently does not have the resources to complete this task. Present FEMA flood maps are based on old data and floods that occurred prior to 1970 after which time dams were installed on major rivers to limit flooding and generate power. Also, a number of bridges and road crossings have been improved which have increased the hydraulic capacity of some rivers and therefore reduced the risk of flooding.

Flood Warnings

The National Weather Service (NWS) of the National Oceanic and Atmospheric Administration is the federal agency in charge of weather forecasts and warnings for the nation, including flood forecasts and warnings. In Oregon, the NWS accomplishes this mission through the Northwest River Forecast Center and forecast offices located in Medford, Pendleton, and Portland, Oregon, and in Boise, Idaho.

Flood forecasts are developed using information from U.S. Geological Survey's (USGS) stream gauging stations, and from gauges operated by state Water Resources Department (WRD). USGS and WRD each have approximately 200 stream gauges in Oregon. Real time stream data is available on line for many of Oregon's larger river basins including the Willamette. Many of these gauges are available real time on the internet and most of the historical data can also be accessed via web sites. Flood warnings generally refer to flood levels that will be a number of feet above "flood stage." In general, flood stage is the water surface level at which water begins going over the banks.[18]

Community Rating System

Currently, fifteen Oregon communities participate in the Community Rating System. These communities have adopted floodplain development standards that are more protective than those required by the National Flood Insurance Program. They have also developed hazard mitigation plans, preserved land and open space for flood storage and to keep structures out of harm's way, and conducted public outreach on flood hazards. Residents in these communities benefit through reduced flood insurance rates.

Several communities, including Linn County, that are not currently participating in the CRS are also implementing floodplain development standards that are more protective than the NFIP. Linn County requires the elevation of residential structures two feet above the base flood elevation and applies its regulations to an area more extensive than those included on Flood Insurance Rate Maps (FIRM).[19]

Linn County does not participate in the CRS program. Within Linn County, the Cities of Albany and Scio participate in the CRS program, with current ratings of 7 and 9 respectively (on a scale of 1 – 10, 1 being best).

Flood Hazard Assessment

The flood hazard assessment provides information on the location of flood hazards, the land and property characteristics within the hazard area, and an assessment of risks to life and property that may result from a flood hazard event. The three elements of hazard assessment are: (1) hazard identification; (2) vulnerability assessment; and (3) risk analysis.

Hazard Identification

The first phase of flood-hazard assessment is hazard identification. Hazard Identification identifies: (1) the geographic extent of areas subject to flooding, (2) the expected intensity of a flood event at different locations, and (3) the probability of occurrence of flood events.

Flood hazard information is depicted using floodplain maps. The County uses the detailed information on floodplain maps to help make policy and land-use decisions. The floodplain maps will help the project Steering Committee analyze vulnerability and risk and identify flood mitigation action items.

The Federal Emergency Management Agency (FEMA) mapped the 100-year and 500-year floodplains in Linn County through the Flood Insurance Study (FIS). Information regarding the probability of flooding at a given location is provided by the FEMA Flood Insurance Rate Maps (FIRMs) produced for the National Flood Insurance Program (NFIP). The Linn County FIRMs were published on September 29, 1986. Occasionally, individual property owners, in the course of developing their property, will request a Letter of Map Amendments from FEMA to indicate that a specific area of their property is outside the 100-year floodplain.

The FIRM floodplain information is incorporated into the county's Geographic Information System (GIS) data. The County GIS also includes elevation contour data for western Linn

County at five-foot intervals in rural areas and two-foot intervals in urban areas. Improved elevation contour information could be useful in the future in improving the accuracy of the local FIRM maps.

As previously mentioned the current FIRM maps could be updated base on recent improvements in data and improvements in the infrastructure in Linn County that have occurred over the past 40 years. The Steering Committee has developed an action item to address the updated data by discussing funding opportunities to develop a hydraulic study for Linn County.

Flood Hazard Vulnerability Assessment

Section 201.6(c)(2)(ii)(A) of the Disaster Mitigation Act of 2000 requires that risk assessments include a description of the jurisdiction's vulnerability to the hazard. This description shall include an overall summary for the hazard and its impact on the community. Vulnerability is described later in this chapter in terms of the type and number of existing and future buildings, infrastructure, and critical facilities located in identified hazard areas.

Linn County Vulnerability Summary

Vulnerability assessment is the second phase in flood hazard assessment. Vulnerability assessment inventories property development and populations that are located within a flood hazard area and so are vulnerable to flooding. Locating and understanding the population, property and facilities that are exposed to flood hazards will assist in reducing risks and preventing losses from future flood events.

The amount of property within the floodplain and the value of those properties must be calculated to estimate potential flood losses. Calculating the county's vulnerability to flood events is difficult because site-specific inventory data, including inundation levels for a specific flood event (i.e. 10-year, 50-year, or 100-year) are not readily available.

Notwithstanding these data limitations, a regional risk assessment completed in 1998 estimated the area, number of tax lots, and road miles in the 100-year floodplain in Linn County, as shown in ***Table 6-2***.

Table 6-2
Flood Hazard Summary

Area in the 100-year Floodplain (Acres)	110,464 acres
Area in the 100-year Floodplain (Square Miles)	173 square miles
Roads in the 100-year Floodplain (Miles)	302.50 miles
Tax lots partially or completely within the 100-year Floodplain	7282

Source: Linn County GIS; May 28, 2010

The Regional All-Hazard Mitigation Master Plan, July 27, 1998, estimated the number of buildings and the total value of buildings within the 100-year floodplain in Linn County using a

model based on census tract, floodplain, road mile, and aggregate building data. The building vulnerability information is shown in ***Table 6-3***.

Table 6-3
Flood Hazard Vulnerability by Building Type

Item	Residential	Commercial	Industrial	Agricultural	Public	Total
Buildings in 100-Year Floodplain	2694	47	32	10	8	2791
Square Footage in 100-Year Floodplain (x1000)	4099	895	904	139	144	6180
Potential losses in 100-Year Floodplain (x$1000)	$87,218	$19,038	$19,230	$2,948	$3,064	$131,498

Source: Regional All-Hazard Mitigation Master Plan July 27, 1998

To update the 1998 hazard and vulnerability estimates of the types and number of buildings, infrastructure, and critical facilities in the flood hazard area, more detailed GIS work to generate more accurate topographic maps, as well as engineering hydraulic modeling studies need to be conducted. This would result in more accurate FIRM maps and therefore better vulnerability estimates. The County currently has insufficient data to complete this step of the vulnerability assessment. Additional inventory data needed might include:

- Updated FEMA Flood Insurance Rate Maps based on better topographical maps and hydraulic modeling.
- Geo-coded building location, type, occupancy, footprint and ground floor elevation data. A mechanism would be needed to collect this information.
- Inundation level at each building for a particular flood event. Elevations could be developed from flood survey data; using aerial surveys of flood photos to derive vertical elevation data at a building location; or using field survey data collected by utilities during the course of road construction, pipe burial or other facilities improvements.

Recent LIDAR data that has become available combined with hydraulic modeling should be used to update the above as much as possible. Human resources and equipment need to be provided to be able to complete the work.

Community Flood Impacts

The type of property damage caused by flood events depends on the depth and velocity of the floodwaters. Faster moving floodwaters can wash buildings off their foundations and sweep cars downstream. Pipelines, bridges, and other infrastructure can be damaged when high waters

combine with flood debris. Extensive flood damage can be caused by basement flooding and landslide damage related to soil saturation from flood events. Surface water entering into crawlspaces, basements, or daylight basements is common during flood events, not only in or near floodplains, but also on hillsides and other areas that are far removed from floodplains. Most flood damage is caused by water saturating materials susceptible to loss (e.g., wood, insulation, wallboard, fabric, furnishings, floor coverings, and appliances). Most of the losses in the 1996 floods were due to saturation damage.

Private property flood issues

The development of private property within the floodplain must conform to the requirements of the Linn County Floodplain Management Code (LCC Chapter 870). The purpose of the Floodplain Management Code is to promote public safety and welfare and to reduce the potential for loss of life and property damage. This is achieved by requiring that redevelopment of private property be done in a manner that will reduce flood impacts and by managing the alteration of the floodplain, channels and natural barriers that accommodate or channel flood waters on private property. In 1996, flood damage to private property totaled one-third of damages statewide.[20] The Floodplain Management Code helps to reduce public costs for emergency operations, relief, evacuations and restorations and reduces flood insurance and development costs through floodplain management.

Homes

Housing losses accounted for the largest share of private property damage during the 1996 flood events.[21] In Linn County, FEMA awarded 312 Housing Assistance Grants totaling $686,576 and 98 Family Assistance Grants totaling $151,941. The Small Business Administration reported the approval of 78 loan applications for homes totaling $1,102,800.[22] Homes in rual floodplain areas often depend on private sewage treatment systems. Homes in frequently flooded areas can suffer damage to septic systems and drain fields. Inundation of these systems may result in leakage of wastewater into surrounding areas. In many cases, flood damage to homes can render them unlivable.

Manufactured Homes

Statewide, the 1996 floods destroyed 156 housing units. Of those units, 61 percent were mobile homes and trailers.[23] Several older manufactured home parks in Linn County are located in floodplain areas. Manufactured homes have a lower level of structural stability than “stick-built” homes. A stick-built home’s foundation and building frame are put together on site as opposed to manufactured homes which are pre-fabricated off site.[24] Manufactured homes in floodplain zones must be anchored to provide additional structural stability during flood events. Linn County enforces the manufactured home construction standards in LCC Chapter 870 for development in floodplains to reduce the severity of damages from flood events.

Business and Industry

Flood events impact businesses by damaging property and by interrupting commerce. Flood events can cut off customer access to a business as well as close a business for repairs. As a result of the 1996 floods, the Small Business Administration reported that it approved 21 loans

for businesses in Linn County that were damaged in the flood, totaling $656, 300. It is estimated that the loans protected 41 jobs that otherwise would have been lost.[25]

A quick response to the needs of businesses affected by flood events can help a community maintain economic vitality in the face of flood damage. Responses to business damages can include funding to assist owners in elevating or relocating flood-prone business structures.

Public Infrastructure

Publicly owned facilities are a key component of daily life for all citizens of Linn County. Damage to public water and sewer systems, transportation networks, flood control facilities, emergency facilities, and offices can hinder the ability of the government to deliver services. Government can take action to reduce risk to public infrastructure from flood events, and to craft public policy that reduces risk to private property from flood events.

Buildings and Roads

In the wake of the 1996 floods, damage to public buildings statewide represented 34 percent of total public losses.[26] Of particular importance during flood events are facilities critical to government response and recovery activities that are located in flood hazard areas.

During natural hazard events, or any type of emergency or disaster, dependable road connections are critical for providing emergency services. The Linn County Road Department is the primary response agency in Linn County for maintaining roadways and bridges, maintaining culverts and roadside drainage systems to reduce flood impacts, monitoring roadway emergencies, closing flooded roadways, and taking necessary emergency maintenance measures to keep roadways functioning during flood events.

Bridges

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

(1) They are often important links in road networks, crossing water courses or other significant natural features; and,

(2) They can be obstructions in watercourses, inhibiting the flow of water during flood events.

Damaged bridges can disrupt or cut off traffic flow and impede access to and by emergency services. They can also lead to economic losses when commuters and consumers have difficulty reaching their destinations and when businesses are unable to deliver products and services to their clients.

There are approximately 586 bridge crossings in Linn County, including state highways, county roads and urban areas. Linn and Benton counties are separated by the Willamette River and there are only two bridge crossing points linking the two counties, comprising five total bridges. Two are on Highway 20 in Albany and three are on Highway 34 at Corvallis. While these bridges are constructed out of the floodplain, numerous other low-lying state and county bridges are susceptible to flooding. Examples during the 1996 flood include bridges on Highway 226

south of Scio; Highway 228 west of Brownsville; and numerous culverts and smaller bridges on rural roads throughout the valley. Flooding at bridge crossings isolates small communities and rural home sites and impedes access to emergency services.

Floods and Natural Systems

Maintaining and restoring natural systems helps mitigate the impact of flood events on the built environment. Floods can change the natural environment and hydrology of an affected area. High water can be beneficial to the natural processes within a floodplain and can benefit riparian areas. Maintaining these natural flood reservoir areas reduces downstream flood levels and impacts.

Riparian Areas

Riparian areas are important transitional areas that link water and land ecosystems. Vegetation in riparian areas is dependent on stream processes, such as flooding, and often is composed of plants that require large amounts of water such as willow and cottonwood trees. Healthy vegetation in riparian buffers can reduce streamside erosion.[27] During flood events, high water can cause significant erosion. Well-managed riparian areas can reduce the amount of erosion and help to protect water quality during flood events. To help protect these areas, the Linn County Land Development Code restricts development within a 50-foot riparian buffer around rivers, streams, lakes and wetlands.

The three watershed councils within Linn County area have also been actively implementing improvements to the riparian areas by completing projects with landowners that add healthy vegetation and other riparian improvements. The Linn County Road Department coordinates many of its efforts with those of the watershed councils as it pertains to bridge crossings, and riparian bank enhancement and stabilization projects completed to protect roads from flood damage.

Wetlands

Many floodplain and stream-associated wetlands absorb and store storm water flows, which reduces flood velocities and stream bank erosion. Preserving these wetlands reduces flood damage and the need for expensive flood control devices such as levees. When the storms are over, many wetlands augment summer stream flows by slowly releasing the stored water back into the stream system.[28]

Wetlands are highly effective at removing nitrogen, phosphorous, heavy metals, and other pollutants from water. For this reason, artificial wetlands are often constructed for cleaning storm water runoff and for tertiary treatment (polishing) of wastewater. Wetlands bordering streams and rivers and those that intercept runoff from fields and roads provide this valuable service free of charge.[29]

Linn County coordinates with the Oregon Division of State lands to restrict development, fill or removal activities that may impact identified wetlands. The Linn County Land Development Code also restricts development within a 50-foot buffer area around inventoried wetlands.

Repetitive Flood Loss Areas

A Repetitive Loss Property is defined as any property with two or more losses in any 10-year rolling period. If there are two losses within 10 days of each other only one of those losses is counted. This is used only for purposes of selecting a property.

FEMA identifies seven properties as repetitive flood loss properties within unincorporated Linn County. If incorporated properties were included, the number would be much larger. Four of the seven properties received this classification due to impacts from the two 1996 floods. One property near Scio was impacted by the February 1996 event and again in December 1998. NFIP claims and loss data are protected by the Privacy Act and are for internal use only. NFIP data can be aggregated for use in the plan so that no particular property can be easily identified. The following five areas in ***Table 6-5*** are identified by FEMA as containing repetitive flood loss properties in Linn County. A map of the general vicinity of these properties can be found in the Executive Summary.

Table 6-4
Repetitive Flood Loss Properties

Location	Occupancy	Flood Zone	Date of Loss	Total Paid Claims
Millersburg Area, North of Albany	Single Family	C	11/19/1996 02/08/1996	$23,183.44
Oakville Road, SW of Albany	Single Family	A	11/19/1996 02/06/1996	$12.395.47
Peoria Road, SW of Corvallis	Single Family	A11	11/20/1996 02/08/1996	$15,431.16
Stayton-Scio Road North of Scio	Single Family	A04	12/28/1998 02/08/1996	$136,803.59
Waterloo Road, South of Lebanon	Single Family	C	11/19/1996 02/06/1996	$69,383.05
Highway 34, SW of Corvallis	Non residential	B	11/19/1996 12/04/1996 12/25/1996 02/27/1999	$41,163.89
Fish Hatchery Road, Southeast of Scio	Single Family	A	02/07/1996 11/24/1999	$34,096.99

Source: FEMA

Risk Analysis

Risk analysis is the third and most advanced phase of hazard assessment. Risk analysis builds on the hazard identification and vulnerability assessment to estimate the damage, injuries and economic losses that may be sustained within a hazard area over a given period of time. The risk

analysis uses mathematical models based on the magnitude of the harm that may result and the likelihood of the harm occurring.

A flood risk analysis for Linn County would include at least two components: (1) the life and value of property that may incur losses from a defined flood event; and (2) the number and type of flood events expected to occur over time. A risk analysis would predict the severity of damage from a range of events.

Hydraulic and flow velocity models can be used to predict the amount of damage expected from different magnitudes of flood events using hydrological analysis of landscape features. Hydraulic modeling could be combined with better topographical data to develop better FIRM maps. Such modeling could also provide velocity data to predict expected damage from flood events over the region and on specific property.

New County LIDAR data could be used to complete this hydraulic modeling to conduct a more accurate and detailed risk analysis for flood events in Linn County. This risk analysis could be used to better plan for infrastructure improvements to reduce or prevent flooding and plan for flood events. Resources are not currently available to complete these activities. A long term approach to conduct data modeling, risk analysis and infrastructure improvements should be evaluated in light of limited staff and resources.

There are numerous bridge crossings that lead to private and public lands that may be affected by flood and scour.

Currently there is insufficient data to conduct a detailed risk analysis for flood events in Linn County. The mitigation plan may include recommendations for improved data and partnerships that may lead to detailed flood risk analysis in the county.

Flood Hazard Mitigation Programs

Existing flood mitigation programs and strategies are principally the responsibility of the Department of Land Conservation and Development (DLCD), the state Building Codes Division (BCD), and the Office of Emergency Management (OEM). In addition to state programs, the National Flood Insurance Program (NFIP) of the Federal Emergency Management Agency (FEMA) is designed to help minimize flood losses through floodplain management. The NFIP relies on insurance, mortgage lending requirements, and floodplain development standards to reduce flood losses.

Goal 7 of the statewide planning goals, administered by DLCD, requires local governments to adopt flood protection policies and controls. The DLCD also administers the NFIP in Oregon, and every community with identified flood hazards is a member of this program. Thus, these local governments are required to adopt the NFIP's minimum requirements. The NFIP is comprised of a flood hazard mapping component, an enforcement component, technical assistance, and insurance which provides a financial safety net for owners of improved property. Together, all four components of the NFIP work together to reduce flood losses.

The state building code for one and two family dwellings and manufactured dwellings requires that the lowest living space in a dwelling be elevated at least one foot above the base flood elevation (BFE). Other buildings are also regulated and required to be elevated a minimum of one foot above base flood elevation or flood proofed.

OEM is involved in many programs which mitigate the effects of flooding including the Hazard Mitigation Grant Program, the Flood Mitigation Assistance Program, co-sponsoring and participating in training and workshops, and "Project Impact" - Building Disaster Resistant Communities. Also, as part of its warning responsibilities, OEM notifies local public safety agencies and keeps them informed of potential and actual flood conditions so prevention and mitigation actions can be taken.[30]

Linn County Programs

Comprehensive Plan

The Linn County Comprehensive Plan at LCC 903.200 through 903.280 includes an inventory of areas subject to natural hazards and a set of Plan policies to guide development within known hazard areas. The FEMA FIRM maps are adopted as the county's flood hazard inventory. Risk reduction measures in areas subject to natural disasters and hazards are implemented through application of the County's Land Development, Floodplain Management and Building Codes.

Land Development Code

The Land Development Code protects public safety and restricts development activities within inventoried natural hazard areas. The Development Code requires grading permits when needed, and requires compliance with the Oregon Residential Specialty Code, the Oregon Structural Specialty Code, and the Linn County Floodplain Management Code. All development regulated by the Land Development Code must be located outside the mapped 100-year floodplain unless it is demonstrated that the use can be designed and engineered to comply with accepted hazard mitigation requirements.

Floodplain Management Code (LCC Chapter 870)

All development within the floodplain must conform to the requirements of the Linn County Floodplain Management Code (LCC Chapter 870). The purpose of the Floodplain Management Code is to promote public safety and welfare and to reduce the potential for loss of life and property damage. This is achieved by requiring construction in a manner that will reduce flood impacts; by managing the alteration of the floodplain, channels and natural barriers that accommodate or channel flood waters; and other planning and site development measures. The FIRM floodplain information is incorporated into the county's Geographic Information System (GIS) data. Grading permits and removal/fill regulations are also administered through the Floodplain Management Code.

Public Facilities

The Linn County Road Department maintains county roadways, bridges, culverts and roadside drainage systems to reduce flood impacts.

State Programs

State of Oregon Floodplain and Floodway Removal/Fill Law

The Oregon Removal/Fill Law, which is administered by the Oregon Division of State Lands, requires a permit for activities that would remove or fill 50 cubic yards or more of material in waters of the state (e.g., streams, lakes, wetlands). Linn County must comply with the removal/fill laws when designing and building facilities, and have related responsibilities when dealing with private development and other construction projects.[31]

Oregon's Wetlands Protection Program

Oregon's Wetlands Program was created in 1989 to integrate federal and state rules concerning wetlands protection with the Oregon Land Use Planning Program. The Wetlands Program has a mandate to work closely with local governments and the Division of State Lands (DSL) to improve land use planning approaches to wetlands conservation. A Local Wetlands Inventory (LWI) is one component of that program. DSL also develops technical manuals, conducts wetlands workshops for planners, provides grant funds for wetlands planning, and works directly with local governments on wetlands planning tasks.

Oregon Wetlands Joint Venture

The Oregon Wetlands Joint Venture is a coalition of private conservation, waterfowl, fisheries, and agriculture organizations working with government agencies to protect and restore important wetland habitats.[32]

Federal Programs

National Weather Service

The National Weather Service provides flood watches, warnings, and informational statements for rivers throughout Linn County.

National Resources Conservation Service (NRCS), US Department of Agriculture

NRCS provides a suite of federal programs designed to assist state and local governments and landowners in mitigating the impacts of flood events. The Watershed Surveys and Planning Program and the Small Watershed Program provide technical and financial assistance to help participants solve natural resource and related economic problems on a watershed basis.

The Wetlands Reserve Program and the Flood Risk Reduction Program provide financial incentives to landowners to put aside land that is either a wetland resource, or that experiences frequent flooding. The Emergency Watershed Protection Program (EWP) provides technical and financial assistance to clearing debris from clogged waterways, restoring vegetation, and stabilizing riverbanks. The measures taken under EWP must be environmentally and economically sound and generally benefit more that one property.

Federal Emergency Management Agency (FEMA) Programs

The Federal Emergency Management Agency (FEMA) resulted from the consolidation of five federal agencies that were dealing with different types of emergencies. Since then, many states

and local jurisdictions have accepted this approach and changed the names of their organizations to include the words "emergency management." FEMA provides maps of flood hazard areas, various publications related to flood mitigation, funding for flood mitigation projects, and technical assistance.

National Flood Insurance Program (NFIP)

Flood insurance is available to citizens in communities that adopt and implement NFIP siting and building standards. The standards are applied to development that occurs within a delineated floodplain, a drainage hazard area, areas subject to inundation during a base flood event ("one percent" or "100 year flood"), and properties within 250 feet of a floodplain boundary. These areas are depicted on federal Flood Insurance Rate Maps that are available through Beaverton, Oregon's Department of Land Conservation and Development is the state's NFIP-coordinating agency.

Linn County currently has 581 NFIP policies in the community with 34 paid losses and 16 closed with out payment losses. The total payment for losses is $530,348.12. Linn County has a Floodplain Manager, which is his auxiliary duty as the Linn County Building Official. Linn County is in good standing with NFIP, has no current or outstanding compliance issues. The most recent Community Assistance Visit was August 25, 2005. Linn County entered the NFIP on January 23, 1974 and the communities Flood Insurance Rate Maps (FIRMs) became effective on September 29, 1986. Linn County is in the process of updating the FIRMs and these should be adopted in 2010. The Linn County Floodplain Ordinance meets FEMA and State minimum requirements.

The Community Rating System (CRS)

The Community Rating System (CRS) recognizes community floodplain management efforts that go beyond the minimum requirements of the NFIP. The cities of Albany and Scio participate in the CRS program. At the current time, Linn County does not. If the County were to implement floodplain management practices that qualify for participation in the CRS program, property owners within the County could receive reduced NFIP flood insurance premiums.

Linn County is currently not participating in the CRS program. The Steering Committee has identified that Linn County should work toward participation in the program.

2005 Flood Mitigation Action Items Progress

The Flood Mitigation Action Items that were part of the 2005 Natural Hazard Mitigation Plan are listed below with a description of progress or status on each item. Those items not listed in this section have either been deferred and are part of the 2010 Natural Hazard Mitigation Plan or deleted.

Long-term Action Items

FL-LT #2: Action 2.2.3. Update Flood Insurance Rate Maps

Coordinating Organization: Planning and Building Department
Internal Partners: Building Official; Emergency Management
External Partners: FEMA; OEM; Insurance Companies; Small Cities

Timeline: 2-5 years
Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective: Objective 2.2. Support the enhancement of County vulnerability assessment activities.

Status: Linn County Planning and Building Department anticipates new Flood Insurance Rate Maps and the changes generated by approved LOM-A's, R's and C's will be adopted in September 2010. Since the maps have not been adopted the Steering Committee deferred this action item.

FL-LT #3: Action 3.3.2. Support multi-objective stream and river enhancement projects that maximize flood mitigation

Coordinating Organization: Board of County Commissioners
Internal Partners: Emergency Management
External Partners: Water Control Districts; Watershed Councils; FEMA; DSL; ODFW; OWRD; DOF; DEQ; USCE; Cities
Timeline: Ongoing
Plan Goals Addressed: Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships.
Plan Objective: Objective 3.3. Develop partnerships with external partners for hazard specific mitigation projects.

Status: Linn County works in a cooperative partnership with the North Santiam Watershed Council, South Santiam Watershed Council, and the Calapooia Watershed Council. Linn County Road Department has supported the efforts of these councils by providing technical support, and match funds for certain projects and programs.

Some of the projects that have provided stream and river enhancement that also have improved flood mitigation during the past few years include the following:

- Driver Road (Calapooia River) Bridge Replacement Project (2006)
- Brush Creek Road (Brush Creek) Bridge Project (2006)
- Brush Creek Road (West Brush Creek) Fish Passage Culvert Replacement Project (2006)
- Brush Creek (Private Drive) Bridge Project (2006)
- Tangent Drive (Calapooia River) Bridge Replacement (2006)
- Wirth Road (Calapooia River) Bridge Replacement (2007)
- South Fifth Avenue Bridge (Replacing culvert) (2006)
- Thum Drive (Brush Creek) Fish Passage Restoration (2007)
- Childers Drive (East Brush Creek) Fish Passage Restoration (2007)
- Scio Main Street (Thomas Creek) Bridge Replacement Project (2007)
- Fish Hatchery Drive Riparian Bank Stabilization and Enhancement (2008)
- Hungry Hill Drive (Crabtree Creek) Riparian Bank Stabilization and Enhancement (2009)
- Gilkey Road (Crabtree Creek) Riparian Bank Stabilization and Enhancement (2009)

- Scravel Hill Bridge Maintenance Project (2009) - Added use of vegetative swales for BMP
- Courtney Creek Drive Bridge Replacement (2009) - lengthened bridge to restore riparian and hydraulic stream function and added use vegetative swales.
- Bolhken Road Bridge Replacement Project (2010)

LCRD is presently developing and designing numerous other road and bridge improvement projects. Improvements will include storm water management and treatment. A current list of these projects can be obtained from Linn County Road Department.

In developing projects, Federal funding has been obtained to replace 4 bridges which will also increase the hydraulic capacity of these bridges. These projects are as follows:

- Upper Berlin Road (Hamilton Creek) Bridge Replacement Project (2011)
- Gilkey Road (Crabtree Creek) Bridge Replacement Project (2012)
- McClun Road (Calapooia River) Bridge Replacement Project (2012)
- Linn West Drive (Calapooia River) Bridge Replacement Project (2011)

LCRD also has obtained $100,000 in Title II funding to identify fish passage barriers in Linn County and assess flooding associated with these road crossings. This will help plan and prioritize fish passage improvement projects for existing culvert and bridge crossings on a County wide basis. Linn County GIS, Linn County Road Department, Linn County Planning and Environmental Health, and the three watershed councils are all cooperative partners in this effort.

Bridges that are vulnerable to scour and erosion caused by a 100 year and 500 year flood event have been listed by ODOT under a new program required by the FHWA. As part of this program, annual bridge inspections administered under contract by ODOT has identified about 60 bridges that are susceptible to damage or loss during such a flood event due to the increased velocity and flood elevation of water. Linn County Road Department Engineering and Bridge Maintenance is presently developing strategies to deal with this potential risk. A proactive plan is being developed and will be developed as funding and resources allow.

Since there are future projects that would support multi-objective stream and river enhancement projects that maximize flood mitigation this action item is deferred to the 2010 Linn County Natural Hazard Mitigation Plan.

Flood Mitigation Action Items

The flood mitigation action items provide direction on specific activities that organizations and residents in Linn County can undertake to reduce risk and prevent loss from flood events. There is one short-term flood hazard action item and there are five long-term flood hazard action items, described below.

Short-term Action Items

FL-ST #1: Action 2.1.4. Participation in the National Flood Insurance Program's Community Rating System

Coordinating Organization: Planning and Building Department
Internal Partners: Building Official; Emergency Management
External Partners: FEMA; Insurance Companies; Small Cities
Timeline: Ongoing
Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective: Objective 2.1. Incorporate mitigation into planning and policy development.

Long-term Action Items

FL-LT #1: Action 2.1.5. Develop management strategies to preserve the function of the floodplain

Coordinating Organization: Planning and Building Department
Internal Partners: Building Official; Board of Commissioners
External Partners: FEMA; DSL; ODFW; OWRD; Watershed Councils
Timeline: Ongoing
Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective: Objective 2.1. Incorporate mitigation into planning and policy development.

FL-LT #2: Action 2.1.6. Develop a scour protection plan for Linn County bridges

Coordinating Organization: Road Department
Internal Partners: Emergency Management;
External Partners: Bridge Maintenance Superviosr
Timeline: Ongoing
Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective: Objective 2.1. Incorporate mitigation into planning and policy development.

FL-LT #3: Action 2.2.3. Update Flood Insurance Rate Maps

Coordinating Organization: Planning and Building Department
Internal Partners: Building Official; Emergency Management; GIS
External Partners: FEMA; OEM; Insurance Companies; Small Cities
Timeline: 2-5 years

Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.

Plan Objective: Objective 2.2. Support the enhancement of County vulnerability assessment activities.

FL-LT #4: Action 2.2.11. Discuss funding opportunities to conduct a new hydraulic study for Linn County

Coordinating Organization: Road Department

Internal Partners: Surveyor; Linn County GIS

External Partners: FEMA

Timeline: ongoing

Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.

Plan Objective: Objective 2.2. Support the enhancement of County vulnerability assessment activities

FL-LT #5: Action 3.3.2. Encourage multi-objective stream and river enhancement projects that maximize flood mitigation

Coordinating Organization: Board of County Commissioners

Internal Partners: Emergency Management; Planning and Building Department

External Partners: Water Control Districts; Watershed Councils; FEMA; DSL; ODFW; OWRD; DOF; DEQ; USCE; Cities

Timeline: Ongoing

Plan Goals Addressed: Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships.

Plan Objective: Objective 3.3. Develop partnerships with external partners for hazard specific mitigation projects.

Flood Hazard Endnotes

[1] Natural and Geologic Background Report, Linn County, 1980 pp. 4

[2] Oregon Emergency Management (OEM); State of Oregon Emergency Management Plan (June 2000)

[3] Cascades West Council of Governments, 1996 Regional Flood Recovery Plan (Dec. 11, 1996), pp. 100

[4] OEM; State of Oregon Emergency Management Plan (June 2000)

[5] Ibid.

[6] Ibid.

[7] Ibid.

[8] Federal Emergency Management Agency (FEMA), Linn County FIS, 09/29/86)

[9] Linn County Emergency Management, 2002 Hazard Analysis

[10] University of Oregon; Community Service Center; Oregon Natural Hazards Technical Resource Guide

[11] OEM; State of Oregon *Natural Hazards Mitigation Plan* (June 2000)

[12] Ibid.

[13] Oregon Natural Hazards Mitigation Plan, November 2003

[14] Ibid.

[15] Ibid.

[16] Ibid.

[17] Ibid.

[18] Ibid.

[19] Ibid.

[20] 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.

[21] Ibid.

[22] 1996 Regional Flood Recovery Plan, Cascades West Council of Governments, pp. 100

[23] 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.

[24] Personal Interview, Ed McMahon. June 24, 2003

[25] 1996 Regional Flood Recovery Plan, Cascades West Council of Governments, pp. 100

[26] 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

[27] Tualatin River Watershed Council, http://www.trwc.org/ (February 2001).

[28] *Department of State Lands, Wetlands Functions and Assessment*, Website: http://statelands.dsl.state.or.us/fact5.pdf (May 2001)

[29] Ibid.

[30] Ibid.

[31] *Surface Water Management Framework*. (January 2001). Clean Water Services (formerly Unified Sewerage Agency.)

[32] Oregon Wetlands Joint Venture, Website: http://www.dfw.state.or.us/ODFwhtml/Wetlands/about.htm (May 2001).

Section 7:
Landslide

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Why are Landslides a Threat to Linn County?

Landslides are a serious geologic hazard in many states, including Oregon. Nationally, landslides cause 25 to 50 deaths each year and can pose a serious threat to human life.[1] The best estimates of the direct and indirect costs of landslide damage in the United States range between $1 billion to $2 billion annually.[2] Although not all landslides result in private property damage, many impact transportation corridors, fuel and energy conduits, and communication facilities.[3]

Landslides and debris flows have helped shape the landscape in much of Linn County. Development, road building and logging can cause or contribute to the severity of landslides. Landslides become hazardous when buildings and infrastructure are placed within their path. In general, slopes that are over 25 percent or have a history of landslides might signal a landslide problem. However, landslides can also occur in areas of generally low relief in the form of cut-and-fill failures, river bluff failures, lateral spreading landslides and mining slope failures.

Table 7-1 describes some of the major landslides that have occurred in Oregon over the last 75 years. The list is not all-inclusive, but focuses on slides that caused loss of life or significant damage. Although most of the listed events were outside of Linn County, all serve as indicators of the type of landslide events likely to occur in the region.

Table 7-1
Major Landslides in Oregon

February 1926	A landslide closed Roosevelt Highway between Coos Bay and Coquille, causing at least $25,000 in damage.
November 1928	A landslide killed two workmen working on a railroad tunnel near Baker.
August 1957	A rockslide killed two quarry workers near Westfir.
February 1961	A large section of Ecola State Park, including the parking lot, slid into the Pacific ocean near Cannon Beach.
March 1972	Three motorists were injured in a mud and rockslide on Interstate 5 near Portland.
January 1974	Nine employees working in a telephone company building were killed when the building was pushed by a mudslide into Canyon Creek near Canyonville.
October 1984	Two children were killed in a rockslide along Interstate 84 near Cascade Locks. The cost of stabilizing the slide area eventually reached $4 million.
September 1990	Four highway workers were injured in a landslide near Troutdale.
February 1996	Heavy rains and rapidly melting snow contributed to hundreds of landslides across the state, many occurring on clear cuts that damaged logging roads.
November 1996	Heavy rain triggered mudslides in Lane and Douglas Counties that resulted in eight fatalities.
February 1999	Two timber workers were killed in a mud and rockslide south of Florence.
January 2000	A landslide north of Florence closed Highway 101 for three months, resulting in major social and economic disruption to nearby communities.

Source: Department of Land Conservation and Development, Natural Hazards Program Website, http://www.lcd.state.or.us

There are several categories of landslides, based on configuration (slide mechanism), slide materials, and rate of movement. Some slides are ancient, deep-seated, and slow moving. Others move rapidly as a mass of rock, mud, and large woody debris. All can be hazardous when in the vicinity of buildings and infrastructure. Oregon counties with the highest percentage of reported landslides are: Lane (24%), Douglas (11%), Linn (10%), Tillamook (9%), Lincoln (8%), and Multnomah (7%).[4]

Landslides and debris flows usually accompany the major storm systems that impact western Oregon. Particularly noteworthy landslides accompanied storms in 1964, 1982, 1986, and 1996. Two major landslide producing winter storms occurred in Oregon during 1996. Intense rainfall triggered over 9,500 landslides and debris flows, some of which resulted directly or indirectly in eight fatalities. Highways were closed and a number of homes were lost statewide. The fatalities and losses resulting from the 1996 landslides led to the passage of Oregon Senate Bill 12, which authorized the mapping of areas subject to rapidly moving landslides and the development of model landslide ordinances.[5]

Mass Movement Topography[6]

Mass movement topography is terrain for which prior landslide activity is inferred on the basis of topographic expression. Mass movement topography is shown on ***Map 7-1***. Mass movement topography in Linn County occurs primarily on the Little Butte terrain of the Cascades formation and in places where landslides undercut Columbia River basalt. On slopes of 15 percent to 50 percent, weathering and failure occur at depths great enough to leave visible evidence of mass movement. On steeper slopes, shallower types of mass movement occur.

In north central Linn County, massive slope failures are present on the sides of Hungry Hill, Rogers Mountain, McCully Mountain, and other high ridges leading eastward towards Detroit Dam. The slides typically develop in the Little Butte Formation and undercut the crests, forming pronounced head scarps. Depth of failure is great below the larger head scarps, and landslide features are well-developed in places. Landslides are occurring in the Cascades Formation on the lower flanks of Snow Peak. On the south side of the mountain along Crabtree Creek rapid down cutting is initiating a series of active slides. Numerous scattered patches of mass movement topography are mapped in the region bounded by Lebanon, Brownsville, and Sweet Home. Sliding is restricted to thick soils and tuffs of the Little Butte Formation. Most of these are underlain by basaltic intrusions and are generally stable.

Damage to structures may occur in areas of mass movement topography through continued slide movement, uneven settling, or a variety of related processes. Cuts, fills, and changes of the ground water budget through use of septic tanks or improper handling of runoff are common factors in reinitiated slide activity.

Several areas of mass movement topography in western Linn County are zoned for residential development. These include some of the slopes south of Lyons, the north side of Rogers Mountain, the Ward Butte area north of Brownsville, the slopes east of Lebanon, the valley areas of the Calapooia drainage, and the lower slopes of Mount Tom in southern Linn County. Without proper development considerations, considerable structural damage could occur in these areas in future years.

The major impacts of mass movement in areas of logging include road and cut-bank failure and the contribution of huge volumes of debris and sediment to streams. A good example is the repeated failures on the upper Crabtree Creek Road leading to Snow Peak Camp.

Steep Slope Failure[7]

Types of landslide on steep slopes (slopes greater than 50 percent) include rock falls, rockslide, and shallow earthflow or mudflow. Unlike deep failures, such as those involved in mass movement topography, failures on steep slopes do not penetrate to great depths. Slope maps may be used to define general areas especially prone to these forms of landslide.

In Linn County, failures on steep slopes are most common along the upper reaches of the Calapooia, Middle Santiam, and North Santiam Rivers and along major creeks such as Wiley Creek and Neal Creek. Steep-slope failures are concentrated along escarpments of Sardine Formation, Columbia River Basalt, and the Little Butte Formation.

Human-induced causes of steep slope failures include undercutting steep slopes; placing of excessive fill; indiscriminant blasting; improper handling of runoff in construction areas; removal of vegetation; and the diversion of streams against steep canyon walls that have poorly engineered valley-bottom roads.

Areas mapped by the Oregon Department of Geology and Mineral Industries (DOGAMI) as steep slopes where possible residential use is allowed include some of the slopes west of Lyons, a few lower valley areas near Cascadia, and part of West Point Hill in southern Linn County. On-site inspections and engineering reports should precede development in these areas. These maps can be found in Appendix D and the Executive Summary M-21.

Causes and Characteristics of Landslide Hazards

This section provides information about landslide types and causes. Much of the information was gathered from the Department of Land Conservation and Development (DLCD) Natural Hazards Program website; the United States Geologic Survey (USGS) Landslide Hazard Fact Sheet 2004-3072; Oregon Department of Geology and Mineral Industries (DOGAMI) Bulletin 84; the Oregon Natural Hazards Mitigation Plan (OR-SNHMP) Region 3 Hazards Assessment; and the Regional All Hazard Mitigation Plan for Benton, Lane and Linn Counties (RAHMP).

What is a landslide?

The term "landslide" is used to describe the down slope movement (sliding or falling) of slope-forming materials composed of rock, soil, artificial fill, or a combination of these. The materials may move by falling, toppling, sliding, spreading, or flowing. The term is also applied to the mass of soil or rock material that results from one of these events.[8]

The various types of landslides can be differentiated by the kinds of materials involved and the mode of movement. Although landslides are primarily associated with mountainous regions, they can also occur in areas of generally low relief.[9]

Landslides are natural processes, but can be triggered or accelerated by changes in groundwater levels, usually from intense rainfall or rapid snow melt; undercutting of a slope or cliff by erosion or excavation; shocks or vibrations from earthquakes or construction; vegetation removal; or the placing of fill on steep slopes.[10]

Landslide Types

Some of the processes that are referred to as landslides are shown in ***Figure 7-1*** and include:

- **Debris Flow**: Rapidly-moving landslides that can travel long distances, often within confined channels, and often involving significant amounts of water and mud. Debris flows (mudslides, mudflows, debris avalanches) are common and generally occur during intense rainfall on previously saturated ground. They usually begin on steep hillsides as slumps or slides that liquefy, accelerate to speeds as great as 35 mph, and flow down slopes and channels onto gently sloping ground.[11]

  The consistency of debris flows ranges from watery mud to thick, rocky, mud-like wet cement, dense enough to carry boulders, trees, and automobiles. Debris flows from different sources can combine in canyons and channels, where their destructive power is greatly increased.[12] Generally speaking, five conditions must be present for a debris flow to occur:

  1. Steep slopes;
  2. Loose rock and soil materials;
  3. Clay minerals;
  4. Saturated soils; and
  5. Rainfall or snow melt generated runoff of high intensity and duration.

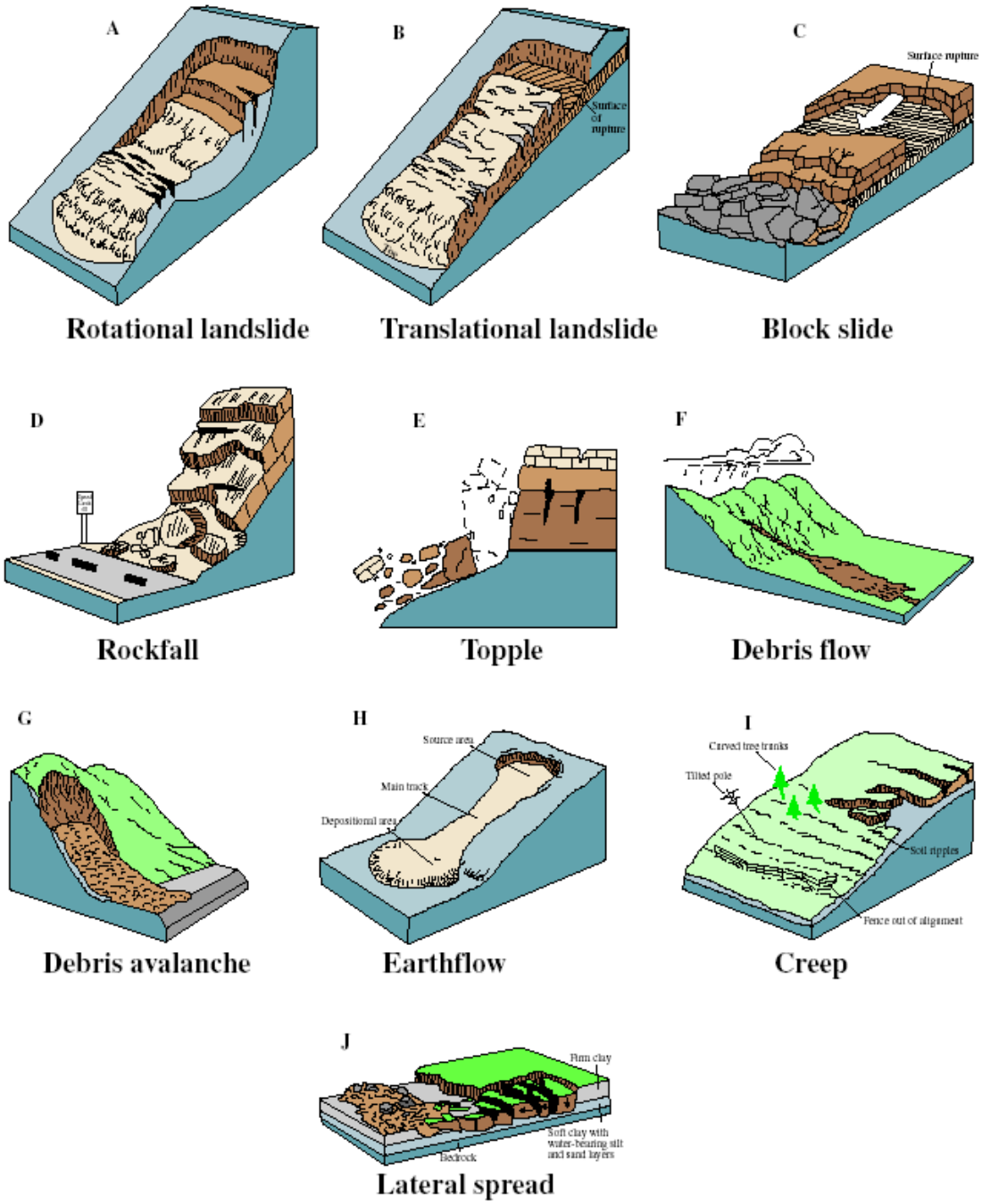
  Debris flow areas are associated with steep gullies. A **debris avalanche** is a type of very rapid to extremely rapid debris flow. A debris avalanche is generally long and narrow and often leaves a V-shaped scar tapering uphill at the head. A **mudflow** is an earth flow consisting of material that is wet enough to flow rapidly and contains at least 50 percent sand, silt and clay-sized particles.[13]

- **Rockfalls**: The abrupt movement of masses of geologic materials that become detached from steep slopes or cliffs. Separation occurs along fractures, joints, and bedding surfaces, and movement occurs by free-fall, bouncing, and rolling. Falls are strongly influenced by gravity, mechanical weathering, and the presence of interstitial water. Depending on the type of materials involved, the result is a rock fall, soil fall, debris fall, boulder fall and so on. All types of falls are promoted by undercutting, differential weathering, excavation or stream erosion. Rock falls are common along Oregon highways where roads are cut through bedrock.[14]

- **Rockslides**: The rapid down-slope movement of rock material along a plane of separation within the bedrock, which could be a fault surface, a fracture surface, or the depositional surfaces found in some sedimentary rocks. These slides can occur on relatively gentle slopes and cause serious damage.[15]

Figure 7-1 illustrates the major types of landslides described in this section.

Figure 7-1 Landslide Types



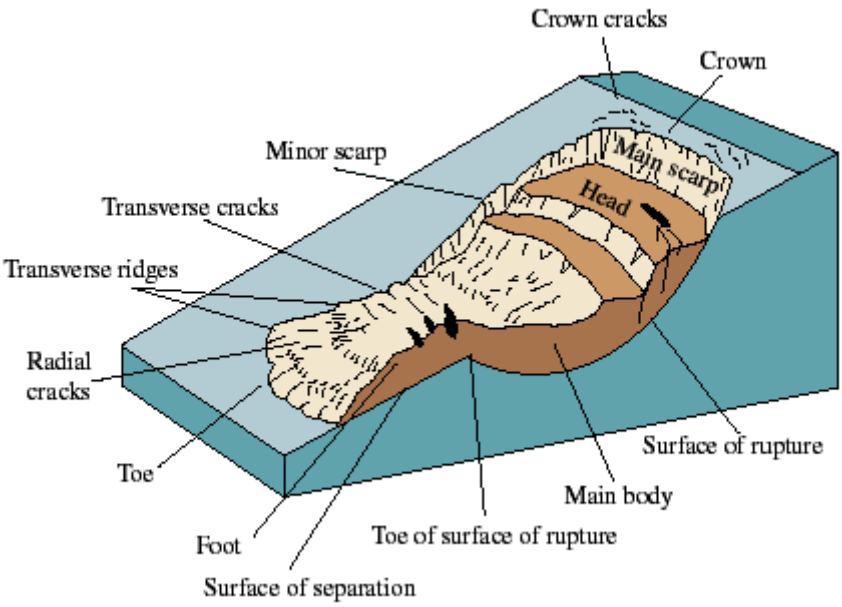
Source: USGS Landslide Hazard Fact Sheet 2004-3072

- **Rotational slides**: Slides in which the surface of the rupture is curved concavely upward and the slide movement is rotational about an axis that is parallel across the slope. The scarp formed at the head of the slope may be almost vertical. The toe usually bulges upward, but sometimes flows outward. **Slumps** are examples of small rotational slides.

  The head of a rotational slide can sometimes be located in the fill side of a road. The axis of the road would generally follow the contour of the hill. Many older hillside roads were built without proper design of the "fill" side of the road. The head of the slide would damage the fill side of the road; and the foot of the slide would damage any buildings located below the road surface, commonly for a distance of 20 to 80 feet below the road surface.[16]

  Figure 7-2 shows a graphic illustration of a rotational landslide, with the commonly accepted terminology describing its features.

Figure 7-2
Rotational Landslide Features



Source: USGS Landslide Hazard Fact Sheet 2004-3072

- **Translational Slides**: Slides in which the mass moves out, or down and out along a more or less planar surface and has little rotational or backward tilting. The mass commonly slides out on the original ground surface. Such a slide may progress over great areas if the conditions are right. The movement of translational slides is commonly controlled by surfaces of weakness such as faults, bedding planes, and variations in shear strength between layers of bedded deposits, or by contact between firm bedrock and overlying loose soils.[17]

Landslide Causes

Factors contributing to landslides and other mass movement include climate, rock type, slope, and natural or human caused changes to any of these factors. Linn County's moist, moderate climate promotes deep weathering which breaks down the rock, increases pore pressures, and decreases shear strength.[18]

Landslides are typically triggered by periods of heavy rainfall or rapid snowmelt. Earthquakes, volcanic activity, and erosion may also trigger landslides. Human activities, including excavation, locating development near steep slopes, and removing vegetation can increase susceptibility to landslide events. Grading for roads and construction can decrease the stability of a hill slope by adding weight to the top of the slope, removing support at the base of the slope, and increasing water content. Landslides on steep slopes are more dangerous because movements can be rapid.[19]

Certain geologic formations are more susceptible to landslides than others. Rocks which weather to clay-rich soils are the least stable and the most prone to failure. The Little Butte Formation, common in Linn County, is particularly high in ash, a component which weathers to clay.[20]

The primary causes of landslides are listed in ***Table 7-2***.

Table 7-2
Landslide Causes

Geological causes	Morphological causes	Human causes
Weak or sensitive materials	Tectonic or volcanic uplift	Excavation of slope or its toe
Weathered materials	Glacial rebound	Loading of slope or its crest
Sheared, jointed, or fissured materials	Fluvial, wave, or glacial erosion of slope toe or lateral margins	Drawdown (of reservoirs)
Discontinuous orientation of materials (unconformity, schistosity, layering, faults)	Subterranean erosion (solution, piping)	Deforestation
Contrast in permeability and/or stiffness of materials	Deposition loading on slope or its crest	Irrigation; Alterating ground water table
	Vegetation removal (fire, drought)	
	Thawing	
	Freeze-and-thaw weathering	
	Shrink-and-swell weathering	

(Source: USGS Landslide Hazard Fact Sheet 2004-3072)

Natural Causes

Natural processes can cause landslides or re-activate historical landslide sites. The undercutting of shoreline material along bodies of water by currents and waves causes many small slides each year. Seismic tremors can trigger landslides on slopes historically known to have landslide movement. Earthquakes can also cause lateral spreading on gentle slopes above steep streams and riverbanks. Heavy precipitation and rainfall can cause landslides by erosion, soil saturation or the combination of both. Linn County is documented to have 50 to 100 rainfall events that may generate up to approximately six inches of rainfall in one day. Landslides are particularly common along stream banks, reservoir shorelines, and large lakes. Steep, concave-shaped slopes with larger drainage areas appear to be more susceptible to landslides than other landforms of over one cubic mile of material. All soil types can be affected by natural landslide triggering conditions.[21]

Human Causes

Human impacts can affect the potential for landslide failures in Linn County. Proper planning can protect people, property and infrastructure. Three major human causes of landslides in Linn County are: (1) Excavation and grading; (2) Drainage and groundwater alterations; and (3) Changes in vegetation.

Excavation and Grading

Slope excavation is common in the development of home sites or roads on sloping terrain. Grading these slopes can result in some slopes that are steeper than the pre-existing natural slopes. Since slope steepness is a major factor in landslides, these steeper slopes can be at an increased risk for landslides. The added weight of fill placed on slopes can also result in an increased landslide hazard. Small landslides can be fairly common along roads, in either the road cut or the road fill.[22]

Drainage and Groundwater Alterations

Water flowing through or above ground is often the trigger for landslides. Any activity that increases the amount of water flowing into landslide-prone slopes can increase landslide hazards. A high ground water table results in increased pore pressure and decreased shear strength of the soil, thus increasing the chance of slide movement. Broken or leaking water or sewer lines can be especially problematic, as can water retention facilities that direct water onto slopes. However, 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 risk of landslide hazards.

Development that results in an increase in impervious surface impairs the ability of the land to absorb water and may redirect water to other areas. Channels, streams, ponding, and erosion on slopes all indicate potential slope problems. Road and driveway drains, gutters, downspouts, and other constructed drainage facilities can concentrate and accelerate flow. Ground saturation and concentrated velocity flow are major causes of slope problems and may trigger landslides.[23]

Changes in Vegetation

Removing vegetation from very steep slopes can increase landslide hazards. The *Storm Impacts Study* conducted by the Oregon Department of Forestry found that landslide hazards in three out of four steeply sloped areas were highest for a period of roughly 10 years after timber harvesting. Areas that have experienced wildfire and land clearing for development may have long periods o increased landslide hazard. In addition, woody debris in stream channels (both natural and man-made from logging) may cause the impacts from debris flows to be more severe.[24]

Major Landslide Hazards[25]

There are multiple types of causes of landslides. The three that cause most of the damaging landslides around the world are: (1) Water; (2) Seismic activity; and (3) Volcanic activity.

Landslides and Water

Slope saturation by water is a primary cause of landslides in Linn County. This effect can occur in the form of intense rainfall, snowmelt, changes in ground-water levels, and water-level changes along coastlines, earth dams, and the banks of lakes, reservoirs, canals, and rivers.

Landsliding and flooding are closely allied because both are related to precipitation, runoff, and the saturation of ground by water. In addition, debris flows and mudflows usually occur in small, steep stream channels and often are mistaken for floods; in fact, these two events often occur simultaneously in the same area.

Landslides can cause flooding by forming landslide dams that block valleys and stream channels, allowing large amounts of water to back up. This causes backwater flooding and, if the dam fails, subsequent downstream flooding. Also, solid landslide debris can "bulk" or add volume and density to otherwise normal streamflow or cause channel blockages and diversions creating flood conditions or localized erosion. Landslides can also cause overtopping of reservoirs and/or reduced capacity of reservoirs to store water.

Landslides and Seismic Activity

Many mountainous areas that are vulnerable to landslides have also experienced at least moderate rates of earthquake occurrence. The occurrence of earthquakes in steep landslide-prone areas greatly increases the likelihood that landslides will occur, due to ground shaking alone or shaking-caused dilation of soil materials, which allows rapid infiltration of water.

The 1964 Great Alaska Earthquake caused widespread landsliding and other ground failure, which caused most of the monetary loss due to the earthquake. Other areas of the United States, such as California and the Puget Sound region in Washington, have experienced slides, lateral spreading, and other types of ground failure due to moderate to large earthquakes. Widespread rockfalls also are caused by loosening of rocks as a result of ground shaking. Worldwide, landslides caused by earthquakes kill people and damage structures at higher rates than in the United States.

Landslides and Volcanic Activity

Landslides due to volcanic activity are some of the most devastating types. Volcanic lava may melt snow at a rapid rate, causing a deluge of rock, soil, ash, and water that accelerates rapidly on the steep slopes of volcanoes, devastating anything in its path. These volcanic debris flows (also known as lahars) reach great distances, once they leave the flanks of the volcano, and can damage structures in flat areas surrounding the volcanoes. The 1980 eruption of Mount St. Helens in Washington triggered a massive landslide on the north flank of the volcano, the largest landslide in recorded time.

Landslide Hazard Assessment

The landslide hazard assessment provides information on the location of landslide hazards, the land and property characteristics within the hazard area, and an assessment of risks to life and property that may result from a landslide event. The three elements of hazard assessment are: (1) Hazard identification; (2) Vulnerability assessment; and (3) Risk analysis.

Section 201.6(c)(2)(i) of the *Disaster Mitigation Act of 2000* (DMA-2000) requires that the risk assessment include a description of the location and extent of all natural hazard that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Hazard Identification

The first essential step of landslide hazard assessment is hazard identification. Hazard identification identifies: (1) The geographic extent of areas that are known to be subject to landslides; (2) The characteristics of potential landslides at different locations; and (3) The probability of occurrence of landslide events.

Landslide Hazard Areas

Locations at risk from landslides or debris flows include areas with one or more of the following conditions[26]:

- On or close to steep hills;
- Steep road-cuts or excavations;
- Existing landslides or places of known historic landslides;
- Steep areas where surface runoff is channeled, such as below culverts, V-shaped valleys, canyon bottoms, and steep stream channels; and
- Fan-shaped areas of sediment and boulder accumulation at the outlets of canyons.

Maps identifying the location of areas showing previous mass movement; potential debris flow areas; and areas of steep slope are included at the end of this chapter.

The Cascade Range is characterized by large, recently active volcanoes. The climate is sub-humid to very wet. The steep volcanic slopes are subject to mudflows, rock falls and snow and

rock avalanches. Some older Tertiary rocks on the west flank of the Cascade Range are prone to land sliding. Debris slides from volcanic eruptions are not considered in this section.

Geologic Hazard Maps

The Department of Geology and Mineral Industries (DOGAMI) published *Bulletin 84, Environmental Geology of Linn County, Oregon* in 1974. *Bulletin 84* includes Geologic Hazards maps for western Linn County. The Linn County Comprehensive Plan at *LCC 903.260(B)(1)* establishes *Bulletin 84* as the official source for determining if a property is located within an area characterized by mass movement topography. ***Map 7-1*** at the end of this section shows identified geologic hazard/mass movement areas for Linn County.

Preliminary Debris Flow Hazard Maps

In response to the catastrophic landslides that occurred in Oregon in 1996, the state of Oregon adopted Senate Bill 12 in 1999 to address rapidly moving landslides (debris flows). Among other requirements, Senate Bill 12 directs DOGAMI to identify areas potentially prone to debris flows on "further review area" maps.

The Oregon Department of Forestry (ODF) has developed preliminary debris flow maps for western Oregon. ***Map 7-2*** shows the mapped debris flow areas in Linn County. While the debris flow maps are generally good for steep slope areas where landslides typically initiate, they are less accurate for identifying the down slope impacts of these landslides, and may not capture many areas that are of a public safety concern. They are not intended to be used as the final "further review areas" as defined by Senate Bill 12, but they are available to local governments to provide an initial indication of debris flow hazards. These maps can be used to show areas where further on-the-ground investigation is needed, but should not be used to determine the actual hazard at any specific location. The preliminary debris flow hazard maps can help analyze vulnerability and risk and identify landslide mitigation action items.[27]

Further Review Area Maps

DOGAMI is refining the ODF debris-flow maps to identify "further review areas" as required by Senate Bill 12. DOGAMI has performed preliminary field investigations throughout western Oregon to improve the delineation of the down-slope run-out areas – the most critical areas in terms of public safety. Findings from those field investigations are being used to develop and evaluate improved methods for GIS modeling of debris flow hazards. Several models have been identified and are currently being tested.[28]

DOGAMI is also inventorying and consolidating slope failure information from the three major storms of February 1996, November 1996, and December 1996/January 1997. The final inventory identified 9,582 known landslide locations. For each documented landslide, up to 15 descriptive items are reported. From this study, DOGAMI found that counties with the highest percentage of total landslides reported are Lane (24 %), Douglas (11 %), Linn (10 %), Clackamas (9 %), Tillamook (9 %), Lincoln (8 %), and Multnomah (7 %)."[29]

Vulnerability Assessment

Vulnerability assessment is the second phase in landslide hazard assessment. Vulnerability assessment inventories development and populations that are located within identified landslide hazard areas.

Section 201.6(c)(2)(ii)(A) of the DMA-2000 requires that the risk assessment include a description of the jurisdiction's vulnerability to the hazard. This description shall include an overall summary for the hazard and its impact on the community. If appropriate data is available, the vulnerability assessment should describe the type and number of existing and future buildings, infrastructure, and critical facilities located in identified hazard areas.

Landslides can impact important transportation routes, impeding commerce and blocking residents from reaching essential services, businesses and places of employment. Locating and understanding the population, property and facilities that are exposed to landslide and debris flow hazards will assist in reducing risks and preventing losses from future landslides.

Information on landslide-prone and debris flow-prone locations in the county can be used to assess the value of property and the population at risk from future landslides. The amount of property within landslide prone areas and the value of those properties can be calculated to estimate potential losses. Calculating a community's vulnerability to landslides is difficult because site-specific vulnerability data is difficult and costly to obtain.

A property-specific assessment of the number of lives or amount of property exposed to landslide hazards has not yet been conducted for Linn County. However, Phase I of the *Regional All Hazard Mitigation Master Plan (RAHMP) for Benton, Lane and Linn Counties* estimated vulnerability and losses due to winter storm induced landslides using small-scale landslide data available in 1998.[30] Unfortunately, the results of this study are not useful on a site-specific scale. An updated vulnerability analysis for landslides in Linn County could be developed using the debris flow hazard maps being prepared by DOF and DOGAMI.

Probability

Most of the Cascade Range in eastern Linn County is classified as having "moderate" landslide incidence and susceptibility. **Susceptibility** is defined as the probability of landslides. **Incidence** is defined as the observed rate of landslides. Parts of the Cascades east side of the Willamette Valley are considered to have "high" landslide incidence and susceptibility. Within the Willamette Valley, the landslide susceptibility and incidence is "low." This is not to say that no landslides can occur in this area; but that the incidence rate is less than 1.5 percent of the area.[31]

The Oregon Department of Forestry (ODF) estimates widespread landslide activity will occur about every 20 years. Landslides at a local level can be expected every two or three years. The probability of a rapidly moving landslide occurring depends on a number of factors. These include steepness of slope, slope materials, local geology, vegetative cover, human activity, and water. There is a strong correlation between intensive winter rainstorms and the occurrence of rapidly moving landslides (debris flows). Consequently, the ODF tracks storms during the rainy season, monitors rain gauges and snow melt, and issues warnings as conditions warrant.[32]

Given the correlation between precipitation and snow melt and rapidly moving landslides, it may be feasible to construct a probability curve. The installation of slope indicators or the use of more advanced measuring techniques could provide information on slower moving slides.[33]

Vulnerability

The probability that Linn County will experience landslides and the county's vulnerability to their effects are identified in the November 2003 Oregon State Natural Hazard Mitigation Plan (OR-SNHMP) Region 3: Mid/Southern Willamette Valley Hazards Assessment. According to the OR-SNHMP, Linn County's overall probability score is "High" and its overall vulnerability score is "Low" for landslides.

The probability score addresses the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

The vulnerability score addresses the percentage of county population or assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

Existing Landslide Vulnerability Estimates

The 1998 RAHMP used national scale data to model winter storm induced landslide vulnerability and risk in Linn County. At that time there were no high resolution studies on landslide hazards and risks or detailed debris flow maps for the area. An updated vulnerability and risk analysis for landslides in Linn County could be developed using the debris flow hazard maps that are currently being prepared by DOF and DOGAMI.

Due to data limitations the RAHMP identified most of the hilly areas of the county as having a "high" potential for landslides. However, there is significant variation in actual landslide susceptibility. Local variation in slope, soil types, drainage conditions, rainfall intensity potential, historical landslide experience and manmade factors was not factored into the model.

The RAHMP landslide vulnerability estimates for Linn County are in ***Table 7-3***. The table does not include estimates for property vulnerable to debris-flow hazards. Because the RAHMP landslide hazard analysis was highly generalized, and developed at a scale of 1:7,500,000, it is unsuitable for local site selection determinations. A more detailed study utilizing large-scale hazard maps and accurate data on the location and types of development could be a useful mitigation item.

Table 7-3
Estimated Building and Road Inventory in Landslide Susceptible Areas

County	Wood Buildings	Steel Buildings	Concrete and Masonry Buildings	Roads and Highways (mi)
Linn County	685	4	16	152

RAHMP July 27, 1998 Page 30

Table 7-4 shows the area, number of tax lots, and road miles within the identified mass movement areas and the State modeled debris flow areas in Linn County. Note that some areas may be in both a Mass Movement area and within one of the Debris Flow hazard areas.

Table 7-4
Landslide Hazard Summary

Hazard	Vulnerability Area (Acres)	Roads and Highways (Miles)	Tax Lots	Residential Structures	Commercial and Industrial Structures	Critical Facilities
Mass Movement	94,338	20	2222	472	0	0
Debris Flow (Moderate)	386,126	35	2008	223	1	0
Debris Flow (High)	151,889	15	1140	3	0	0

Source: Linn County Geographic Information Systems, February 2005

In order to be able to identify the types and number of buildings, infrastructure, and critical facilities in the landslide hazard area, more detailed GIS studies are needed. The county currently has insufficient data to complete this step of the vulnerability assessment.

Areas subject to slides caused by intense rainfall that could impact county roads, highways and private roads need to be evaluated. The above summarized estimate seems to be low when compared to those knowledgeable of the roads in Linn County. It is not known if the estimate was based on slides generated from intense rainfall that are probabilistic to occur every 50 to 100 years. The County currently has insufficient resources to complete this evaluation which is important as it could be used to plan future improvements to life line routes and other routes vital to Linn County.

Section 201.6(c)(2)(ii)(B) of the *Disaster Mitigation Act of 2000* (DMA-2000) requires that the risk assessment include an estimate of the potential dollar losses to vulnerable structures. There is insufficient development and vulnerability data available to estimate potential dollar losses to vulnerable structures and facilities at this time. The collection and analysis of appropriate data would serve as an important mitigation item to be completed in the future. Needed data includes the location and ranking of hazard areas; the location, types and numbers of buildings, infrastructure and critical facilities; and the location, construction, materials, and replacement value of buildings, infrastructure and critical facilities in hazard areas.

Risk Analysis

Risk analysis is the third and most advanced phase of hazard assessment. Risk analysis builds on the hazard identification and vulnerability assessment to estimate the damage, injuries and economic losses that may be sustained within a hazard area over a given period of time. The risk analysis uses mathematical models based on the magnitude of the harm that may result and the likelihood of the harm occurring.

Section 201.6(c)(2)(ii)(B) of the *Disaster Mitigation Act of 2000* (DMA-2000) requires that the risk assessment include an estimate of the potential dollar losses to vulnerable structures. A landslide risk analysis for Linn County would include at least two components: (1) The life and value of property and critical facilities that may incur losses from a landslide event; and (2) The number and type of landslide events expected to occur over time. A risk analysis would predict the severity of damage from a range of events and the probability of those events occurring at specific locations.

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 characteristics, and precipitation intensity. This type of analysis could generate estimates of the damages to the county due to a specific landslide or debris flow event. At the time of publication of this plan, data was insufficient to conduct a risk analysis.[34]

Phase I of the *Regional All Hazard Mitigation Master Plan (RAHMP) for Benton, Lane and Linn Counties* includes estimated landslide losses in Linn County. Although the RAHMP does not include detailed landslide data, the plan develops a loss estimate model for winter storm induced landslides using data available in 1998.

Minor amounts of landslide-induced ground movement is not normally life threatening. For example, settlements of 0.5 inches may occur due to landslide, and such settlements will generally cause some damage in buildings, but such damage is not likely to cause severe injury. Given that a site experiences some permanent ground movement, the extent of building damage depends on where the structure is located within the zone of permanent ground deformation (PGD). For example, if the structure straddles the area were the ground moves, to where the ground does not move, then the structure will experience major damage. On the other hand, if the structure is located within a large land mass which moves, more or less, as a unified mass, then the structure may experience very little or no damage (other than loss of buried utilities).

The experience of wood frame structures in Japan in past earthquakes suggests that in large lateral spreads (1 meter or more) perhaps 50 percent of the structures are extensively damaged or worse; whereas the other structures are only modestly damaged. Engineering judgment suggests that steel frame structures should be only modestly more susceptible to PGD-induced damage as compared to wood structures; and concrete structures should be the most susceptible.[35]

For roads, it is assumed that minor landslides are repaired by coning off the affected section, and repaving with asphalt. For major movements of 60 inches, it is assumed that the fill-side lane of a two lane road is rebuilt at about 70 percent of the cost of a new two lane road. For ground movements over 100 inches, it is assumed that the road is rebuilt.

Based on slides caused by heavy rainfall that occurred in Linn County on Ford Mill Road and McCully Mountain Road in December 1995 and January 1996, we know that the above basis for estimating repairs to roads caused by slides is very low. This can vary from two times that calculated by this method to a factor of ten times this amount depending on the location. Based on this experience, past estimated losses due to slides should be updated.

The RAHMP developed fragility curves and damage state probabilities assuming that the slight damage state results in 5 percent loss; moderate damage 15 percent loss; extensive damage 50 percent loss; and total collapse 100 percent loss. Then, for the PGDs that correspond to areas that experience significant lateral spreads, the losses to buildings are shown in ***Table 7-5***:

Table 7-5
Building and Road Loss Ratios, Given Permanent Ground Deformation (PGD)

Rainfall Intensity in 24 hours	Expected PGD, Given that Site Slides (Inches)	Wood Buildings (Percent)	Steel Buildings (Percent)	Concrete Buildings (Percent)	Roads and Highways (Percent)
0 - 3 inches	0	0	0	0	0
3 - 4 inches	5	5	6	8	5
4 - 6 inches	10	10	12	18	15
6 - 10 inches	30	30	33	50	40
10 - 15 inches	60	50	55	70	70
15+ inches	100	75	80	90	100

Source: RAHMP July 27, 1998 Page 31

The RAHMP model assumed the average wood structure has replacement value of $150,000; the replacement value of concrete and steel structures is $1,000,000; and roads cost $750,000 per km to repair. Based on these average valuations, the estimated landslide losses in the county are listed in ***Table 7-6***. Based on this information, the largest losses from landslides will be to roads and highways. The estimates in ***Table 7-6*** are probable maximum losses, given the entire county is subjected to the 2, 25 or 100 year storm at the same time. However, no single storm is likely to produce the 100-year rainfall throughout the entire county. It is more likely that a single storm

will produce the 100-year rainfall in about 25 percent of the area; the 25 year rainfall in about 50 percent of the area; and the 2 year rainfall in about 25 percent of the area. This suggests that the losses would be about one-half the estimated losses in the table.[36]

Table 7-6
Landslide Loss Estimates (Excludes Casualty and Indirect Losses)

Storm Event	Wood Buildings	Steel Buildings	Concrete and Masonry Buildings	Roads and Highways	Total Losses
2-year	$929,000	$42,000	$248,000	$2,281,000	$3,500,000
25-year	$3,995,000	$173,000	$998,000	$9,766,000	$14,932,000
100-year	$7,382,000	$315,000	$1,820,000	$17,731,000	$27,248,000

Source: RAHMP July 27, 1998 Page 32

The RAHMP does not include detailed maps showing areas prone to debris flows. Debris flows are not as damaging to roads and highways as are deep seated landslides. This is because the typical debris flow will generate debris atop the road, but not actually fail the road. While road closure still occurs, the cost to repair (remove the debris) the road usually includes dirt removal, off haul, and minor fence and signage repairs. More expensive repairs, including mitigation to prevent future debris flows, are usually not performed. Based on these factors, the losses due to debris flows is estimated to be about 20 percent of that from deep seated landslides, when measured on a dollar loss ratio.[37] Local experience indicates that the above estimate for damage to roads and highways is low.

Currently there is insufficient data to conduct a detailed risk analysis for landslide events in Linn County. The mitigation plan may include recommendations for improved data and partnerships that may lead to a detailed landslide risk analysis. An updated risk analysis for landslides in Linn County could be developed using the debris flow hazard maps being prepared by DOF and DOGAMI along with site-specific development information contained in Linn County's Assessor and GIS databases and more specific footprint and site information not currently available.

Community Landslide Issues

What is Susceptible to Damage from a Landslide Event?

Landslides can affect utility services, transportation systems, and critical lifelines. In addition to the immediate damages and loss of service that communities may suffer, the disruption of infrastructure, roads, and critical facilities may also have a long-term effect on the economy. Utilities including potable water, wastewater, telecommunications, natural gas, and electricity are all essential to the community. Loss of electricity has the most widespread impact on the whole community and can even affect other utilities. For example, even landslide movements as small as an inch or two increase the potential for natural gas pipelines to break.[38]

Roads and Bridges

Roads are subject to closure during landslide events and constitute the largest losses incurred from landslide hazards in Linn County. The Linn County Road Department and the Oregon Department of Transportation (ODOT) are responsible for responding to slides that inhibit the flow of traffic and/or damage a road or bridge.

Since many Linn County residents are dependent on roads for commuting to work, delays and detours generated by a landslide event will likely have an economic impact on residents and businesses. Bridges are a critical part of road connections that may suffer extensive damage in landslide events. A transportation analysis should be conducted to determine which of Linn County's roads and bridges should be classified as critical to the transportation network.

It is not cost effective to mitigate for all slides, due to the fact that some historical slides are likely to become active again even after mitigation measures have been implemented. The Road Department can alleviate problem areas by grading slides, and by installing new drainage systems on the slopes to divert water from the landslides. This type of response activity is often the most cost-effective in the short-term.

Lifelines and Critical Facilities

It is important to identify facilities determined to be critical to life and safety, such as hospitals, emergency services, and public utilities that are subject to direct impacts from landslides. Critical facilities may also be indirectly impacted by landslides. Lifelines and critical facilities must remain accessible during a natural hazard event. The impact of closed transportation arteries is increased if the closed road or bridge is the access to a hospital or other emergency facility, or if populations are cut off from emergency services or utilities. Therefore, inspection and repair of critical transportation facilities and routes is essential and should be a high priority. Loss of power and/or phone service is also potentially a consequence of landslide events. In hillside areas, soil erosion can be accelerated by heavy rains, resulting in loss of soil support beneath high voltage transmission towers.

Landslide Loss Potential

Landslides are a significant hazard to life and property. In some cases, it is cost effective to mitigate existing infrastructure against landslides. More often, the most cost effective approach to deal with landslides is by zoning regulations, whereby landslide hazard areas are identified prior to construction, and the planned facilities are either relocated or the landslide is mitigated prior to construction. If the cost to mitigate a landslide is high, and the risk of landslide loss is suitably small, in some cases it may be worthwhile to accept the risk and consequences from unmitigated landslides. Landslides should also be considered in the development of emergency response plans.[39]

How to Reduce the Effects of Landslides[40]

Vulnerability to landslide hazards is a function of location, type of human activity, use, and frequency of landslide events. The effects of landslides on people and structures can be lessened by total avoidance of landslide hazard areas or by restricting, prohibiting, or imposing conditions

on hazard-zone activity. Local governments can reduce landslide effects through land-use policies and regulations. Individuals can reduce their exposure to hazards by educating themselves on the past hazard history of a site and by making inquiries to planning and engineering departments of local governments. They can also obtain the professional services of an engineering geologist, a geotechnical engineer, or a civil engineer, who can properly evaluate the hazard potential of a site, built or unbuilt.

The hazard from landslides can be reduced by avoiding construction on steep slopes and existing landslides, or by stabilizing the slopes. Stability increases when ground water is prevented from rising in the landslide mass by:

(1) Covering the landslide with an impermeable membrane;

(2) Directing surface water away from the landslide;

(3) Draining ground water away from the landslide; and

(4) Minimizing surface irrigation.

Slope stability is also increased when a retaining structure and/or the weight of a soil/rock berm are placed at the toe of the landslide or when mass is removed from the top of the slope.

Landslide Mitigation Programs

Linn County Codes

Statewide Planning Goal 7 seeks to "protect life and property" from natural disasters and hazards such as floods, landslides, and earthquakes. Linn County complies with Goal 7 by incorporating hazard inventories into the comprehensive plan and by adopting policies and ordinances to protect people and property from the identified hazard.

The Linn County Comprehensive Plan (Plan) in LCC Chapter 903 contains policies to address areas subject to natural and geologic hazards. The Plan identifies DOGAMI *Bulletin 84, Environmental Geology of Western Linn County, Oregon,* and subsequent amendments, as the official source for determining if a property is located within a mass movement area. *LCC 903.260(B)(10)* sets forth that:

> *If a development is proposed in an area known to have geologic or natural hazards, the county may require the applicant to submit a report which details the extent of the hazard. The county, before approving the proposal, must find that presence of a hazard will not be detrimental to the development.*

The Linn County Land Development Code in LCC 921.980(D)(2) states:

> *In an area containing mass movement topography as indicated in the Bulletin 84, Environmental Geology of Western Linn County, Oregon, no person may develop land unless the applicant provides a report from an Oregon Engineering Geologist to the Director before development permits may be issued. The report shall state that the land can be safely developed. If the report provides recommendations for development, those recommendations shall be incorporated into the site development.*

State Programs and Activities

Statewide Planning Goal 7[41]

Statewide Planning Goal 7 is one of the original 14 Statewide Planning Goals adopted by the Land Conservation and Development Commission in 1974. Goal 7 seeks to "protect life and property" from natural disasters and hazards such as floods, landslides, and earthquakes. To help accomplish this protection, the Goal requires that local plans be based on an inventory of known areas subject to natural hazards and disasters and advises that "developments subject to damage or that could result in loss of life shall not be planned nor located in known areas of natural disasters and hazards without appropriate safeguards."

Senate Bill 12[42]

In response to the catastrophic landslide events that occurred in Oregon in 1996, the state of Oregon adopted Senate Bill 12 in 1999 to address rapidly moving landslides (debris flows). Among other requirements, Senate Bill 12 requires local governments to:

> *Regulate through mitigation measures and site development standards the siting of dwellings and other structures designed for human occupancy in further review areas where there is evidence of substantial risk for rapidly moving landslides.*

In brief, Senate Bill 12 (Source: DLCD Natural Hazards Program website):

- Directs the Oregon Department of Geology and Mineral Industries (DOGAMI) to identify areas potentially prone to debris flows on "further review area" maps;
- Directs the Oregon Department of Land Conservation and Development (DLCD) to assist local governments in implementing the Bill;
- Requires the Oregon Board of Forestry to adopt regulations that reduce the risks associated with rapidly moving landslides;
- Requires the Oregon Department of Forestry (ODF) and DOGAMI to provide technical assistance to local governments;
- Requires the Oregon Department of Transportation (ODOT) to provide warnings to motorists during periods determined to be of the highest risk of rapidly moving landslides along areas of state highways with a history of being most vulnerable to rapidly moving landslides; and
- Directs the Office of Emergency Management of the Department of State Police to coordinate state resources for rapid and effective response to landslide-related emergencies.

Department of Geology and Mineral Industries (DOGAMI)

Senate Bill 12 requires DOGAMI to map "further review areas" in coordination with the Oregon Department of Forestry (ODF). The ODF and DOGAMI have worked together to develop landslide hazard identification maps in order to provide information to local governments that will allow for more informed mitigation decisions.

Department of Land Conservation and Development (DLCD)

The DLCD awarded a grant to Douglas County for the development of a model program to help in the mitigation of rapidly moving landslide hazards. Douglas County agreed to produce four main products: (1) A model landslide hazards ordinance; (2) Model documents to support implementation of Senate Bill 12; (3) A model Transfer of Development Rights program; and (4) Procedures to integrate DOGAMI's "further review area" maps into local tax parcel maps.

Oregon Department of Forestry (ODF)

Senate Bill 1211 and Senate Bill 12, passed in 1997 and 1999 respectively, contain provisions to be addressed by the ODF. These provisions include the interim prohibition of forest operations in certain areas and the development of certain forest practices requirements. The interim prohibitions authorized by Senate Bill 1211 will eventually be replaced by the forest practice rules to be adopted by the Oregon Board of Forestry as required by Senate Bill 12. (Source: DLCD Natural Hazards Program)

Interim Prohibitions[43]

Senate Bill 1211, a precursor to Senate Bill 12, authorized the ODF to prohibit forest operations on steep, landslide-prone sites above homes and busy roads in the interest of public safety. Specifically, the State Forester is authorized to prohibit operations if all of the following conditions exist:

- The operation location includes high-risk sites;
- Homes and other buildings where people are likely to be present during periods of intense rainfall or where county or state highways are in such close proximity to the potential path of a landslide or debris torrent that there is significant risk to human life; and
- The farthest expected extent of a potential landslide or debris torrent that might originate in the operation area, based on physical features of the landslide or debris torrent path, will reach the residences, buildings, or highways.

Forest Practices Requirements

Senate Bill 12 required the ODF to adopt and enforce forest practice rules to reduce the risk of serious bodily injury or death from rapidly moving landslides (Oregon Revised Statutes (ORS) 527.630)). ORS 527.710(11) sets forth the criteria the Board of Forestry should consider in adopting such rules, including the exposure of the public to these safety risks and appropriate practices to reduce the occurrence, timing, or effects of rapidly moving landslides.

Landslide Warnings

The Oregon Department of Geology and Mineral Industries (DOGAMI) is developing a slope failure database that it has used to study the relationship between rainfall events and debris flows. Records from the four major storms that hit western Oregon during 1996 and 1997 confirm that the occurrence of many landslides and debris flows can be related to rainfall intensity and duration. The relationships that have been shown between rainfall intensity and debris flows are useful in helping to determine areas where debris flow warning systems are

appropriate. A debris-flow hazard warning system has been developed, and a current alert message can be found at the ODF.[44]

Oregon's landslide / debris flow warning system primarily involves three state and one federal agency: the ODF, DOGAMI, the Oregon Department of Transportation (ODOT), and the National Oceanic and Atmospheric Administration (NOAA). The warning system is triggered by rainfall and monitored in areas that have been determined to be hazardous.
As the lead agency, ODF is responsible for forecasting and measuring rainfall from storms that may trigger debris flows. Advisories and warnings are issued as appropriate. Information is broadcast over NOAA weather radio and on the Law Enforcement Data System. DOGAMI provides additional information on debris flows to the media. ODOT provides information concerning the location of landslides / debris flows and alternate transportation routes.[45]

House Bill 3375 (2003)

House Bill 3375 (2003) directs local governments to adopt new land use regulations for siting dwellings and other structures once DOGAMI issues final maps of rapidly moving landslide hazard areas. The bill clarifies that local governments may deny a request for a building permit if a geotechnical report discloses information about landslide hazards. This bill repeals the mitigation threshold requirements and transferable development rights program in landslide areas in Senate Bill 12.

Oregon State Building Code Standards

The Oregon Building Codes Division adopts statewide standards for building construction that are administered by 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 a building 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, emergency response facilities, and special occupancy structures, such as large schools and prisons.[46]

2005 Landslide Mitigation Action Items Progress

<u>The Landslide Mitigation Action Items that were part of the 2005 Natural Hazard Mitigation Plan are listed below with a description of progress or status on each item. Those items not listed in this section have either been deferred and are part of the 2011 Natural Hazard Mitigation Plan or deleted.</u>

2005 Short-term Action Items

LS-ST #1: Action 3.1.2. Use and publicize the Oregon Department of Forestry's debris flow warning system

Coordinating Organization: Linn County Emergency Management
Internal Partners: Road Department; Board of Commissioners
External Partners: DOF; DOGAMI; OEM; ODOT; Radio Stations; NOAA
Timeline: Ongoing
Plan Goals Addressed: Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships.
Plan Objective: Objective 3.1. Increase citizen awareness and promote risk reduction activities through education and outreach.

Status: The debris flow warning system information is now included in National Weather Service issued flood warnings. Refer to the Portland NWS web site for current information. Since the operating agency has changed the action item LS-ST #1 has been changed to reflect the NOAA debris flow warning system.

2005 Long-term Action Items

LS-LT #1: Action 2.2.6. Use final DOF Debris Flow Hazard maps and improved development data to update the landslide vulnerability and risk analysis.

Coordinating Organization: Linn County Emergency Management
Internal Partners: GIS; Assessor; Road Department; Planning & Building
External Partners: DOF; DOGAMI; OEM; FEMA
Timeline: 3-5 years
Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective: Objective 2.2. Support the enhancement of County vulnerability assessment activities.

Status: Due to the adoption of House Bill 3375, which amended SB 12 and postponed adoption of the debris flow maps, Linn County has not updated the landslide vulnerability and risk analysis. Since there maybe new technology that may provide improved data compared to the DOF Debris Flow Hazard maps the Steering Committee has deleted this action item and replaced with Action Item 2.2.8.

2010 Landslide Mitigation Action Items

Landslide mitigation action items provide direction on specific activities that communities, organizations, and residents in Linn County can undertake to reduce risk and prevent loss from landslide events. The Steering Committee identified one short-term and one long-term landslide hazard action item.

Short-term Action Items

LS-ST #1: Action 3.1.3. Use and publicize the NOAA debris flow warning system

Coordinating Organization: Linn County Emergency Management
Internal Partners: Road Department; Board of Commissioners
External Partners: NOAA; DOF; DOGAMI; OEM; ODOT; Radio Stations
Timeline: Ongoing
Plan Goals Addressed: Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships.
Plan Objective: Objective 3.1. Increase citizen awareness and promote risk reduction activities through education and outreach.

LS-ST #2: Action 3.1.4. Increase public education related to landslide hazards by distributing DOGAMI landslide informational brochure.

Coordinating Organization: Linn County Emergency Management
Internal Partners: Planning and Building Department; Road Department
External Partners: DOGAMI; OEM
Timeline: Ongoing
Plan Goals Addressed: Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships.
Plan Objective: Objective 3.1. Increase citizen awareness and promote risk reduction activities through education and outreach.

Long-term Action Items

LS-LT #1: Action 2.2.8. Continue to improve identification of debris flow area in Linn County by using mapping with current data and technology.

Coordinating Organization: Linn County GIS
Internal Partners: Emergency Management; Assessor; Road Department; Planning & Building
External Partners: DOF; DOGAMI; OEM; FEMA
Timeline: 3-5 years
Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective: Objective 2.2. Support the enhancement of County vulnerability assessment activities.

LS-LT #2: Action 2.2.9. Implement Linn County existing development standards for structures located within a "mass movement area".

Coordinating Organization: Linn County Planning and Building Department
Internal Partners: GIS; Assessor; Emergency Management
External Partners: DOGAMI; OEM; FEMA
Timeline: 3-5 years
Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective: Objective 2.2. Support the enhancement of County vulnerability assessment activities.

Landslide Endnotes

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

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

[3] Ibid.

[4] Oregon State Natural Hazard Mitigation Plan (OR-SNHMP) (Region 3) Mid/Southern Willamette Valley Hazards Assessment, Nov. 2003, pp R3-22

[5] Ibid.

[6] State of Oregon Department of Geology and Mineral Industries (DOGAMI) Bulletin 84 (1974), Environmental Geology of Western Linn County, Oregon, pp 62-66

[7] Ibid. pg 67

[8] Department of Land Conservation and Development (DLCD) Natural Hazards Program Website, http://www.lcd.state.or.us

[9] Regional All Hazard Mitigation Plan for Benton, Lane, Lincoln and Linn Counties (RAHMP) July 27, 1998, pg. 25

[10] DLCD Natural Hazards Program Website, http://www.lcd.state.or.us

[11] Ibid.

[12] Ibid.

[13] RAHMP, July 27, 1998, pg. 26

[14] Ibid. pg. 25

[15] Ibid.

[16] Ibid.

[17] Ibid.

[18] DOGAMI Bulletin 84 (1974), pg. 62

[19] Douglas County Natural Hazard Mitigation Plan (NHMP), 2003, pp. 105

[20] DOGAMI Bulletin 84 (1974), pg. 62

[21] Douglas County NHMP (2003), pp. 105

[22] Ibid. pg. 106

[23] Ibid. pg. 106

[24] Ibid. pg. 105

[25] USGS Landslide Hazard Fact Sheet 2004-3072 (July 2004)

[26] Douglas County NHMP (2003), pp. 105

[27]DLCD Natural Hazards Program Website, http://www.lcd.state.or.us

[28] Ibid.

[29] Ibid.

[30] RAHMP July 27, 1998, pg. 32

[31] RAHMP July 27, 1998, pp 29-30

[32] OR-SNHMP Region 3 Hazard Assessment, pp R3-23

[33] Ibid.

[34] Douglas County NHMP (2003), pp 107

[35] RAHMP July 27, 1998, pg. 30

[36] Ibid. pg. 32

[37] Ibid. pg. 33

[38] Regional All Hazard Mitigation Master Plan for Clackamas County (February 1998) Goettel & Associates.

[39] Source: RAHMP, July 27, 1998, Page 25

[40] USGS Landslide Hazard Fact Sheet 2004-3072 (July 2004)

[41] Source: DLCD Natural Hazards Program Website, http://www.lcd.state.or.us

[42] Ibid.

[43] Ibid.

[44] Ibid.

[45] OR-SNHMP Region 3 Hazard Assessment, pp R3-23

[46] *Planning for Natural Hazards: The Oregon Technical Resource Guide*, Department of Land Conservation and Development (July 2000), Chapter 5.

Section 8:
Wildfire

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Why is Wildfire a Threat to Linn County?

This report defines wildfire as an uncontrolled burning of wildlands (forest, brush or grassland). Although fire is a natural part of forest and grassland ecosystems in Linn County, wildfire can pose a significant risk to life and property in wildland/urban interface areas. The urban interface is the area at the urban-rural fringe where homes and other structures are built into a forested or natural landscape. If left unchecked, fires in these areas can threaten lives and property.

Over 900,000 acres, or nearly 65 percent of Linn County, is forested.[1] These forested lands play a critical role in the economic, environmental and social vitality of the county. Wildfire poses a serious threat to economic activity, recreation, life and property in forested areas. Because 35 percent of Linn County's population resides outside of cities, wildfire poses a threat to rural communities, rural residential areas and other rural home sites located throughout the county.

Linn County's climate is characterized by warm dry summers. During the summer fire season the danger of fire in the county's forests and grasslands increases as the trees, brush and grassland dries and increases the potential for a conflagration. The forest lands in eastern Linn County are subject to annual small to moderate fires caused by human and natural causes, such as lightening.[2]

Much of the Willamette Valley in western Linn County is dominated by grass seed fields. Beginning in 1948, Oregon's grass seed farmers began burning their fields to control disease and dispose of straw. In 1988, grass smoke from a controlled burn in a field adjacent to Interstate 5 between Albany and Highway 34 intruded across the interstate, causing a 24-car pile-up. Thirty-eight people were injured and seven people died. Since then legislation has been adopted restricting but not eliminating the burning of fields. Grass farmers have developed alternatives to burning and currently burn fewer acres than allowed by law. [3] In June of 2009, the Oregon Legislative Assembly passed Senate Bill 528[4], further reducing the acres growers are allowed to burn.

Burning of any kind is a potential threat to safety. Forest slash burns, grass field burns, and residential back yard burning in the wildland/urban interface all have the potential to ignite wildfire, threatening health, life and property.

Causes and Characteristics of Wildfire Hazards

The characteristics of fire are important to understand when trying to mitigate its negative effects on humans and structures. In order for fire to exist, the three components of the fire triangle must be present. The triangle consists of fuel, heat, and oxygen.[5]

Most naturally caused fires are initiated by lightning strikes. Human-caused fires, both accidental and deliberate, are produced in many ways, including campfires, chimneys, torches, matches, fireworks, cigarettes, vehicle fires, military ordnance, and smoldering slash piles.[6] Whether natural or human-caused, the ignition is started because the fire triangle exists. Fire occurring in natural ecosystems begins as a point of ignition, burns outward into circles and, if escalates,

spreads in the direction toward which the wind is blowing.[7] Additionally, when burning occurs on uneven terrain, the fire spreads upslope to eventually form itself into broad ellipses.[8]

Effects of fire on ecosystem resources can represent damages, benefits, or some combination of both, depending largely on the characteristics of the fire site, the severity of the fire, the time period of valuation, and the values placed on the resources affected by the fire.[9] The ecosystems of most forests depend upon fire to maintain various functions. The use of fire for beneficial purposes is considered for reducing fuel loads, disposing of slash, preparing seedbeds, thinning overstocked stands, increasing forage plant production, improving wildlife habitats, changing hydrologic processes, and improving aesthetic environments.[10] However, despite its beneficial values to ecosystems, fire has been suppressed for years because of its perceived effects on timber harvest and threat to human life. In addition, new development continues to push its way into what is termed as the "wildland/urban interface."

The Interface

There are three categories of interface fire:[11]

- The classic wildland/urban interface exists where well-defined urban and suburban development presses up against open expanses of wildland areas;
- The mixed wildland/urban interface is characterized by isolated homes, subdivisions, and small communities situated predominantly in wildland settings; and
- The occluded wildland/urban interface exists where islands of wildland vegetation occur inside a largely urbanized area.

Unlike most other natural hazards, the wildland/urban interface is not designated by geography alone. Certain conditions must be present for significant interface fires to occur. The most common are hot, dry, and windy weather; the inability of fire protection forces to contain or suppress the fire; the occurrence of multiple fires that overwhelm committed resources; and a large fuel load (dense vegetation).[12]

Once a fire has started, several conditions influence its behavior, including fuel, topography, weather, drought, and development. These combined conditions are the key elements that add to increased wildfire risk. The severity of the wildfire is ultimately affected by the severity of these conditions. For example, if a steep slope is combined with extremely low humidity, high winds, and highly flammable vegetation, then a high–intensity wildfire may develop.

Since the 1970s, Oregon's growing population has expanded further and further into traditional resource lands such as forestland. The "interface" between urban and suburban areas and the resource lands created by this expansion has produced a significant increase in threats to life and property from fires, and has pushed existing fire protection systems beyond original or current design or capability.[13] Property owners in the interface are often unaware of the problems and threats they face. Therefore, many owners have done very little to manage or offset fire hazards or risks on their own property. Human activities also increase the incidence of fire ignition and potential damage.

The Oregon State Natural Hazards Mitigation Plan (OR-SNHMP) Region 3 Hazards Assessment identifies the following as Wildland/Urban Interface Communities in Linn County[14]:

- Albany
- Brownsville
- Clear Lake Resort
- Harrisburg
- Lebanon
- Marion Forks
- Mill City
- New Idahna
- Scio
- Sweet Home East
- Sweet Home West

There are many other rural residential areas in Linn County that may be subject to wildfire hazards because of their location in forested areas or on steep dry slopes. Examples of such rural residential exception areas include: Bartel's Canyon Estates, Cascadia, Middle Ridge, Mountain Home Drive, Mt. Tom/Wildwood Estates, Northernwood Drive, Powell Hills, Rodger's Mountain, Washburn Heights, the Upper Calapooia, and others.

Fuel[15]

Fuel is the material that feeds a fire, and is a key factor in wildfire behavior. Fuel is classified by volume and by type. *Volume* is described in terms of "fuel loading," or the amount of available vegetative fuel. The *type* of fuel refers to the species of trees, shrubs, and grass that are present. Oregon, as a western state with prevalent conifer, brush, and rangeland fuel types, is subject to more frequent wildfires than other regions of the nation.

An important element in understanding the danger of wildfire is the availability of diverse fuels in the landscape, such as natural vegetation, manmade structures, and combustible materials. A house surrounded by brushy growth rather than cleared space allows for greater continuity of fuel and increases the fire's ability to spread. After decades of fire suppression, "dog-hair" thickets have accumulated. These enable high intensity fires to flare and spread rapidly.

Structures that are made of combustible material such as shake roofs and wood siding are especially susceptible to fire. Untrimmed bushes near these structures often serve as "ladder fuels," enabling a slow moving ground fire to climb onto rooftops and into the crowns of trees. A crown fire is significantly more difficult to suppress than a ground fire, and are much more threatening to structures in the interface.

Wildfire at the upper end of the wildfire intensity spectrum is likely to spread into the tops of the tallest trees in violent and discontinuous surges.[16] Fire that occurs at this severe end of the spectrum responds to its own convective winds, spreading rapidly as sparks from exploding trees ignite other fires many meters away.[17] Because of the many different possible "fuels" found in the interface landscape, firefighters have a difficult time predicting how fires will react or spread.

Topography[18]

Topography influences the movement of air, thereby directing a fire's course. For example, if the percentage of uphill slope doubles, the rate of spread in wildfire will likely double. Gulches and canyons can funnel air and act as chimneys, which intensify fire behavior and cause the fire to spread faster. Solar heating of dry, south-facing slopes produces upslope drafts that can complicate fire behavior.

Unfortunately, hillsides with hazardous topographic characteristics are often desirable as residential areas. This underscores the need for wildfire hazard mitigation and increased education and outreach to homeowners living in interface areas.

Linn County's geography is characterized by broad flat Willamette Valley terraces in the west and mountainous uplands and peaks of the Cascade Range to the east. The western Cascade uplands have elevations up to 5000 feet and are characterized by gentle slopes to very steep slopes on canyon walls and side slopes.

In between the valley floor and the Cascade uplands are low, sometimes steep foothills that range in elevation from 300 to 1400 feet. Most of the county's unincorporated rural population resides in residential areas developed in these western Cascade foothills and other low hills that rise up from the valley floor. Significant examples include the large Viewcrest and Scravel Hill residential areas northeast of Albany; the Tyler Heights, Agate Hills, Blueberry Hill, Butte Creek and Middle Ridge areas south of Lebanon; the Rowell Hill, Riggs Hill, Marks Ridge, Topview Acres, and Ames Creek residential areas around Sweet Home; Oakview Heights and Powell Hills north of Brownsville; the Mount Tom area east of Harrisburg; the Rodgers Mountain, Hungry Hill and Loma Drive areas near Scio; and others.

Weather[19]

Weather patterns combined with certain geographic locations can create a favorable climate for wildfire. Areas where annual precipitation is less than 30 inches per year are extremely fire susceptible.[20] High-risk areas in Oregon 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. In addition, many high intensity fires produce their own wind, which aids in the spread of fire.

Recent concerns about the effects of climate change, particularly drought, are contributing to concerns about wildfire vulnerability. The term *drought* is applied to a period in which an unusual scarcity of rain causes a serious hydrological imbalance.

Drought contributes to the frequency and intensity of fires. Unusually dry winters, or significantly less rainfall than normal, can lead to relatively drier conditions and leave reservoirs and water tables lower. Drought leads to problems with irrigation and may contribute to additional fires, or additional difficulties in fighting fires. However, most fuel types, other than grasses, require two or three years of drought before the fuel becomes dangerously dry.

All areas of Linn County receive an average of more than 40 inches of rainfall per year. However, the county usually receives very little rainfall during the warm summer months, commonly going long periods with no measurable precipitation. During the summer fire season the danger of fire in the forests and grasslands increases as the trees, brush and grassland dries and increases the potential for conflagration. The county is highly susceptible to lightning induced fires during late summer Cascade thunderstorms.

Development

Growth and development in forested areas is increasing the number of structures in the interface. Wildfire affects development, yet development can also influence wildfire. While wildfires have always been part of the ecosystem in Oregon, homes in the interface often lead to human ignition of fire. The increase in human development and activity in the interface combined with the high fuels content from years of fire suppression can create a lethal combination.

Homeowners often prefer lots that are private and have scenic views nestled in vegetation. A private setting may be far from public roads, or hidden behind a narrow, curving driveway. These conditions, however, make evacuation and firefighting difficult. The scenic views found along mountain ridges can also mean areas of dangerous topography. 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. [21]

Wildfire Hazard Assessment

The wildfire hazard assessment provides information on the location of wildfire hazards, the land and property characteristics within the hazard area, and an assessment of risks to life and property that may result from a wildfire. The three elements of hazard assessment are: (1) hazard identification; (2) vulnerability assessment; and (3) risk analysis.

Section 201.6(c)(2)(i) of the *Disaster Mitigation Act of 2000* (DMA-2000) requires that the risk assessment include a description of the location and extent of all natural hazard that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Hazard Identification

The first phase of wildfire-hazard assessment is hazard identification. Hazard Identification identifies: (1) the geographic extent of areas subject to wildfire, (2) the expected intensity of a wildfire event at different locations, and (3) the probability of occurrence of wildfire events.

Wildfire hazard areas are commonly identified in areas of wildland/urban interface. The level of wildfire hazard is determined by the ease of fire ignition, from natural or human causes, and the difficulty of fire suppression. Wildfire hazard can be magnified by several fire suppression and control factors, such as the fuel load, weather, topography, and property characteristics. Hazard identification rating systems are based on weighted factors of fuels, weather, and topography.[22]

To determine the "base hazard factor" of specific wildfire hazard sites and interface regions, several factors must be considered. Categories used to assess the base hazard factor include[23]:

- Topographic location, characteristics and fuels;
- Site/building construction and design;
- Site/region fuel profile (landscaping)
- Defensible space;
- Accessibility;
- Fire protection response; and
- Water availability.

The use of Geographic Information System (GIS) tools and improved data can assist in fire hazard assessment, allowing further integration of fuels, weather, topography, and development data for fire behavior prediction, watershed evaluation, developing mitigation strategies, and hazard mapping. A map of all the Rural Fire Districts in Linn County can be found in the Executive Summary, M-15 (Maps).

Wildfire in the US

On average there are more than 100,000 wildfires in the United States each year, burning more than 4 million acres and hundreds of homes within wildland areas. In 2007 there were 9.3 million acres burned in the U.S. in 85,705 separate fires. Lightning caused approximately 15 percent of the fires, human negligence and arson are responsible for the remainder.[24] Wildland fire data for the U.S. during the 2007 fire season, along with recorded averages, is summarized in ***Table 8-1***.

Table 8-1
U.S. Wildland Fire Season
2007 Summary

Item	Summary
Number of Fires (2007 final)	85,705
10-year Average (1996-2006)	78,251
Acres Burned (2002 final)	9,321,326
10-year Average (1996-2006)	5,860,000

Source: National Interagency Fire Center, Boise Idaho, Wildland Fire Statistics.
Retrieved February 18, 2005 from: http://www.nifc.gov/stats/wildlandfirestats.html

During the 2000 fire season, more than 7.5 million acres of public and private lands burned in the US, resulting in loss of property, damage to resources, and disruption of community services. Taxpayers spent more than $1.6 billion to combat 90,000 fires nationwide.[25] Many of these fires burned in wildland/urban interface areas and exceeded the fire suppression capabilities of those areas.

The magnitude of the year 2000 fires is the result of two primary factors: (1) severe drought, accompanied by a series of storms that produced thousands of lightning strikes and windy conditions; and (2) the effects of wildfire suppression over the past century that has led to buildup of brush and small diameter trees in the nation's forests and rangelands.[26]

Wildfire in Oregon

Oregon has a very lengthy history of fire in the undeveloped wildlands and in the developing wildland/urban interface. There have been many fires in Oregon, named and unnamed.[27]

Table 8-2 lists some of the major fires that occurred in Oregon from 1848 to 2002.

Table 8-2
Historic Oregon Wildfires (1848-2002)

Year	Fire	Number of 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
1987	Silver	970,000
1992	Lone Pine	31,000
1996	Skeleton	17,000
2002	Biscuit	500,000

Source: "Atlas of Oregon," William G. Loy, et al, University of Oregon Books, 1976. Oregon Department of Forestry, "Tillamook Burn to Tillamook State Forest," revised 1993. Department of Forestry, http://www.odf.state.or.us/DIVISIONS/protection/fire_protection/stats/histfire.asp?id=3070105 Oregon Emergency Management, State Hazard Risk Assessment, 2003.

In 1990, Bend's Awbrey Hall Fire destroyed 21 homes, causing approximately $9 million in damage and costing over $2 million to suppress. In 1996, Bend's Skeleton Fire burned over 17,000 acres and damaged or destroyed 30 homes and structures. In that same year, 218,000 acres were burned, 600 homes were threatened, and 44 homes were lost statewide.[28] In 2002, the Biscuit Fire became one of Oregon's most destructive fires in recent history, impacting nearly

500,000 acres, destroying 4 homes, 9 outbuildings, 1 lookout, and numerous recreational structures. The costs of fighting this fire totaled $153 million and included over 7,000 firefighters and support personnel.[29]

The number of wildfires in Oregon varies from year to year. In 2009 Oregon had 1,089 wildfires that burned 7,033.94 acres. Between 1999 and 2008 Oregon has averaged 1,116 wildfires a year and between 1994 and 2003 burning an average of 26,782.03 acres. The cost of fire suppression varies accordingly, averaging $8.69 million annually over the past 16 years. Lightning accounts for approximately 30 percent of forest fires in Oregon, the remaining 70 percent are human caused.[30] Oregon wildfire data from the Oregon Department of Forestry (ODF) is summarized in ***Table 8-3***.

Table 8-3
Oregon Seasonal Fire Occurrence
State and Association Districts

Item	Summary
Number of Fires – All Causes (2009 season)	1,089
10-year Average – All Causes (1999-2008)	1,116
Number of Lightning Caused Fires Only (2008 season)	292
10-year Average (1999-2008)	319
Number of Human Caused Fires Only (2008 season)	695
10-year Average (1994-2003)	797
Acres Burned (2009 final)	7,033.94
10-year Average (1994-2003)	26,782.03
Average State Fire Suppression Costs* (1985-2000)	$8.69 million
Year 2000*	$5.75 million
Low year (1997)*	$1.21 million
High year (1987)*	$32.08 million

Source: Oregon Department of Forestry March 22, 2010
Retrieved March 22, 2010 from : http://egov.oregon.gov/ODF/FIRE/GenCause.pdf

Oregon Department of Forestry November 26,2004
Retrieved February 18, 2005 from : www.odf.state.or.us/DIVISIONS/protection/Fire_protection/stats
*Figures apply to the 15.8 million acres of state, private and federal forest lands protected by the Oregon Department of Forestry

In recent years, the cost of fire suppression has risen dramatically. A large number of homes have been threatened or burned, more fire fighters have been placed at risk, and fire protection in wildland areas has been reduced. These factors prompted the passage of Oregon Senate Bill (SB) 360 (Forestland / Urban Interface Protection Act, 1997).[31] SB 360:

(1) Establishes legislative policy for fire protection;

(2) Defines urban/wildland interface areas for regulatory purposes;

(3) Establishes standards for locating homes in the urban/wildland interface; and

(4) Provides a means for establishing an integrated fire protection system.

Wildfire in Linn County

The eastern two-thirds of the county are forested. The forest lands are owned by the US Forest Service, Bureau of Land Management, Oregon Department of Forestry and private owners. The Western one-third of the county is primarily grassland or moderate to steep Cascade foothills. During the summer fire season the danger of fire in the forests and grasslands increases as the trees, brush and grassland dries and increases wildfire potential.[32]

In 1988, a controlled burn in a field adjacent to Interstate 5 between Albany and Highway 34 caused a multi-vehicle accident when the smoke drifted across the highway. The forest land in eastern Linn County are subject to annual small to moderate fires caused by human intervention and natural causes, such as lightning.[33]

In 2006, the Santiam Unit of the Oregon Department of Forestry recorded a total of 16 fires, which burned only 9.73 acres. The main cause of these fires was debris burning. In the same time period the Sweet Home Unit, a total of 51 fires burned 1,181 acres. Lightning was the greatest cause of fire within the sweet Home Unit. The largest single fire was the Middle Fork Fire, which burned 1,070 acres September of 2006.

Linn County Community Wildfire Protection Plan (CWPP)

In November of 2007 the Linn County Community Wildfire Protection Plan was completed and adopted by the Linn County Board of Commissioners. Several Linn County and state agencies collaborated to develop the plan. These agencies included the Oregon Department of Forestry, Bureau of Land Management, Salem Office, Linn County Planning and Building Department, Linn County Fire Defense Board, Willamette National Forest and Bureau of Land Management, Eugene Office and other Linn County emergency services agencies. In addition, the CWPP draws upon the input and feedback provided by members of the public and other stakeholders who participated in a public workshop. The Linn County Community Wildfire Protection Plan builds upon the section of the Natural Hazard Mitigation Plan.

Probability of Future Wildfire[34]

The natural ignition of forest fires is largely a function of weather and fuel. Human-caused fires add another dimension to the probability of wildfire. Dry and diseased forests can be mapped accurately and some statement can be made about the probability of lightening strikes. Each forest is different and consequently has different probability / recurrence estimates.

This document defines wildfire as an uncontrolled burning of forest, brush, or grassland. Wildfire always has been a part of these ecosystems and sometimes with devastating effects. Wildfire results from natural causes (e.g., lightening strikes), a mechanical failure (Oxbow Fire), or human-caused (unattended campfire, debris burning, or arson). The severe fire season of 1987

resulted in a record setting mobilization of fire fighting resources. Most wildfires can be linked to human carelessness.

The intensity and behavior of wildfire depends on a number of factors including fuel, topography, weather, and density of development. There are a number of often-discussed strategies to reduce the negative impacts of these phenomena. They include land-use regulations, management techniques, site standards, building codes, and the Oregon Forestland-Urban Interface Fire Protection Act (1997). All of these have a bearing on a community's ability to prevent, withstand, and recover from a wildfire event.

The State Office of Emergency Management estimates that the probability that Linn County will experience fires in interface areas is "High." This ranking is based on an analysis of risk conducted by county emergency program managers with the assistance of a team of local public safety officials. [35]

Vulnerability Assessment

Vulnerability assessment is the second phase in wildfire hazard assessment. Vulnerability assessment inventories property development and populations that are located within wildfire hazard areas. Locating and understanding the population, property and facilities that are exposed to wildfires will assist in reducing risks and preventing losses from future wildfire events.

Section 201.6(c)(2)(ii)(A) of the DMA-2000 requires that the risk assessment include a description of the jurisdiction's vulnerability to the hazard. This description shall include an overall summary for the hazard and its impact on the community. If appropriate data is available, the vulnerability assessment should describe the type and number of existing and future buildings, infrastructure, and critical facilities located in identified hazard areas.

An understanding of risk begins with the knowledge that wildfire is a natural part of forest and grassland ecosystems. Past forest practices included the suppression of all forest and grassland fires. This practice, coupled with areas of dry brush or trees weakened or killed through insect infestation, has fostered a dangerous situation. Present state and national forest practices include the reduction of understory vegetation through thinning and prescribed (controlled) burning. [36]

Each year a significant number of people build homes within or on the edge of the forest (wildland/urban interface), thereby increasing wildfire hazards. Many Linn County communities (incorporated and unincorporated) are within or abut areas subject to serious wildfire hazards. In Oregon, there are about 240,000 homes worth around $6.5 billion within the wildland/urban interface. Such development has greatly complicated firefighting efforts and significantly increased the cost of fire suppression. These communities have been designated "Interface Communities" and include those listed on page 8-4 of this report.[37]

Risk Analysis

Risk analysis is the third and most advanced phase of hazard assessment. Risk analysis builds on the hazard identification and vulnerability assessment to estimate the damage, injuries and economic losses that may be sustained within a hazard area over a given period of time. The risk

analysis uses mathematical models based on the magnitude of the harm that may result and the likelihood of the harm occurring.

The State Office of Emergency Management estimates that the **probability** that Linn County will experience fires in interface areas is "High." The county's **vulnerability** to the effects of interface fires is identified as "Moderate." These rankings are based on an analysis of risk conducted by county emergency program managers with the assistance of a team of local public safety officials.[38]

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

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

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

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

Most of Linn County outside of urban areas is susceptible to wildland fires during the dry summer months. A detailed community inventory of factors that affect vulnerability is important in assessing risk and is currently beyond the scope and capabilities of this assessment. Development of wildfire hazard maps have been completed as part of the Linn County Community Wildfire Protection Plan, which assists county fire districts and fire departments in developing fire mitigation plans to address the areas most vulnerable to wildfires in Linn County.

Key factors in assessing wildfire risk include ignition sources, building materials and design, community design, structural density, slope, vegetative fuel, fire occurrence, and weather, including occurrences of drought. At the time of publication of this plan, data was insufficient to conduct a risk analysis. The National Wildland/Urban Fire Protection Program has developed the Wildland/Urban Fire Hazard Assessment Methodology tool for communities to assess their risk to wildfire. Information on wildfire hazard assessment is available at http://www.Firewise.org.[39]

When assessing the risks from natural hazards, established mitigation practices already provide benefits in reduced disaster losses. It is important to understand the benefits of past mitigation practices when assessing their risks, being mindful of opportunities to further reduce losses. Possible mitigation practices include[40]:

- Identify and map current hazardous forest conditions such as fuel, topography, etc.;
- Identify forest / urban interface communities (list of interface communities, Federal Register, 08/17/01. V. 66, N. 160);
- Identify and map Forest Protection Districts;

- Identify and map water sources;
- Implement effective addressing system in rural forested areas;
- Clearly mark evacuation routes;
- Identify and locate seasonal forest users. Initiate information program through schools, summer camps, forest camping grounds, lodges, etc;
- Identify and map bridges that can (and can not) support the weight of emergency vehicles. This is a basic requirement for fire suppression;
- Form committees to implement Oregon Senate Bill 360. This is required in Oregon Senate Bill 360; and
- Enforce existing county road standards in interface areas to reflect fire suppression needs. Roads must be wide enough for fire suppression vehicles to turn around. Road grades cannot be too steep for large, heavy vehicles.

Community Wildfire Issues

Growth and Development in the Interface

The forested hills where homes and structures are built are considered to be interface areas, as are residential developments surrounded by grasslands. The development of homes and other structures encroaching onto the forest wildland and other natural areas is expanding the wildland/urban interface. The interface areas are characterized by a diverse mixture of varying housing structures, development patterns, ornamental and natural vegetation, and natural fuels.

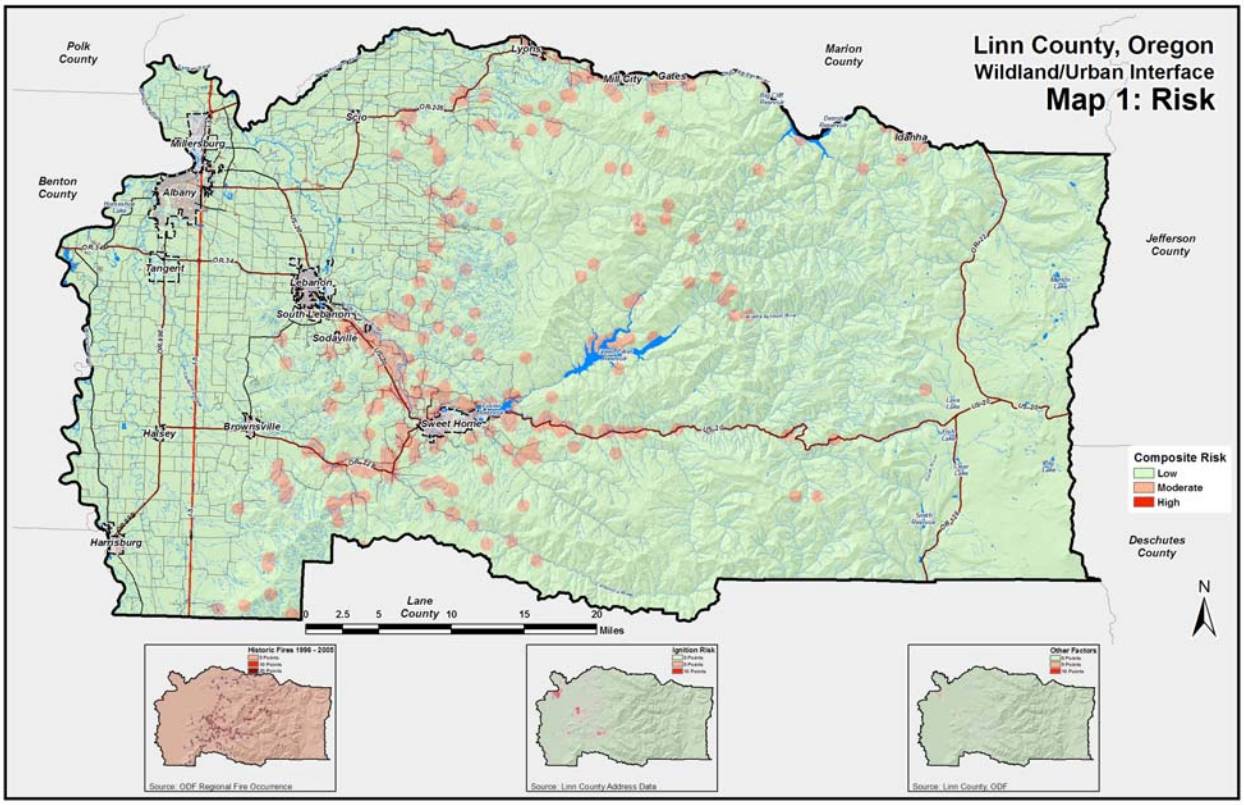
People living in or near wildland settings in Linn County are vulnerable to the threat of wildfire. The Linn County Rural Residential Buildable Lands Inventory (BLI-2002) shows there is a significant amount of built land in rural areas throughout western Linn County. Current zoning regulations limit the number of new homes that can be established on currently undeveloped land. However, unforeseen legislative changes to Oregon's land use system could result in the expansion of residential development on lands marginally suited for farm or forest use. These types of marginal lands often contain characteristics that increase risks to wildfire.

The vegetation in these interface areas consists of an assortment of grasses, shrubs, and deciduous and coniferous trees. Steep slopes may also be a consideration in determining wildfire prone areas. In the event of a wildfire, vegetation, structures, and other flammables can merge into unwieldy and unpredictable events. Factors germane to the fighting of such fires include access, firebreaks, proximity of water sources, distance from fire stations, and available firefighting personnel and equipment. Reviewing past wildland/urban interface fires shows that many structures are destroyed or damaged by wildfire for one or more of the following reasons:[41]

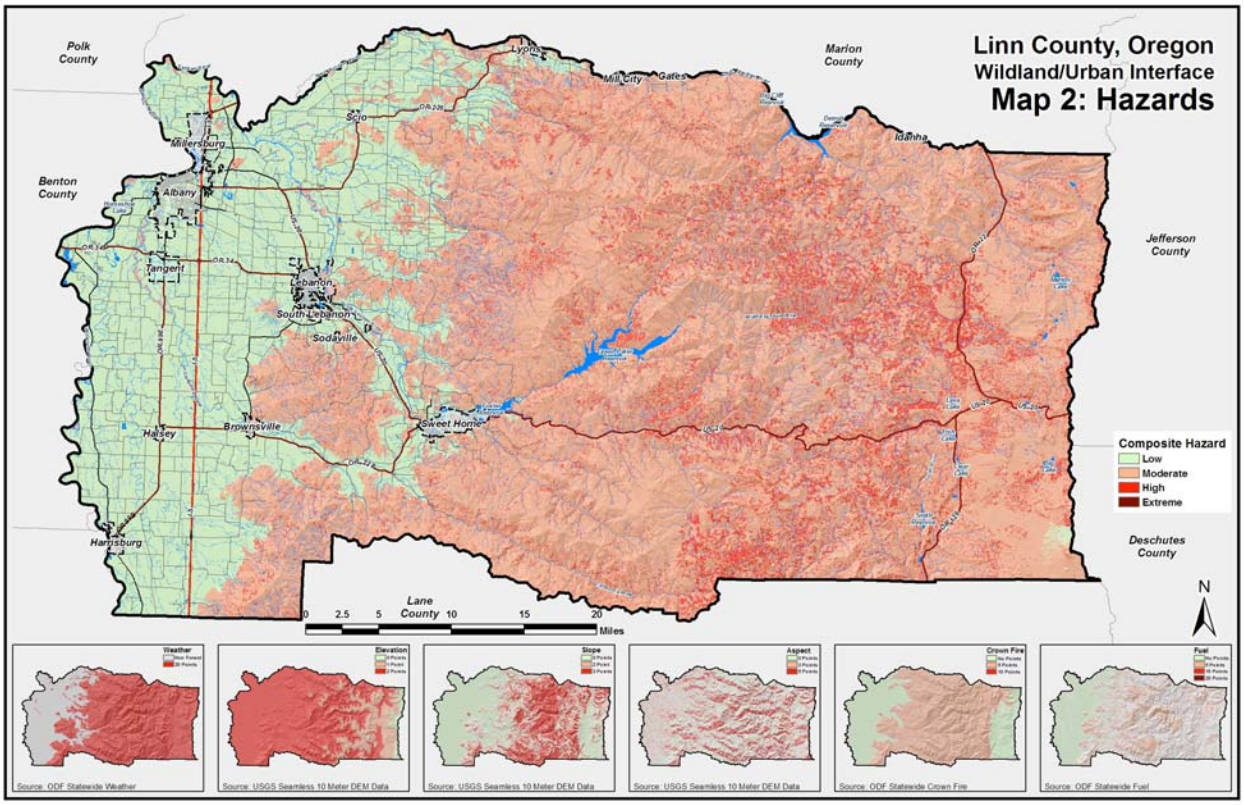
- Combustible roofing material;
- Wood construction;
- Structures with no defensible space;
- Fire department with poor access to structures;

- Subdivisions located in heavy natural fuel types;
- Structures located on steep slopes covered with flammable vegetation;
- Limited water supply; and
- Winds over 30 miles per hour

The map shows that the majority of the County has a low risk, with some pockets of moderate risk along Highway 20 and at recreation areas and historic sites in the Cascade Mountains. Ignition risk is highest in areas surrounding Lebanon, Sweet Home, Brownsville, and in the North Santiam River canyon. There are no areas of high risk.



Map 2 shows that the hazard of wildfire occurrence is moderate to high in most of the forested areas in Linn County, with pockets of highest hazard along Highway 22.



Road Access

Road access is a major issue for all emergency service providers. Of particular concern to firefighters are developments with narrow roadways and few routes of egress; routes with very limited accessibility; and houses without adequate turn-around space. Developments that do not allow rear access to homes can be a significant problem for firefighters and emergency services in defending the structure and ensuring the safety of its inhabitants.

To ensure adequate ingress and egress for emergency vehicles, the Linn County Land Development Code at LCC 935.200 includes a number of roadway improvement standards. The Code requires that all access roadways and drives be constructed of an all-weather surface capable of supporting 50,000 pounds gross vehicle weight (GVW). Some rural fire protection districts may require a surface capable of supporting 80,000 pounds GVW. The roadway must be at least 12 feet in width and must be constructed of six-inches of crushed rock or gravel or six inches of quarry run rock topped with four inches of one-inch minus crushed gravel.

All roads and access drives must maintain an unobstructed vertical clearance of 13 feet six inches and a horizontal clearance of 20 feet along their entire length. Roadways below 20 feet in width must have at least one vehicle turnout for emergency vehicles every 500 feet and provide a

turnaround at the end of the access road. Additional access safety requirements are contained in *LCC 935.200*.

Minimum Fuel Break Standards

To reduce fire risks associated with development in forested areas, the Linn County Land Development Code requires all dwellings in the Farm/Forest (F/F) and Forest Conservation and Management (FCM) zones to maintain a 30-foot wide primary fuel break around structures and a 100-foot wide secondary fuel break around the primary fuel break. The specific standards are described at *LCC 934.590(8).*

Fire Safety Construction Standards

In addition to the State Uniform Building Code (UBC) requirements for residential development, the Linn County Land Development Code contains additional fire safety construction requirements for dwellings in the F/F and FCM zones at LCC 934.590.

Water Supply

Water supply is a critical factor in the ability to fight wildland fires. Developments lacking an adequate water supply and hydrant taps create extra challenges for firefighting personnel. Another water supply issue is that of small diameter pipe water systems, which are inadequate to provide sustained fire-fighting flows.

The majority of rural development in wildfire prone areas is not connected to any sort of public water system and must rely on emergency services response, water trucks, and on site water sources in the event of a fire or wildfire. The Land Development Code requires that a dwelling shall be located within a fire protection district or shall be provided structural fire protection by contract. If this is not practical, then alternative means for protecting the structure from fire hazards may be provided such as an on-site water storage system, pond, stream or lake subject to standards in LCC 934.590(B)(6).

Rural Services

People moving from more urban areas to secluded rural developments may not realize they are living outside of a fire protection district, or that the services provided are not the same as in an urban area. The diversity and amount of equipment and the number of personnel can be substantially limited in rural areas, and the response time may be increased. Fire protection may rely more on the landowner's personal initiative to take measures to reduce fire risk and protect their own property. Therefore, public education and awareness may play a greater role in rural or interface areas.[42]

Development in rural areas in Linn County influences the wildland/urban interface. Although structural losses from wildfires in Linn County have historically been relatively low, continued development, and along with it an increase in fuel loads, expands the public need for natural hazards mitigation planning in the county.

Vulnerable Assets – Estimating Potential Losses

Section 201.6(c)(2)(ii)(B) of the *Disaster Mitigation Act of 2000* (DMA-2000) requires that the risk assessment include an estimate of the potential dollar losses to vulnerable structures. There is insufficient development and vulnerability data available to estimate potential dollar losses to vulnerable structures and facilities at this time. The collection and analysis of appropriate data would serve as an important mitigation item to be completed in the future. Needed data includes the location and ranking of hazard areas; the types and numbers of buildings, infrastructure and critical facilities; and the location, construction, materials, and replacement value of buildings, infrastructure and critical facilities in hazard areas.

Wildfire Mitigation Programs

Existing mitigation activities include current mitigation programs and activities that are being implemented by city, county, regional, state, or federal agencies and organizations.

Local Programs

All development within Linn County must comply with the fire protection construction standards in the Oregon Structural Specialty Code (based on the International Building Code (IBC)) and the Linn County Land Development Code, as well as additional standards set forth by the applicable rural fire protection districts. The Land Development Code contains development standards designed to mitigate wildland fire risks affecting access standards (LCC 935.200) and other county development standards relating to site design and preparation, construction materials, fuel loads and fuel breaks, water supply, and other safety concerns (LCC 934.900).

Linn County Forestland Development Handbook

Linn County has developed a guide for development in the Farm/Forest (F/F) and the Forest Conservation and Management (FCM) zones. The *Linn County Forestland Development Handbook* was published in June 2003 and was funded by Title III funds. The forestland development handbook is a free publication given to property owners when they request information or a development permit in the F/F or FCM zones. The handbook describes the forestland structural siting standards contained in the Land Development Code including property line setbacks, building material requirements, road and access design standards, firebreaks and water supply standards.

State Programs

Oregon Revised Statute 215.730

ORS 215.730, Additional Criteria for Forestland Dwellings, provides criteria for approving dwellings located on lands zoned for forest and mixed agriculture/forest use. Under its provisions, county governments must require, as a condition of approval, that single-family dwellings on lands zoned as forestland meet the following requirements:

1. Dwelling has a fire retardant roof;
2. Dwelling will not be sited on a slope of greater than 40 percent;

3. Evidence is provided that the domestic water supply is from a source authorized by the Water Resources Department and not from a Class II stream as designated by the State Board of Forestry;
4. Dwelling is located upon a parcel within a fire protection district or is provided with residential fire protection by contract;
5. If dwelling is not within a fire protection district, the applicant provides evidence that the applicant has asked to be included in the nearest such district;
6. If dwelling has a chimney or chimneys, each chimney has a spark arrester; and
7. Dwelling owner provides and maintains a primary fuel-free break and secondary break areas on land surrounding the dwelling that is owned or controlled by the owner.

If a governing body determines that meeting the fourth requirement is impractical, local officials can approve an alternative means for protecting the dwelling from fire hazards.

Oregon Revised Statute 477.015-061

Provisions in *ORS 477.015-061*, Urban Interface Fire Protection, were established through efforts of the Oregon Department of Forestry, the Office of the State Fire Marshal, fire service agencies from across the state, and the Commissioners of Deschutes, Jefferson, and Jackson Counties. It is innovative legislation designed to address the expanding interface wildfire problem within Oregon Department of Forestry Fire Protection Districts. Full implementation of the statute is to occur on or after January 1, 2002. The statute does the following:

1. Directs the State Forester to establish a system of classifying forestland-urban interface areas;
2. Defines forestland-urban interface areas;
3. Provides education to property owners about fire hazards in forestland-urban interface areas. Allows for a forestland- urban interface county committee to establish classification standards;
4. Requires maps identifying classified areas to be made public;
5. Requires public hearings and mailings to affected property owners on proposed classifications;
6. Allows property owners appeal rights;
7. Directs the Board of Forestry to promulgate rules that set minimum acceptable standards to minimize and mitigate fire hazards within forestland-urban interface areas; and
8. Creates a certification system for property owners meeting acceptable standards. Establishes a $100,000 liability limit for cost of suppressing fires, if certification requirements are not met.

Senate Bill 360

Senate Bill 360, passed in 1997, is state legislation put in place to address the growing wildland/urban interface problem. The bill has three purposes:

1. To provide an interface fire protection system in Oregon to minimize cost and risk and maximize effectiveness and efficiency;
2. To promote and encourage property owners' efforts to minimize and mitigate fire hazards and risks; and
3. To promote and encourage involvement of all levels of government and the private sector in interface solutions.[43]

The bill included a five-year implementation plan that includes public education and outreach, and the development of rules, standards, and guidelines that address landowner and agency responsibilities. The success of Senate Bill 360 depends upon cooperation among local and regional fire departments, fire prevention cooperatives, and the Oregon Department of Forestry, which means that inter agency collaboration is vital for successful implementation of the bill. This cooperation is important in all aspects of wildland firefighting. Resources and funding are often limited, and no single agency has enough resources to tackle a tough fire season alone. The introductory language of Senate Bill 360 states: "The fire protection needs of the interface must be satisfied if we are to meet the basic policy of the protection of human life, natural resources, and personal property. This protection must be provided in an efficient and effective manner, and in a cooperative partnership approach between property owners, local citizens, government leaders, and fire protection agencies."

Oregon Department of Forestry

The 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. [44]

ODF has been involved with emergency managers to provide support during non-fire events and ODF has worked with industrial partners (big timber companies) to share equipment in the case of extremely large fires. [45]

Federal Programs

The proposed role of the federal land managing agencies, such as the U.S. Forest Service and the Bureau of Land Management, in the wildland/urban interface is diverse. Their roles include: reducing fuel hazards on the lands they administer; cooperating in prevention and education programs; providing technical and financial assistance; and developing agreements, partnerships, and relationships with property owners, local protection agencies, states, and other stakeholders in wildland/urban interface areas. These relationships focus on activities before a fire occurs, which render structures and communities safer and better able to survive a fire occurrence. [46]

Federal Emergency Management Agency Programs

The Federal Emergency Management Agency (FEMA) is directly responsible for providing fire suppression assistance grants and, in certain cases, major disaster assistance and hazard mitigation grants in response to fires. The role of FEMA in the wildland/urban interface is to

encourage comprehensive disaster preparedness plans and programs, increase the capability of state and local governments, and provide for a greater understanding of FEMA's programs at the federal, state, and local levels.[47]

Fire Suppression Assistance Grants

Fire Suppression Assistance Grants may be provided to a state only if the state has an approved hazard mitigation plan for the suppression of a forest or grassland fire that threatens to become a major disaster on public or private lands. These grants are provided to protect life and improved property, and encourage the development and implementation of viable multi-hazard mitigation measures, and provide training to clarify FEMA's programs.

The grant may include funds for equipment, supplies, and personnel. A Fire Suppression Assistance Grant is the form of assistance most often provided by FEMA to a state for a fire. The grants are cost-shared with states. Once the federal grant money is provided to the State, it is then passed along to local jurisdictions. This money would ultimately be passed along to Linn County to be applied to projects. FEMA's US Fire Administration (USFA) provides public education materials addressing wildland/urban interface issues, and the USFA's National Fire Academy provides training programs.[48]

Hazard Mitigation Grant Program

Following a major disaster declaration, the FEMA Hazard Mitigation Grant Program provides funding for long-term hazard mitigation projects and activities to reduce the possibility of damages from all future fire hazards and to reduce the costs to the nation for responding to and recovering from the disaster.

National Wildland/Urban Interface Fire Protection Program

Federal agencies can use the National Wildland/Urban Interface Fire Protection Program to focus on wildland/urban interface fire protection issues and actions. The Western Governors' Association (WGA) can act as a catalyst to involve state agencies, as well as local and private stakeholders, with the objective of developing an implementation plan to achieve a uniform, integrated national approach to hazard and risk assessment and fire prevention and protection in the wildland/urban interface. The program helps states develop viable and comprehensive wildland fire mitigation plans and performance-based partnerships.

US Forest Service

The US Forest Service (USFS) implements a fuel-loading program to assess fuels and reduce hazardous buildup on US forestlands.

Other Mitigation Programs and Activities

Some areas of the country are facing wildland/urban issues collaboratively. These are model programs that include local solutions. One example of this is in Ashland, Oregon. Because of the highly flammable slopes above Ashland, homeowners in the wildland urban interface face a high risk of encountering a wildland fire. The City has partnered with local organizations to help coordinate mitigation strategies with homeowners in high-risk areas. Currently, more than 40

acres have been treated in the interface above Ashland.[49] Treatment has included thinning of tree stands, removing of highly flammable noxious weeds (i.e. Scotch broom), and the creation of fuel breaks along ridge tops most susceptible to wildland fire. The City has contributed approximately one-half million dollars towards cost shares with homeowners to help reduce fuels near their homes.[50]

In California, the Los Angeles County Fire Department has retrofitted more than 100 fire engines with fire retardant foam capability, and Orange County is evaluating a pilot insurance grading and rating schedule specific to the wildland/urban interface. Both are examples of successful programs that demonstrate the value of pre-suppression and prevention efforts when combined with property owner support to mitigate hazards within the wildland/urban interface. [51]

Prescribed Burning

The health and condition of a forest will determine the magnitude of a wildfire. If fuels (slash, dry or dead vegetation, fallen limbs and branches) are allowed to accumulate over long periods of time without being methodically cleared, fire can move more quickly and destroy everything in its path. The results are more catastrophic than if the fuels are periodically eliminated. Prescribed burning is the most efficient method to get rid of these fuels. In 1998, 3,000 prescribed fires were used to burn approximately 163,000 acres statewide.[52]

Firewise

Firewise is a program developed within the National Wildland/ Urban Interface Fire Protection Program, and it is the primary federal program addressing interface fire. It is administered through the National Wildfire Coordinating Group whose extensive list of participants includes a wide range of federal agencies. The program is intended to empower planners and decision makers at the local level. Through conferences and information dissemination, Firewise increases support for interface wildfire mitigation by educating professionals and the general public about hazard evaluation and policy implementation techniques.

Firewise offers online wildfire protection information and checklists, as well as listings of other publications, videos, and conferences. The interactive home page allows users to ask fire protection experts questions, and to register for new information as it becomes available.

For more information on the Firewise program, contact:

> The Wildland/Urban Interface Fire Program
> C/o The National Fire Protection Association
> 1 Batterymarch Park, Quincy, MA 02269 - http://www.firewise.org

FireFree Program

FireFree is a unique private/public program for interface wildfire mitigation involving partnerships between an insurance company and local government agencies. It is an example of an effective non-regulatory approach to hazard mitigation. Originating in Bend, the program was developed in response to the city's "Skeleton Fire" of 1996, which burned over 17,000 acres and damaged or destroyed 30 homes and structures.[53] Bend sought to create a new kind of public

education initiative that emphasized local involvement. SAFECO Insurance Corporation was a willing collaborator in this effort. Bend's pilot program included:

- A short video production featuring local citizens as actors, made available at local video stores, libraries, and fire stations;
- Two city-wide yard debris removal events;
- A 30-minute program on a model FireFree home, aired on a local cable television station; and
- Distribution of brochures, featuring a property owner's evaluation checklist and a listing of fire-resistant indigenous plants.

The success of the program helped to secure $300,000 in Federal Emergency Management Agency (FEMA) "Project Impact" matching funds. By fostering local community involvement, FireFree also has the potential for building support for sound interface wildfire policy. For information on FireFree, contact:

SAFECO Plaza T-8,
Seattle, WA 98185, (206) 545-6188

2005 Wildfire Mitigation Action Items Progress

The Wildfire Mitigation Action Items that were part of the 2005 Natural Hazard Mitigation Plan are listed below with a description of progress or status on each item. Those 2005 action items not listed in this section have either been deferred and are part of the 2010 Natural Hazard Mitigation Plan or deleted.

WF-ST #1: Action 2.2.7. Develop wildfire hazard maps and vulnerable asset inventories

Coordinating Organization:	Linn County Emergency Management
Internal Partners:	GIS; Assessor; Planning and Building; Road Dept
External Partners:	DOF; Fire Districts; Fire Marshall; OEM; FEMA
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.2. Support the enhancement of County vulnerability assessment activities.

Status:
The Oregon Department of Forestry and local rural fire departments completed this action item. All vulnerable assets and structures within ODF response areas have been evaluated and mapped using a "TDS RECON" hand held personal computer/GPS device. As a direct result of the data collected, fuels reduction programs are on going supervised by the Oregon Department of Forestry. Since this action item has been completed, the Steering Committee decided to delete it from the 2010 update.

WF-ST #2: Action 3.3.4. Develop the countywide Community Wildfire Protection Plan

Coordinating Organization: Linn County Emergency Management
Internal Partners: Planning and Building Department; Board of Commissioners
External Partners: DOF; Fire Districts; Fire Marshall; Cities; OEM
Timeline: 1-3 years
Plan Goals Addressed: Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships.
Plan Objective: Objective 3.3. Develop partnerships with external partners for hazard specific mitigation projects.

Status:
Deleted - Linn County, Oregon's Community Wildfire Protection Plan was completed and adopted in November of 2007 in partnership with ECONorthwest. Maps are included in the CWPP showing the regions of Linn County with the highest risk and fuels to support a wild land fire. The plan developed action items for the five goals identified. The Natural Hazard Mitigation Plan update will analyze the CWPP and incorporate those action items that would be suitable for the Natural Hazard Mitigation Plan. The CWPP is an addendum to the Linn County Natural Hazard Mitigation Plan.

WF-ST #3: Action 3.3.5. Partner with the Oregon Department of Forestry and Rural Fire Districts to promote home site assessment programs for wildfire hazards

Coordinating Organization: State Fire Marshall
Internal Partners: Emergency Management; Board of Commissioners
External Partners: DOF; Fire Districts; Cities; OEM
Timeline: Ongoing
Plan Goals Addressed: Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships.
Plan Objective: Objective 3.3. Develop partnerships with external partners for hazard specific mitigation projects.

Status:
Home site assessments were completed during 2007 and 2008. The entire portion of Linn County lying within Oregon Department of Forestry boundaries were assessed and documented. ODF has sent letters to home owners with high risk concerns, many property owners have taken advantage of the opportunity to work side by side with ODF personnel to mitigate their wildfire hazards by utilizing the fuels reduction crews and equipment available through ODF.
The Linn County Planning and Building Department currently provide documentation to new dwellings within the Forested areas of the Farm/Forest zone district and in the Forest Conservation and Management zone district. The documentation is "A Guide for development"

which provides standards for access, fire access, fuel breaks and other safety guidelines. Since this action item is ongoing, the Steering Committee decided to defer it from the 2010 update.

Long-term Action Items

WF-LT #1: Action 3.3.3. Conduct community based fuel reduction demonstration projects in the interface

Coordinating Organization: State Fire Marshall
Internal Partners: Emergency Management; Board of Commissioners
External Partners: DOF; Fires Districts; Cities; OEM
Timeline: 3-5 years
Plan Goals Addressed: Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships.
Plan Objective: Objective 3.3. Develop partnerships with external partners for hazard specific mitigation projects.

Status: Fuels reduction projects using both National Fire Plan and Title II funds are ongoing and several areas have been mitigated. Using the above mentioned funding sources both adult and juvenile fuels reduction crews supervised by ODF continue to work reducing fuels in target areas of Linn County. The Mt. Tom Area and Linn County Parks are two of the projects targeted for fuels reduction. Home site assessment is the first step of this process, with fuels reduction crews following up to provide fuel mitigation with the homeowner assistance. This program should continue to be listed on the Long Term Action Item list. Fuels reduction projects will continue based on future available funding. The Steering Committee has decided to defer this action item and include it in the 2010 update.

2010 Wildfire Mitigation Action Items

The wildfire mitigation action items provide direction on specific activities that organizations and residents in Linn County can undertake to reduce risk and prevent loss from wildfire events. There is one short-term and one long-term wildfire hazard action items described below.

Short-term Action Items

WF-ST #1: Action 3.3.4. Partner with the Oregon Department of Forestry and Rural Fire Districts to promote home site assessment programs for the wildfire hazard.

Coordinating Organization: Oregon Department of Forestry
Internal Partners: Emergency Management
External Partners: DOF; Fire Defense Board; Fire Marshall; Cities
Timeline: ongling

Plan Goals Addressed: Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships.

Plan Objective: Objective 3.3. Develop partnerships with external partners for hazard specific mitigation projects.

Long-term Action Items

WF-LT #1: Action 3.3.3. Conduct community based fuel reduction demonstration projects in the interface

Coordinating Organization: State Fire Marshall

Internal Partners: Emergency Management; Board of Commissioners

External Partners: DOF; Fires Districts; Cities; OEM

Timeline: 3-5 years

Plan Goals Addressed: Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships.

Plan Objective: Objective 3.3. Develop partnerships with external partners for hazard specific mitigation projects.

Wildfire Endnotes

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Section 9:
Severe Weather

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This section is concerned with severe weather events and focuses on severe winter storms and windstorms. Flooding is not included in this chapter, as it has been covered separately in *Section 6: Floods*.

Why is Severe Weather a Threat to Linn County?

Severe weather events pose a significant threat to life, property, and the local economy in Linn County by creating conditions that disrupt essential regional services such as public utilities, telecommunications, and transportation routes. Such storms can produce rain, freezing rain, ice, snow, cold temperatures, and high winds. High winds and ice storms can destroy trees and power lines, potentially interrupting utility services.

Severe Weather Characteristics

Linn County Weather

Western Linn County has a temperate climate characterized by dry warm summers and wet cool winters. In the foothills of the Western Cascades more extreme conditions are prevalent. Willamette Valley temperatures vary between 20 and 100 degrees Fahrenheit during the year. Linn County's average annual precipitation is approximately 42 inches in the central part of the valley, increasing to approximately 52 inches at Sweet Home and more than 80 inches a year in the upper Cascades.[1]

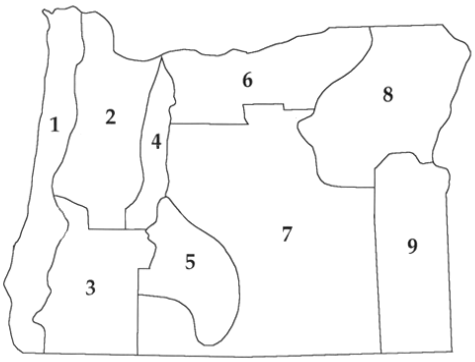
Severe winter weather in Linn County is characterized by extreme cold, snow, ice, and sleet. Although such conditions may be expected in the Cascade Mountains in eastern Linn County, they are considered to be unusual and result in more severe impacts in the Willamette Valley. Although outbreaks of very cold air occur with some degree of regularity, many communities are unprepared, financially and otherwise. Severe weather conditions typically do not last long in western Linn County, which may lead some jurisdictions to relegate winter-preparedness to a low priority.[2]

Severe storms affecting Linn County with snow and ice typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from October through March.[3] A majority of the destructive surface winds in Oregon, and specifically, in Linn County, are from the southwest.[4] Winds sometimes blow from the east, but most often do not carry the same destructive force as those from the Pacific Ocean.

The National Climatic Data Center has established climate zones in the US for areas that have similar temperature and precipitation characteristics. As shown in ***Figure 9-1***, most of Linn County is in Zone 2, while the Cascade Mountains in eastern Linn County are in Zone 4.

The climate in Zone 2, including all of the populated areas of Linn County, generally consists of wet, cool winters and warm, dry summers. The wettest months are November through March. Snowfall and freezing temperatures are uncommon on the lower elevations of the valley floor. Cascadia, in the lower Cascades, averages 10 inches of snowfall annually while the Santiam Pass averages 85 inches.[5]

Figure 9-1
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: Taylor, George H. and Hannan, Chris, *The Oregon Weather Book*, OSU Press (1999)

Historical weather and storm data for Linn County can be found at the following websites:

- NOAA National Climatic Data Center database - http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms
- National Weather Service - http://www.nws.noaa.gov/organization.php
- Oregon State University – Oregon Climate Service - http://www.ocs.oregonstate.edu/index.html
- Climate of Oregon Narrative, NWS - http://www.wrcc.dri.edu/narratives/OREGON.htm
- State of Oregon Natural Hazard Mitigation Plan - http://csc.uoregon.edu/pdr_website/projects/state/snhmp_web/index.htm

Snow

The lower valley elevations normally experience very little snowfall. Snowfall amounts increase as the elevation rises into the Cascades in eastern Linn County. Cascadia, east of Sweet Home, averages 10 inches of snowfall annually while the Santiam Pass averages 85 inches. During the last week of December 2003 and the first week of 2004, the Willamette Valley was blanketed with ice that was subsequently covered by an unusually heavy snow storm. The impacts were severe enough to damage the electrical power infrastructure and cause extremely hazardous travel conditions throughout the county for several days.[6]

Ice

Like snow storms, ice storms are comprised of cold temperatures and moisture, but subtle changes can result in varying types of ice formation including freezing rain, sleet, and hail.[7]

Sleet and hail can create hazards for motorists when they accumulate. Freezing rain can cause the most dangerous conditions within a community and can be the most damaging of ice formations. Much of the damage from ice storms occurs when the ice thaws. Although some tree limbs fall from the weight of the ice, many broken tree limbs are held in place by the frozen ice structure. Water lines that have frozen in the storm will begin to leak as the ice melts. As a result, storm emergency periods often extend beyond the freeze to include the thaw.

The most difficult thing about comparing ice storms lies in the fact that ice is not an officially-measured weather parameter. Temperature, precipitation, winds and snowfall (among others) are routinely measured at stations statewide, but ice is not. To compare storms it is necessary to look at them subjectively using anecdotal information.[8]

Wind

A windstorm is generally a short duration event involving straight-line winds and/or gusts in excess of 50 mph. A majority of the destructive surface winds in Linn County are from the southwest. Strong southwesterly winds are associated with storms moving onto the coast from the Pacific Ocean. If the winds are from the west, they may be stronger on the coast than in the interior valleys because of the north-south orientation of the Coast Range, which obstruct and slow down the westerly surface winds. In Linn County, the most destructive winds are those which blow from the south, parallel to the major mountain ranges.[9]

Windstorms affect areas of Linn County with significant tree stands as well as areas with exposed property, major infrastructure, and above ground utility lines. The lower wind speeds typical in the valley are still high enough to knock down trees, bring down power lines, and cause other property damage. Linn County was severely impacted by the Columbus Day Storm of 1962.

> *The Columbus Day Storm of 1962 was a classic example of a southerly windstorm. The storm developed well off the coast of California and moved from the southwest, then turned and came directly from the south toward the Oregon Coast. Atmospheric pressure fell rapidly ahead of the storm center and rose rapidly once the storm center passed, creating very tight and sharp pressure gradients. When strong surface winds are further reinforced by upper airflow in the same direction (as was the case in the Columbus Day Storm), the surface wind speed is enhanced.*[10]

Severe Summer Heat Storms

Linn County occasionally experiences heat storms, defined as periods where the temperature exceeds 90 degrees Fahrenheit for more than three days.[11] The severity of the storm increases when high temperatures are accompanied by warm winds. These conditions cause the tissue in trees to shrink and contract. The wood in trees twists and cracks, causing limb failures that damage property, disable systems, and cause personal injuries. In addition to tree failures, extreme summer heat causes pressure on the electrical system as people increase their use of air conditioners. Water supply systems can also become stressed. Older citizens and others who are medically compromised can experience increased rates of heat exhaustion and stroke. Heat storms usually result in stagnant air and air quality alert days.

Severe Weather Risk Assessment

Hazard Identification

Section 201.6(c)(2)(*i*) of the Disaster Mitigation Act of 2000 requires that the risk assessment include a description of the location and extent of all natural hazard that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Location and Extent of Severe Weather Events

Severe weather events consisting of snow, ice or wind storms occur throughout Linn County. Because severe weather events are atmospheric and not geologic, they generally affect the entire community.

Specific hazard events can sometimes be more destructive to a particular area. An extremely destructive wind storm on February 7, 2002 impacted the areas around Lebanon, Brownsville and Sweet Home much more severely than the areas around Albany and Scio. The ice and snow storms of December 2003-January 2004 impacted the entire county and most of western Oregon. In September 2007 Linn County was affected by a tornado rated at F0 near Albany and Lebanon causing $20,000 in damage to buildings and $22,000 to crops.

The Cascade Mountains in eastern Linn County annually experience levels of snow, ice and wind that can be devastating when those same weather characteristics occur in the populated portions of western Linn County.

History of Severe Weather in Linn County

Winter Storms[12]

Winter storms generally involve severe snow and ice storms which can result in power outages and disrupt transportation. This hazard is characterized by a variety of weather factors such as the amount of snow or rainfall, air temperature, wind velocity and temperature, and ground saturation or snow pack conditions.

During the last week of December 2003 and the first week of January 2004 snow and ice in Linn County was severe enough to damage the electrical power infrastructure and cause extremely hazardous travel conditions throughout the county. A presidential Disaster Declaration for public infrastructure was made.

Although such conditions are expected in the Cascade Mountains, they are considered to be unusual in the Willamette Valley. Outbreaks of very cold air occur in the valley with some regularity, but severe weather conditions do not last long. This causes most jurisdictions to relegate winter-preparedness to a low priority and most communities are unprepared for severe winter storms, financially and otherwise.

Table 9-1 identifies notable severe winter storms that have impacted Linn County.

TABLE 9-1
SEVERE WINTER STORMS

DATE	LOCATION	CHARACTERISTICS
Dec., 1861	Statewide	Snowfall varied between 1 and 3 feet. Did not leave Willamette Valley floor until late February
Dec., 1864	Willamette Valley & Columbia Basin	Heavy snowfall. Albany (Linn County) received 16 inches in 1 day.
Jan., 1916	Statewide	Two snow storms, each totaling 5 inches or more
Dec., 1919	Corvallis (Benton County)	Corvallis received 22 inches of snow and set an all-time low temperature record of 14 degrees F
Jan.- Feb., 1937	Statewide	Heavy snow throughout the Willamette Valley. Dallas (Polk Co.) had 24 inches; Salem (Marion County) had 25 inches
Jan., 1950	Statewide	Heaviest snowfall since 1890. Many highway closures. Considerable property damage.
Jan., 1956	Western Oregon	Packed snow became ice. Many automobile accidents throughout the region
Mar., 1960	Statewide	Snowfall: 3-12 inches, depending on location. More than 100 snow related accidents in Marion County
Jan., 1969	Statewide	Lane County surpassed old snowfall record. Eugene (Lane Co.) had a total snow depth of 47 inches. Three to $4 million in property damage
Jan., 1980	Statewide	A series of storms bringing snow, ice, wind, and freezing rain. Six fatalities.
Feb., 1985	Statewide	Western valleys received between 2-4 inches of snow; Massive power failures (tree limbs broke power lines)
Dec., 1985	Willamette Valley	Heavy snowfall throughout valley
Mar., 1988	Statewide	Strong winds and heavy snow
Feb., 1989	Statewide	Heavy snowfall and record low temperatures. Salem (Marion Co.) received 9 inches
Feb., 1990	Statewide	Average snowfall from one storm about 4 inches (Willamette Valley)
Dec., 1992	Western Oregon	Heavy snow. Interstate Highway closed.
Feb., 1993	Western Oregon	Record snowfall at Salem airport
Winter 1998-90	Statewide	Series of storms. One of the snowiest winters in Oregon history
Dec., 2003–Jan., 2004	Statewide	Wet snow blanketed highways in the Willamette Valley, causing power lines and trees to topple. Oregon 34 east of Philomath was closed for 30 hours January 5 and 6 while crews removed trees. Presidential disaster declaration for 30 of Oregon's 36 counties

Jan. – Feb. 2008	Marion and Linn Counties	A series of vigorous winter storms brought record setting snow accumulation to Detroit, Oregon. Three dozen Oregon National Guard personnel were called in to help with snow removal in Detroit and Idanha. The towns received over 12 feet of snow in several weeks.

Source: Taylor, George and Ray Hatton, 1999, *The Oregon Weather Book,* p.118-122.

Source: Oregon Department of Transportation, 2008, State Natural Hazard Mitigation Plan, Winter Storm Chapter

Ice Storms

The "Oregon Weather Book" identifies a number of ice storms in Oregon. Some were confined to the area near the Columbia Gorge, but others were much more widespread, affecting the entire Willamette Valley or most of western Oregon. The following described ice storm events are similar to the storm that occurred the last week of December 2003 and the first week of January 2004:[13]

> **Jan. 5-7, 1942**. Moist, warm air from the south and southwest met cold air coming through the Columbia River Gorge. In some areas there was considerable sleet, followed by freezing rain. Throughout the middle and upper portions of the Willamette Valley the precipitation was mostly freezing rain, which resulted in heavy accumulations of ice on all exposed surfaces. Roads and streets became dangerous for travel, orchard and shade trees were damaged, and telephone, telegraph, and power wires and poles were broken down.
>
> **January 1950**. Severe blizzard conditions Jan. 13 and a heavy sleet and ice storm on Jan. 18-19 together caused several hundred thousand dollars' worth of damage (1950 dollars) and virtually halted traffic for two to three days. The Columbia River Highway was closed between Troutdale and The Dalles leaving large numbers of motorists stranded, removed to safety only by railway. Damage to orchard crops, timber, and power services was common, costing thousands in damages.
>
> **Jan. 30-31, 1963**. Substantial snowfall amplified by moderate to severe icing conditions produced hazardous highways. Large numbers of power lines were downed due to large amounts of ice or felled trees. Injuries, one reported death, and statewide school closures were due to the icy streets and highways.
>
> **Nov. 22-23, 1970**. Freezing rain caused severe glazing across western Oregon, especially in Corvallis, Albany, Salem, Independence, and Dallas. Ice accumulations up to a half inch thick broke thousands of tree limbs and in turn telephone lines. Hazardous traffic conditions, power and phone outages, and felled trees were common.
>
> **Jan. 11-12, 1973**. Rains glazed streets and highways, contributing to numerous auto, bus and truck accidents and persons injured in falls. Most hospitals reported "full house" conditions. Glaze of .25 to .5 inches was common in the Willamette Valley, with up to .75 inches of ice covering all surfaces in the West Hills of Portland.

Ice storms of comparable magnitude to the winter 2003-2004 event occur in Linn County on average about once every 10 years. The 2003-2004 ice storm, with the resulting school closures, downed and damaged trees, and power outages lasting several days in some areas, probably ranks in the top 10 such events in the last 100 years.[14]

Wind Storms

The Columbus Day Storm of 1962 was so devastating that it has become the benchmark from which other storms in Oregon and Linn County are measured.[15] Wind storms on December 10, 1995 and February 6, 2002 caused enough damage in Linn County to be included in Presidential Disaster Declarations. Other significant storms in Linn County include those listed in ***Table 9-2.***

TABLE 9-2
SIGNIFICANT WINDSTORMS[16]

DATE	AFFECTED AREA	CHARACTERISTICS
Apr., 1931	Western Oregon	Unofficial wind speeds reported at 78 mph. Damage to fruit orchards and timber.
Nov. 10-11, 1951	Statewide	Widespread damage; transmission and utility lines; Wind speed 40-60 mph; Gusts 75-80 mph
Dec., 1951	Statewide	Wind speed 60 mph in Willamette Valley. 75 mph gusts. Damage to buildings and utility lines.
Dec., 1955	Statewide	Wind speeds 55-65 mph with 69 mph gusts. Considerable damage to buildings and utility lines
Nov., 1958	Statewide	Wind speeds at 51 mph with 71 mph gusts. Every major highway blocked by fallen trees
Oct., 1962	Statewide	Columbus Day Storm; Oregon's most destructive storm to date. 116 mph winds in Willamette Valley. Estimated 84 houses destroyed, with 5,000 severely damaged. Total damage estimated at $170 million
Mar., 1971	Most of Oregon	Greatest damage in Willamette Valley. Homes and power lines destroyed by falling trees. Destruction to timber in Lane Co.
Nov., 1981	Most of Oregon	Highest winds since 10/62. Wind speed 71 mph in Salem. Marinas, airports and bridges severely damaged
Jan., 1990	Statewide	Heavy rain with winds exceeding 75 mph. Significant damage. One fatality
Dec., 1995	Statewide	Followed path of Columbus Day Storm. Wind speeds 62 mph in Willamette Valley. Damage to trees (saturated soil a factor) and homes. (FEMA-1107-DR-OR)
Nov., 1997	Western Oregon	Wind speed 52 mph in Willamette Valley. Trees uprooted. Considerable damage to small airports.
Feb., 2002	Western Oregon	Strongest storm to strike western Oregon in several years. Many downed power lines (trees); damage to buildings; water supply problems (lack of power). Estimated damage costs: $6.14 million. (FEMA-1405-DR-OR)
July, 2003	Marion County	$15,000 in property damage
December 2004	Marion, Lane, Polk Counties	$6,250 in property damage *property damage estimate includes counties outside of Region 3

December 2005	Marion, Linn County	$3,000 in property damage
April 2004	Lane County	$3,000 in property damage
January 2005	Linn, Marion	Windstorms cause $6,000 of damage in Linn and Marion Counties. A storm total of $15,000 in damages spread out among Linn, Marion, Clackamas, Multnomah, and Washington Counties.
January 2006	Yamhill, Marion, Polk	Wind storm with winds up to 58 mph, caused a total of $500,000 in damages spread out over all counties.
February 2006	Yamhill, Marion, Polk, Linn, Lane, Benton	Wind storm with gusts up to 77 mph causes $227,000 in dams in Linn, Lane, Marion, Benton, Polk and Yamhill Counties. Storm caused damages in region 2 and region 1 as well for a total storm damage of $575,000
May 2006	Lane County	$5,000 in property damage in Eugene, approximately 13,000 customers out of power
May 2007	Marion County	Hail storm causes $5,000 in damages
March 2008	Marion County	Heavy winds measured at 40 mph causes $15,000 in damage near Woodburn.

Source: Taylor, George H., and Ray Hatton, 1999, *The Oregon Weather Book*, p.151-157; and FEMA-1405-DR-OR: February 7, 2002, Hazard Mitigation Team Survey Report, Severe Windstorm in Western Oregon.

Source: Oregon State Natural Hazard Mitigation Plan (OR-SNHMP) (Region 3) Mid/Southern Willamette Valley Hazards Assessment, Nov. 2003, R3-39 and R3-40

The February 6, 2002 windstorm damaged the electrical distribution infrastructure in six counties. A presidential Disaster Declaration was made for public infrastructure damage when over five million dollars damage was incurred to publicly held electrical power companies. Power company officials have reported that damage from the February 2002 event would have been far more severe if the company had not instituted a tree maintenance program after the December 1995 event.[17]

Damage to power lines and poles affected privately owned and publicly held electrical companies and agencies. While over 80 homes and businesses were damaged, insurance covered all but a few structures. Therefore, there was no Presidential disaster declaration for individual assistance.[18]

Observance of weather patterns in the northeastern Pacific Ocean depicted in enhanced satellite photos available on the Internet can provide advance notice of potential wind and rain storms. The Internet address for this is:

http://www.ocs.orst.edu/pub/weather/data/gifs/ir/goes_west/current.gif

Tornadoes[19]

Tornadoes do occasionally touch down in Linn County, causing light damage. These are classified as “cold core” tornadoes, and do not have as much energy as the more volatile “warm

core" tornadoes that occur in the Mid-Western United States. These storms have occurred in all seasons. Observed tornadoes are listed in ***Table 9-3***.

TABLE 9-3
RECORDED TORNADOES[20]

DATE	COUNTY	RESULT
January, 1887	Lane	Fences damaged; Livestock losses; Trees up-rooted
November, 1925	Polk	Buildings, barns, and fruit trees damaged
February, 1926	Polk	House, and trees damaged
September, 1938	Linn	Observed in Brownsville. No damage.
December, 1951	Lane	Barn destroyed
January, 1953	Benton	Observed. No damage
March, 1960	Marion	Several farms damaged near Aumsville. Trees uprooted.
May, 1971	Yamhill	House and barn damaged near McMinnville
August, 1975	Lane	Metal building destroyed near Eugene.
August, 1978	Yamhill	Minor damage near Amity
April, 1984	Yamhill	Barn roof destroyed
May, 1984	Lane	Barn and shelter damaged near Junction City
November, 1989	Lane	Telephone poles and trees up-rooted near Eugene
November, 1991	Marion	Barn damaged near Silverton
September 2007	Linn County	A tornado rated at F0 near Albany and Lebanon causes $20,000 in damage to buildins and $22,000 to crops.

Source: George Taylor and Ray Hatton, The Oregon Weather Book (1999), pp.130-137

Source: Oregon State Natural Hazard Mitigation Plan (OR-SNHMP) (Region 3) Mid/Southern Willamette Valley Hazards Assessment, Nov. 2003, R3-41

Avalanches

Lightly populated and uninhabited areas along the western slope of the cascades are subject to risk from avalanches. However, there is usually little danger to life or structural property.

Probability of Future Severe Weather Events

Severe winter storms occur about every four years in Linn County.[21] The recurrence interval of a windstorm on the order of the 1962 Columbus Day Storm is about 100 years. A windstorm on the order of the February 7, 2002 event has a 10 to 12 year recurrence interval.[22]

Vulnerability Assessment

Section 201.6(c)(2)(*ii)*(A) of the Disaster Mitigation Act of 2000 requires that the risk assessment include a description of the jurisdiction's vulnerability to the hazard. This description shall include an overall summary for the hazard and its impact on the community. If best available data allows, vulnerability should be described in terms of the type and number of existing and future buildings, infrastructure, and critical facilities located in identified hazard areas.

Severe Winter Storm Vulnerability[23]

The probability that Linn County will experience severe winter storms and the region's vulnerability to their effects are depicted in ***Table 9-4*** below. These scores are established by Oregon Emergency Management based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

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

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

Table 9-4
Vulnerability and Probability Assessment of Winter Storms

	Benton	Lane	Linn	Marion	Polk	Yamhill
Vulnerability	M	H	H	H	-	M
Probability	H	H	H	H	-	M

Source: Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

Wind Storm Vulnerability[24]

Many buildings, utilities, and transportation systems within Linn County are vulnerable to wind damage. This is especially true in open areas, such as natural grasslands or farmlands. It also is true in forested areas, along tree-lined roads and electrical transmission lines, and on residential parcels where trees have been planted or left for aesthetic purposes. Structures most vulnerable to high winds include insufficiently anchored manufactured homes and older buildings in need of roof repair. The Oregon Department of Administrative Service's inventory of state-owned and operated buildings includes an assessment of roof conditions as well as the overall condition of the structure. Oregon Emergency Management has arranged this information by county.

Fallen trees are especially troublesome. They can block roads and rails for long periods, which can affect emergency operations. In addition, up-rooted or shattered trees can down power and utility lines and effectively bring local economic activity and other essential facilities to a standstill. Much of the problem may be attributed to a shallow or weakened root system in saturated ground. Many roofs have been destroyed by uprooted ancient trees growing next to a house. In some situations, strategic pruning may be the answer. Counties should work with utility companies in identifying problem areas and establishing a tree maintenance and removal program.

Bridges that may be closed during periods of high wind are an additional consideration. The probability that Linn County will experience windstorms and the region's vulnerability to their effects are depicted in ***Table 9-5*** below. These scores are established by Oregon Emergency Management based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

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

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

TABLE 9-5
Vulnerability and Probability Assessment of Windstorms

	Benton	Lane	Linn	Marion	Polk	Yamhill
Vulnerability	M	M	M	H	H	M
Probability	H	H	H	H	H	L

Source: Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

Community Impacts

Life and Property

Severe weather can be a deceptive killer. Storms—which bring snow, ice, and high winds—can have a significant impact on life and property. Many severe winter storm deaths occur as a result of traffic accidents on icy roads, heart attacks while shoveling snow, and hypothermia from prolonged exposure to the cold. Debris carried along by extreme winds can contribute directly to loss of life and indirectly through the failure of protective buildings, structures and infrastructure.

Property is at risk due to flooding (see ***Section 6***) and landslides (see ***Section 7***) that result from heavy rain and snowmelt. Additionally, ice, wind, and snow can affect the stability of trees, power lines, telephone lines, and television and radio antennas. Falling trees and limbs affected by these events and saturated soils can become hazards for houses, cars, utilities, and other property. These conditions can be major hindrances to emergency response and disaster recovery.

Windstorms have the ability to cause damage more than 100 miles from the center of storm activity. Wind pressure can create a direct 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. The forces applied by the wind to the building's protective envelope (doors, windows, and walls) can cause failure of some of the building's components and considerable structural damage. The effects of wind speed are shown in ***Table 9-6***.

Table 9-6
Effects of Wind Speed

WIND SPEED (MPH)	WIND EFFECTS
25-31	Large branches will be in motion.
32-38	Whole trees in motion; inconvenience felt
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.
75-95	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

Infrastructure

Traffic

Severe weather can cause prolonged and extreme traffic disruptions. The importance of transportation is especially noticeable in situations where travel is difficult or dangerous. Both property damage and loss of life are risks to those who must drive. Economic concerns arise during storms that cause dangerous road conditions since many people choose to stay home in these situations. Additionally, traffic delays or blockages can seriously hinder the ability of emergency service providers.

Utilities

Falling trees are the major cause of power outages resulting in interruption of services and damaged property. The issue of weather related power outages must be addressed because many Linn County residents rely on electricity for heat, either directly or indirectly. Even homes using natural gas typically require electricity for system ignition and to operate and run circulation fans and thermostats. Natural gas distribution systems also rely to some degree on electrical service to keep the system operational and widespread power outages can interrupt that service. Power loss is also a concern economically as businesses may have to close during power outages.

Many overhead wires are at risk from snow and ice accumulations that are beyond their design specifications. High winds can create flying debris and down utility lines. For example, tree limbs breaking in winds of only 45 mph can be thrown more than 75 feet. As such, overhead power lines can be damaged even in relatively minor windstorm events.

Increasing population and new infrastructure in Linn County mean that more lives and property are exposed to risk. This situation creates a higher probability that damage will occur from severe weather events.

Water Lines

The most frequent water system problem related to cold weather is a break in cast iron mainlines. Breaks frequently occur during severe freeze events as well as during extreme cooling periods through the months of October, November, and December. In almost every severe winter storm previously described, broken pipes led to the closures of schools and businesses in Linn County.

During freezes, the broken mains not only result in lost water service to customers but also cause extensive property damage from spilled water. Severe weather can also affect the water system in other ways. Power interruptions at distribution pump stations, groundwater wells can have dramatic negative consequences to the water system. Another common problem during severe freeze events is the failure of commercial and residential water lines. Inadequately insulated potable water and fire sprinkler pipes can rupture and cause extensive damage to property.

Vulnerable Assets

Section 201.6(c)(2)(ii)(B) of the *Disaster Mitigation Act of 2000* (DMA-2000) requires that the risk assessment include an estimate of the potential dollar losses to vulnerable structures. There is insufficient development and vulnerability data available to estimate potential dollar losses to vulnerable structures and facilities at this time. The collection and analysis of appropriate data would serve as an important mitigation item to be completed in the future. Needed data includes the location and ranking of hazard areas; the types and numbers of buildings, infrastructure and critical facilities; and the location, construction, materials, and replacement value of buildings, infrastructure and critical facilities in hazard areas.

Severe Weather Mitigation Programs

Existing mitigation activities include current mitigation programs and activities that are being implemented by county, regional, state, or federal agencies and organizations.

Local Programs

The Linn County Road Department maintenance crews implement the county's tree and limb maintenance program. The Road Department documents potentially hazardous vegetation along county road rights-of-way and conducts spraying, pruning and removal activities along roadways each year. Pacific Power also conducts a tree maintenance program along its overhead facilities.

The Oregon Department of Transportation (ODOT) has issued road clearing priority maps for state highways and alternate routes in Linn County. The Linn County Road Department has developed emergency road clearing and maintenance protocols and priorities that identify additional county roads as Priority 1, Priority 2, Priority 3, or non-priority roads. The Road Department is organized into five maintenance districts. In the event of a severe weather event or other natural hazard that precipitates road closures, each maintenance district uses the established road priority maps to determine emergency maintenance priorities. The priority maps are included at the end of this chapter. The Road Department deploys county-maintained road grading, sanding and snow plow equipment to improve public safety on county roads.

Federal Programs

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.

2005 Flood Mitigation Action Items Progress

The Flood Mitigation Action Items that were part of the 2005 Natural Hazard Mitigation Plan are listed below with a description of progress or status on each item. Those items not listed in this section have either been deferred and are part of the 2010 Natural Hazard Mitigation Plan or deleted.

Short-term Action Items

WS-ST #1: Action 2.2.4 Develop pre-storm strategies for coordinated debris removal following wind and winter storms

Coordinating Organization:	Road Department
Internal Partners:	Emergency Management; Sheriff
External Partners:	911 Coordinator; Utility Companies; Cities
Timeline:	Ongoing
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.2 Support the enhancement of County vulnerability assessment activities.

Status: No progress has been made on action item due to lack of funding and resources. The Steering Committee decided to defer this action item.

Long-term Action Items

WS-LT #1: Action 2.2.5 Identify severe weather hazard areas and inventory vulnerable buildings, infrastructure and critical facilities.

Coordinating Organization:	Emergency Management
Internal Partners:	Road Dept; Planning and Building; Assessor; GIS
External Partners:	Emergency Services Providers; ODOT; OEM; FEMA; Utility Companies; Insurance Companies
Timeline:	2-5 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.2 Support the enhancement of County vulnerability assessment activities.

Status: No progress has been made on action item due to lack of funding and resources. The Steering Committee decided to defer this action item.

Severe Weather Mitigation Action Items

The severe weather event mitigation action items were identified and prioritized by the Mitigation Plan Steering Committee during open meetings with input from stakeholders and other interested members of the public. The action items provide direction on specific activities that the County and organizations and residents in Linn County can undertake to reduce risk and prevent loss from severe weather events. There is one short-term and there are two long-term severe weather hazard action items described below.

Short-term Action Items

WS-ST #1: Action 2.2.4 Develop pre-storm strategies for coordinated debris removal following wind and winter storms

Coordinating Organization:	Road Department
Internal Partners:	Emergency Management; Sheriff
External Partners:	911 Coordinator; Utility Companies; Cities
Timeline:	Ongoing
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.2 Support the enhancement of County vulnerability assessment activities.

Long-term Action Items

WS-LT #1: Action 2.2.5 Inventory buildings, infrastructure and critical facilities that are vulnerable to sever weather.

Coordinating Organization:	Emergency Management
Internal Partners:	Road Dept; Planning and Building; Assessor; GIS
External Partners:	Emergency Services Providers; ODOT; OEM; FEMA; Utility Companies; Insurance Companies
Timeline:	2-5 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.2 Support the enhancement of County vulnerability assessment activities.

WS-LT #2: Action 3.3.6 Develop partnerships to implement programs to keep trees from threatening lives, property, and public infrastructure during wind and winter storms

Coordinating Organization:	Emergency Management
Internal Partners:	Road Dept; Parks Dept; Commissioners
External Partners:	Utility Companies; Insurance Companies; DOF; Timber Companies; Arbor Care Companies
Timeline:	2-5 years
Plan Goals Addressed:	Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships
Plan Objective:	Objective 3.3. Develop partnerships with external partners for hazard specific mitigation projects.

Severe Weather Endnotes

[1] Linn County Emergency Management Agency 2004 Hazard Analysis, pg. 3

[2] Oregon State Natural Hazard Mitigation Plan (OR-SNHMP) (Region 3) Mid/Southern Willamette Valley Hazards Assessment, Jan. 2009, pp R3-42

[3] Interagency Hazard Mitigation Team, *State Hazard Mitigation Plan* (2000) Oregon State Police - Office of Emergency Management

[4] National Weather Service Web-Page, http://www.wrh.noaa.gov/pqr/pdxclimate/index/php (Accessed 20 October 2004)

[5] Western Regional Climate Center

[6] Linn County Emergency Management Agency 2004 Hazard Analysis, pg. 4

[7] Taylor, George H. and Hannon, Chris, *The Oregon Weather Book,* (1999) Oregon State University Press

[8] Taylor, George, Oregon State Climatologist, Albany Democrat-Herald, January 17, 2004

[9] Taylor, George H. and Hannon, Chris, *The Oregon Weather Book,* (1999) Oregon State University Press

[10] Ibid.

[11] National Weather Service Web-Page, http://www.wrh.noaa.gov/pqr/pdxclimate/PG21.html (Accessed 20 October 2004)

[12] Linn County Emergency Management Agency 2004 Hazard Analysis, pg. 5

[13] Taylor, George, Oregon State Climatologist, Albany Democrat-Herald, January 17, 2004

[14] Ibid.

[15] Oregon State Natural Hazard Mitigation Plan (OR-SNHMP) (Region 3) Mid/Southern Willamette Valley Hazards Assessment, Jan. 2009, pp R3-38

[16] Ibid. pg. R3-39, R3-40

[17] Linn County Emergency Management Agency 2004 Hazard Analysis, pg. 5

[18] Ibid.

[19] Ibid.

[20] Oregon State Natural Hazard Mitigation Plan (OR-SNHMP) (Region 3) Mid/Southern Willamette Valley Hazards Assessment, Jan. 2009, pp R3-41

[21] Ibid. pg. R3-45

[22] Ibid. pg. R3-41

[23] Ibid. pg. R3-45, R3-46

[24] Ibid. pg. R3-42, R3-43

Section 10:
Drought

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Why is Drought a Threat to Linn County?

A drought is a long period of abnormally low precipitation that persists long enough to produce a serious hydrologic imbalance.[1] Drought is a normal part of virtually every climate on the planet, even relatively wet climates. It is the most complex of all natural hazards, and it affects more people than any other hazard. Analysis shows that it can be as expensive as floods and hurricanes.[2] The impacts could affect agricultural producers by loss of crops, damage to crop quality, income loss fro farmers due to reduced crop yields, reduced productivity of cropland, insect infestation, plan disease and increased irrigation costs.

The impacts of drought are greater than the impacts of any other natural hazard. They are estimated to be between $6 billion and $8 billion annually in the United States and occur primarily in agriculture, transportation, recreation and tourism, forestry, and energy sectors.[3]

With drought, there is an increase in wildfire potential, and trees are more susceptible to insects like the bark beetle.[4] Social and environmental impacts are also significant, although it is difficult to quantify these impacts.

History of the Hazard in Your Community

There are no records of a severe drought in Linn County. Drought is averted as a result of the County's high rainfall from moist air masses moving onto land from the Pacific Ocean, especially during winter months. Table 1 describes drought that affected the entire state of Oregon, but no recorded damages in Linn County could be found.

Table 1: Historic Droughts in Oregon[5]

DATE	DESCRIPTION
1904-1905	A statewide drought period of about 18 months.
1917-1931	A very dry period throughout Oregon, punctuated by brief wet spells in 1920-21 and 1927
1936-1941	A three-year intense drought in Oregon
1976-1981	Intense drought in western Oregon; 1976-77 single driest year of century
1985-1997	Generally a dry period, capped by statewide droughts in 1992 and 1994
2000-2001	Klamath drought intensifies; low snow pack in mountain worsens conditions Draw-down at Detroit Lake, Oregon, all but curtail lake recreation.

Causes and Characteristics of the Hazard

Drought can be defined in several ways. The American Heritage Dictionary defines drought as "a long period with no rain, especially during a planting season." Another definition of drought is a deficiency in surface and sub-surface water supplies. In socioeconomic terms, drought occurs when a physical water shortage begins to affect people, individually and collectively and the area's economy.

The severity of the drought depends upon the degree of moisture deficiency, and the duration and size of the affected area. There are four different ways that drought can be defined:

• Meteorological – a measure of departure of precipitation from normal; due to climatic differences what is considered a drought in one location may not be a drought in another location;

• Agricultural – refers to a situation when the amount of moisture in the soil no longer meets the needs of a particular crop;

• Hydrological – occurs when surface and subsurface water supplies are below normal; and

• Socioeconomic – refers to the situation that occurs when physical water shortage begins to affect people.

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

A drought is a period of drier than normal conditions that results in water-related problems.[6] Drought occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another. Drought is a temporary condition; it differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate.[7]

In Oregon, drought is often associated with El Niño events. In strong El Niño situations, warmer than normal waters cover nearly the entire eastern and central tropical Pacific. The area of strong convection, which produces large rain clouds, usually shifts eastward as waters in those areas warm. In the western Pacific, easterly trade winds often reverse and blow from the west, reducing ocean temperatures.[8]

Warmer temperatures in the central and eastern Pacific cause much greater cloudiness in those regions, while cooler than average temperatures in the western Pacific cause that normally very active area to be less cloudy, with fewer storms and less rainfall. Both the polar and subtropical jet streams are changed as well. The former often dips southward over the North Pacific, and then veers northward into Alaska. Although some storms still reach the Northwest, they tend to be less frequent than during average years.[9] This causes the Northwest to be generally drier than average during such an event.

Drought Risk Assessment

Hazard Identification

Section 201.6(c)(2)(*i*) of the Disaster Mitigation Act of 2000 requires that the risk assessment include a description of the location and extent of all natural hazard that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

There are no records of a severe drought in Linn County. Drought is averted as a result of the County's high rainfall from moist air masses moving onto land from the Pacific Ocean, especially during winter months. Table 1 describes drought that affected the entire state of Oregon, but no recorded damages in Linn County could be found.

Probability of Future Occurrence

Droughts are not uncommon in the State of Oregon, nor are they just an "east of the mountains" phenomenon. They occur in all parts of the state, in both summer and winter. Oregon's drought history reveals many short-term and a few long-term events. The average recurrence interval for severe droughts in Oregon is somewhere between 8 and 12 years. Linn County's Natural Hazards Mitigation Steering Committee believes that the County's probability of experiencing a drought is "low," meaning one incident is likely within a 75 – 100 year period. The Region 3 Mid/Southern Willamette Valley Regional Profile and Risk Assessment, however, describes Linn County as having no having significant concern for experiencing a drought event.

Vulnerability Assessment

Section 201.6(c)(2)(*ii)*(A) of the Disaster Mitigation Act of 2000 requires that the risk assessment include a description of the jurisdiction's vulnerability to the hazard. This description shall include an overall summary for the hazard and its impact on the community. If best available data allows, vulnerability should be described in terms of the type and number of existing and future buildings, infrastructure, and critical facilities located in identified hazard areas.

Drought Vulnerability[10]

A vulnerability assessment that describes the number of lives or amount of property exposed to elements of drought has not yet been conducted for Linn County. Depending on the severity of the drought, however, it poses a risk for agricultural and timber losses, property damage, and disruption of water supplies and availability in urban and rural areas.

Factors included in assessing drought risk include agricultural practices, including crop types and varieties grown, soil types, topography, and water storage capacity. When sufficient data is collected for hazard identification and vulnerability assessment, a risk analysis can be completed.

Community Impacts

Life and Property

Many drought-related economic impacts occur in agriculture and related sectors because of the reliance of these sectors on surface and subsurface water supplies. In addition to obvious losses in yields in crop and livestock production, drought is also associated with increases in insect infestations, plant disease, and wind erosion. The incidence of forest and range fires increases substantially during extended droughts, which in turn places both human and wildlife populations at higher levels of risk.[11] Both urban and rural water users are impacted by drought. Based on the severity of the drought, water usage may be limited or curtailed for specific uses to ensure that sufficient water is available to maintain water pressure, firefighting supply, drinking, and sanitation requirements.

Environmental

Environmental losses are the result of damages to plant and animal species, wildlife habitat, and air and water quality; forest and range fires loss of biodiversity; and soil erosion. Some of the

effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. Many species, however, will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity of the landscape.[12]

Vulnerable Assets

Section 201.6(c)(2)(ii)(B) of the *Disaster Mitigation Act of 2000* (DMA-2000) requires that the risk assessment include an estimate of the potential dollar losses to vulnerable structures. There is insufficient development and vulnerability data available to estimate potential dollar losses to vulnerable structures and facilities at this time. The collection and analysis of appropriate data would serve as an important mitigation item to be completed in the future. Needed data includes the location and ranking of hazard areas; the types and numbers of buildings, infrastructure and critical facilities; and the location, construction, materials, and replacement value of buildings, infrastructure and critical facilities in hazard areas.

Drought Mitigation Action Items

The following mitigation action items were formulated through researching regional mitigation plans, and natural hazards planning literature, and interviews with local stakeholders. Plan action items were refined through discussions with the mitigation plan steering committee and through an open house that presented the proposed action items to the public.

The drought action items provide direction on specific activities that organizations and residents in Linn County can undertake to reduce risk and prevent loss from drought. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

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

Short-term Action Items

DR-ST #1: Action 2.2.6 Support local agency programs that promote measures to reduce water use during drought emergencies.

Coordinating Organization:	Board of Commissioners
Internal Partners:	Planning and Building; Emergency Management; Parks and Recreation Department
External Partners:	NRCS; Department of Agriculture; WRD; Local Water Districts
Timeline:	Ongoing
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.

Plan Objective: **Objective 2.2 Support the enhancement of County vulnerability assessment activities.**

Long-term Action Items

DR-LT #1: Action 3.1.2 Support local agency programs for farmers and ranchers, that provide education and training on water conservation measures, including drought management practices for crops and livestock.

Coordinating Organization:	Board of Commissioners
Internal Partners:	Planning and Building; Road Department
External Partners:	OSU Extension Services; NRCS; Farm Bureau; WRD;ODFW
Timeline:	2-5 years
Plan Goals Addressed:	Goal 3. Protect life, the built environment , the economy and natural resources through community wide partnerships.
Plan Objective:	Objective 3.1 Increase citizen awareness and promote risk reduction through education and outreach.

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[1] Interagency Hazard Mitigation Team. 2000. State Hazard Mitigation Plan . Oregon State Police – Office of Emergency Management. Salem, OR.

[2] National Drought Mitigation Center

[3] Ibid

[4] Halemeier, David. Park Ranger, USFS Willamette National Forest, Detroit

Ranger Station. Personal Interview. November 16, 2004.

[5] Oregon State Natural Hazard Mitigation Plan (OR –SNHMP) (Region 3) Mid/Southern Willamette Valley Hazards Assessment, Jan 2009.

[6] Moreland, A. 1993. Open-File Report 93-642. USGS.

[7] National Drought Mitigation Center.

[8] George H. Taylor. March 1998. Impacts of the El Southern/Southern

Oscillation on the Pacific Northwest.

[9] Ibid

[9] Interagency Hazard Mitigation Team. 2000. State Hazard Mitigation Plan.

Oregon State Police – Office of Emergency Management. Salem, OR.

[11] National Drought Mitigation Center

[12] Ibis

Section 11:
Earthquake

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Why are Earthquakes a threat to Linn County?

Oregon is rated third highest in the nation for potential loss due to earthquakes. This is partly due to the fact that until recently, Oregon was not considered to be an area of high seismicity, and the majority of its buildings and infrastructure were not designed for ground shaking at the magnitude now expected.

Recent studies of geological records show that Oregon has a history of seismic events, and that the Cascadia Subduction Zone is capable of producing magnitude 9.0 earthquakes. Projected losses in the Cascadia region could exceed $12 billion; 30,000 buildings could be destroyed and 8,000 lives lost in the event of a magnitude 8.5 Cascadia Subduction Zone earthquake[1].

Identifying locations susceptible to seismic activity generated by local faults or the Cascadia Subduction Zone, adopting strong policies and implementing measures, and using other mitigation techniques are essential to reducing risk from seismic hazards in Linn County.

The older a structure is the greater the risk of damage from earthquake. Seismic standards were not adopted into the state's building codes until 1973. Homes built before then normally did not incorporate earthquake resistant designs. As of March 2000, 72 percent of housing units in Linn County were constructed prior to 1980.[2]

Earthquake Characteristics

Most large earthquakes in the Pacific Northwest are shallow crustal, deep intraplate, or subduction zone earthquakes. These earthquakes can have great impact on Oregon communities.

Crustal Fault Earthquakes

Crustal fault earthquakes are the most common and occur at relatively shallow depths of 6-12 miles below the surface.[3] While most crustal fault earthquakes are smaller than magnitude (M) 4.0 and generally create little or no damage, some can produce earthquakes of magnitudes 7.0 and higher and cause extensive damage. The county contains many areas of moderate to steep slopes where the soils are saturated for much of the year. A crustal fault quake could contribute to landslides in such areas.

Deep Intraplate Earthquakes

Occurring at depths from 25 to 40 miles below the earth's surface in the subducting oceanic crust, deep intraplate earthquakes can reach magnitude 7.5.[4] The February 28, 2001 earthquake in Washington State was a deep intraplate earthquake. It produced a rolling motion that was felt from Vancouver, British Columbia to Coos Bay, Oregon and east to Salt Lake City, Utah. A 1965 magnitude 6.5 intraplate earthquake centered south of the Seattle-Tacoma International Airport caused seven deaths.[5]

Subduction Zone Earthquakes

The Pacific Northwest is located at a convergent plate boundary where the Juan de Fuca and North American tectonic plates meet. The two plates are converging at a rate of about 1-2 inches per year. This boundary is called the Cascadia Subduction Zone and extends from British Columbia to northern California. Subduction zone earthquakes are caused by the abrupt release of slowly accumulated stress. Subduction zones similar to the Cascadia Subduction Zone have produced earthquakes with magnitudes (M) of 8.0 or larger. Historic subduction zone quakes include the 1960 Chile (M 9.5) and the 1964 southern Alaska (M 9.2) earthquakes. Geologic evidence shows that the Cascadia Subduction Zone has generated great earthquakes, most recently about 300 years ago. The largest is generally accepted to have been M 9.0 or greater. The average recurrence interval of these great Cascadia earthquakes is approximately 500 years, with gaps between events as small as 200 years and as large as 1,000 years. Such earthquakes may cause great damage to the coastal area of Oregon as well as inland areas in western Oregon. Shaking from a large subduction zone earthquake could last up to five minutes.

The December 26, 2005 Sumatra quake is an example of a subduction zone earthquake. This was the fourth largest earthquake in the world since 1900 and is the largest since the 1964 Prince William Sound, Alaska earthquake. In total, more than 283,100 people were killed and 126,900 were displaced by the earthquake and subsequent tsunami in 10 countries in South Asia and East Africa. The earthquake was felt at Banda Aceh, at Meulaboh and at Medan, Sumatra and in parts of Bangladesh, India, Malaysia, Maldives, Myanmar, Singapore, Sri Lanka and Thailand. The tsunami caused more casualties than any other in recorded history and was recorded nearly world-wide on tide gauges in the Indian, Pacific and Atlantic Oceans. Surface water oscillations were observed in India and the United States. Subsidence and landslides were observed in Sumatra.[6]

Earthquake Risk Assessment

Hazard Identification

Section 201.6(c)(2)(*i*) of the Disaster Mitigation Act of 2000 requires that the risk assessment include a description of the location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Location and Extent of Earthquake Hazard[7]

The geographical position of Linn County makes it susceptible to earthquakes from four sources: (1) the off-shore Cascadia Fault Zone; (2) deep intra-plate events within the subducting Juan de Fuca plate; (3) shallow crustal events within the North America Plate; and (4) earthquakes associated with renewed volcanic activity. All have some tie to the subducting or diving of the dense, oceanic Juan de Fuca Plate under the lighter, continental North America Plate. Stresses occur because of this movement and there appears to be a link between the subducting plate and the formation of volcanoes some distance inland from the off-shore fault zone.

When crustal faults slip, they can produce earthquakes with magnitudes (M) up to 7.0 and can cause extensive damage, which tends to be localized in the vicinity of the area of slippage. Deep intraplate earthquakes occur at depths between 30 and 100 kilometers below the earth's surface. They occur in the subducting oceanic plate and can approach M7.5. Subduction zone earthquakes pose the greatest hazard. They occur at the boundary between the descending oceanic Juan de Fuca Plate and the overriding North American Plate. This area of contact, which starts off the Oregon coast, is known as the Cascadia Subduction Zone (CSZ). The CSZ could produce an earthquake up to 9.0 or greater.

The Willamette Valley has experienced a few historic earthquakes centered in the region. The area has been shaken historically by crustal and intraplate earthquakes and prehistorically by subduction zone earthquakes centered outside the area. The most devastating future earthquakes will probably originate along shallow crustal faults in the region and along the Cascadia Fault Zone. Deep-seated intra-plate events, as occurred near Olympia, Washington in 1949 and 2001, could generate magnitudes as large as M7.5.

Earthquake associated hazards include severe ground shaking, liquefaction of fine-grained soils, and land sliding. The severity of these effects depend on several factors, including the distance from the earthquake source, the ability of soil and rock to conduct seismic energy and the degree (angle) and composition of slope materials. Earthquakes produced through volcanic activity could reach magnitudes of M5.2. However the Cascade volcanoes are some distance away from populated centers, which tends to lessen the risk.

The Department of Geology and Mineral Industries (DOGAMI) earthquake data shows active faults within the proximity of Linn County, several active crustal faults are located nearby in Benton and Marion Counties. Earthquake risk in Linn County is reflected in the Oregon Structural Specialty Code (OSSC) (based on the International Building code (ICB)) (i.e., Seismic Design Categories A-F). The higher the numerical designation, the more stringent the building standards become. Linn County is within OSSC Seismic Design Category D.

Recent DOGAMI earthquake data shows a fault line located near the intersection of Peoria Road and HWY 34 that runs north to south. There is another fault line in Linn County that crosses through the very NW corner of Linn County next to the Willamette River.

Recent DOGAMI Earthquake data also shows areas that would be subject to very high liquefaction during earthquake occurrences. These areas are in the general proximity of the Willamette River, South Santiam River and North Santiam River. The majority of the Willamette Valley contains mostly areas of moderate liquefaction susceptibility.

The DOGAMI has also mapped areas of severe ground shaking, liquefaction, and earthquake-induced landslides for all the counties in the Willamette Valley. These maps can be used for general planning purposes. The DOGAMI severe ground shaking, liquefaction, and earthquake-induced landslides maps for Linn County are included at the end of this chapter.

Previous Occurrences of Earthquakes

Table 10-1 below contains information on previous Pacific Northwest earthquakes. Not all of the earthquakes in the table had significant impacts in Linn County. However, Linn County is vulnerable to the same tectonic forces and impacts.

TABLE 10-1
SIGNIFICANT EARTHQUAKES

DATE	LOCATION	SIZE (M)	COMMENTS
Approximate Years 1400 BCE* 1050 BCE 600 BCE 400 750 900	Offshore, Cascadia Subduction Zone	Probably 8-9	Based on studies of earthquake and tsunami at Willapa Bay, Washington. These are the mid-points of the age ranges for these six events.
January, 1700	Offshore, Cascadia Subduction Zone	Approximately 9.0	Generated a tsunami that struck Oregon, Washington, and Japan; destroyed Native American villages along the coast
April, 1896	McMinnville	4	Also felt in Portland
July, 1930	Perrydale	4	Cracked plaster
April, 1949	Olympia, WA	7.1	Significant damage in Washington. Minor damage in NW Oregon. Intraplate
August, 1961	Albany (Linn County)	4.5	Minor damage in Albany
November, 1962	Portland area	5.5	Shaking lasted up to 30 seconds; chimneys cracked; windows broken; furniture moved
March, 1963	Salem	4.6	Minor damage in Salem
March, 1993	Scotts Mills, OR	5.6	On Mt. Angel-Gales Creek fault. $30 million damage (including Oregon State Capitol in Salem) (FEMA-985-DR-OR)
February, 2001	Nisqually, WA	6.8	Felt in the region, no damage reported

*BCE = Before Common Era

Sources: Ivan Wong and Jacqueline D.J. Bolt, 1995, "A Look Back at Oregon's Earthquake History, 1841-1994", *Oregon Geology*, pp. 125-139.

February 28, 2001, Nisqually Earthquake -- Magnitude 6.8

The most recent large earthquake to be felt in the Northwest was the Nisqually earthquake, on February 28, 2001. This earthquake was centered northeast of Olympia, Washington,

approximately 200 miles north of Linn County, and measured a magnitude of 6.8 on the Richter scale. In the Puget Sound area, this quake caused 400 injuries, one quake-related death, and about $2 billion dollars in damage.[8]

September 21, 1993, Klamath Falls Earthquakes – Magnitude 5.9

The most damaging far-inland earthquakes of the century in the California-Oregon border region. These earthquakes occurred along faults which are part of the northernmost Basin and Range geologic province. Significant damage occurred in older un-reinforced brick buildings in the Klamath Falls area, approximately 200 miles south of Linn County. Rock falls caused the death of one motorist. This sequence illustrates that inland communities, although not as frequently hit as coastal regions, are also vulnerable to strong earthquakes.[9]

March 25, 1993, Scotts Mills Earthquake – Magnitude 5.7

In 1993, the Scotts Mills earthquake shook the northern Willamette Valley. It was a magnitude 5.7 on the Richter scale, and caused extensive damage primarily in the communities of Molalla, Woodburn, Newberg, McMinnville, and Salem.

November 5, 1962, Vancouver, Washington – Magnitude 5.2

Three and a half weeks after the devastating Columbus Day Storm, an earthquake that measured approximately 5.5 on the Richter scale shook Northwest Oregon. Centered approximately 60 miles north of Linn County, it was the largest quake to be generated by a fault under Portland and Vancouver.[10] This earthquake disappeared quickly from headlines, most likely because residents were still recovering from the Columbus Day Storm at the time of the earthquake.[11]

April 13, 1949, Olympia, Washington – Magnitude 7.1

On April 13, 1949, residents of Northwest Oregon felt an earthquake that was centered near Olympia, Washington, approximately 180 miles north of Linn County. In Washington, this quake caused 8 deaths and caused extensive damage to buildings and infrastructure.

Probability of Future Earthquake Events[12]

The Cascadia Subduction Zone generates an earthquake on average every 500-600 years. However, as with any natural process, the average time between events can be misleading. Some of the earthquakes may have been 150 years apart with some closer to 1,000 years apart. Establishing a probability for crustal earthquakes is more difficult.

There have been 5 earthquakes above magnitude 4 (4M) centered in this region (see ***Table 10-1*** above), of which the 1993 Scotts Mills earthquake was the largest. Oregon's seismic record is short and the number of earthquakes above 4M centered in the Willamette Valley is small. Therefore, any kind of prediction would be questionable. Earthquakes generated by volcanic activity in Oregon's Cascade Range are possible, but likewise unpredictable.

The predictability of future earthquakes has improved with the development of additional information and technology. It is the intent that this plan be updated when such information becomes available.

Vulnerability to Future Earthquake Events[13]

The Willamette Valley is especially vulnerable to earthquake hazards because much of the area is susceptible to earthquake-induced landslides, liquefaction, and strong ground shaking. The Oregon Department of Geology and Mineral Industries (DOGAMI) has developed two earthquake loss models for Oregon based on the two most likely sources of seismic events: (1) the Cascadia Subduction Zone (CSZ); and (2) combined crustal events (500-year Model). Both models are based on HAZUS software currently used by the Federal Emergency Management Agency (FEMA) as a means of determining potential losses from earthquakes.

In 2007, DOGAMI completed a rapid visual screening (RVS) of educational and emergency facilities in communities across Oregon, as directed by the Oregon Legislature in Senae Bill 2 (2005). RVS is a technique used by the Federal Emergency Management Agency (FEMA), known as FEMA 154, to identify, inventory, and rank buildings that are potentially venerable to seismic events. DOGAMI surveyed a total of 3,349 buildings, giving each a 'low', 'moderate', 'high', or 'very high' potential of collapse in the event of an earthquake. It is important to note that these rankings represent the probability of collapse based on limited observed and analytical data and are therefore approximate rankings.[14] To fully assess a building's potential of collapse, a more detailed engineering study completed by a qualified professional is required, but the RVS study can help to prioritize which buildings to study. The results for Linn County are shown in ***Table 10-2, below.***

TABLE 10-2
BUILDINGS COLLAPSE POTENTIAL

Level of Collapse Potential			
Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
74	15	30	23

Source: DOGAMI, 2007, Open File Report 07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment

The CSZ event model is based on a potential 9.0 earthquake generated off the Oregon coast. The model does not take into account a tsunami, which probably would develop from the event. The 500-Year crustal event model does not look at a single earthquake (as in the CSZ model); it encompasses many faults, each with a two percent chance of producing an earthquake in the next 50 years. The model assumes that each fault will produce a single "average" earthquake during this time. Neither model takes un-reinforced masonry buildings into consideration.

The DOGAMI cautions that the models contain a high degree of uncertainty and should be used only for general planning purposes. Despite their limitations, the models provide some approximate estimates of damage. The results are shown in ***Table 10-3***, ***Table 10-4*** and ***Table 10-5*** below.

TABLE 10-3
ESTIMATED LOSSES FROM M9 CSZ AND LOCAL CRUSTAL EVENT

REGION 3 COUNTIES	BUILDING VALUE (BILLIONS)	TOTAL BUILDING-RELATED LOSSES FROM A 9.0 CSZ EVENT (BILLIONS)	TOTAL BUILDING-RELATED LOSSES FROM A CRUSTAL EARTHQUAKE (BILLIONS)
Benton	$4.85	$1.1	$0.8
Lane	$21.055	$5.0	$3.4
Linn	$5.669	$1.2	$1.3
Marion	$15.86	$2.6	$3.9

Source: DOGAMI, *Geologic Hazards, Earthquake and Landslide Hazard Maps, and Future Earthquake Damage Estimates, 2008*

TABLE 10-4
ESTIMATED LOSSES ASSOCIATED WITH A MAGNITUDE 8.5 – 9.0 SUBDUCTION EVENT*

LOSS CATEGORY	Benton	Lane	Linn	Marion
Injuries (5pm time period)	1,356	3,945	1,049	2,492
Deaths (5pm time period)	96	264	67	157
Displaced Households	2,375	7,633	2,563	5,787
Economic Losses For Buildings	$1,049.51 million	$4,652 million	$1,150.68 million	$2,604 million
Operational the Day After the Event				
Fire station	100%	100%	100%	100%
Police Station	100%	100%	100%	100%
Schools	91%	100%	100%	99%
Bridges	91%	84%	100%	89%
Economic Loss to Infrastructure				
Highways	$33.5 million	$211 million	$44 million	$127.7 million
Airports	$0 million	$13.3 million	23.10 million	$13 million
Communications	$0 million	$0.33 million	$0.07 million	$0.03 million
Debris Generated (thousands of tons)	0	2,000	0	1,000

Source: DOGAMI, *Geologic Hazards, Earthquake and Landslide Hazard Maps, and Future Earthquake Damage Estimates, 2008*

Notes: *The existence of many un-reinforced masonry buildings was not taken into account in the HAZUS run which produced these numbers

TABLE 10-5
ESTIMATED LOSSES ASSOCIATED WITH AN ARBITRARY M6.5-6.9 CRUSTAL EVENT[1]

MITIGATION FACTORS	REGION 3 COUNTIES					
	Benton	Lane	Linn	Marion	Polk	Yamhill
INJURIES	557	1,821	993	3,249	321	1,178
DEATHS	33	96	59	189	18	67
DISPLACED HOUSEHOLDS	1,755	7,716	3,683	10,701	1,412	4,256
ECONOMIC LOSSES FOR BUILDINGS[2]	$762.25 million	$3,351.03 million	$1,315.72 million	$3,979.57 million	$409.43 million	$1,525.35 million
OPERATIONAL THE DAY AFTER THE EVENT						
Fire station	75%	100%	77%	61%	100%	50%
Police Station	75%	91%	40%	65%	100%	64%
Schools	91%	99%	70%	74%	100%	68%
Bridges	100%	97%	91%	86%	93%	89%
ECONOMIC LOSSES TO INFRASTRUCTURE						
Highways	$18.7 million	$106 million	$129.70 million	$271.5 million	$35.7 million	$71.3 million
Airports	$19.3 million	$16 million	$38.3 million	$38 million	$11 million	$43.9 million
Communications	$0.24 million	$20.63 million	$0.11 million	$0.18 million	$0.05 million	$0.10 million
DEBRIS GENERATED (in thousands of tons)	0	1,000	0	1,000	0	0

Source: DOGAMI, *Geologic Hazards, Earthquake and Landslide Hazard Maps, and Future Earthquake Damage Estimates, 2008*.

Notes:

[1]Every part of Oregon is subject to earthquakes. The 500-year model is an attempt to quantify the risk across the state. The estimate does not represent a single earthquake. Instead, the 500-year model includes many faults, each with a 10% chance of producing an earthquake in the next 50 years. The model assumes that each fault will produce a single "average" earthquake during this time. More and higher magnitude earthquakes than used in this model may occur. (DOGAMI, 1999).

Probability and Vulnerability Scores

The probability that Willamette Valley counties will experience earthquakes and the region's vulnerability to their effects are depicted in ***Table 10-6*** below. These scores are based on an

analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

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

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

TABLE 10-6
Vulnerability and Probability Assessment of Earthquake

	Benton	Lane (Inland)	Linn	Marion	Polk	Yamhill
Vulnerability	H	M	H	H	H	M
Probability	M	L	H	H	M	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

Earthquake Hazard Vulnerability: Identifying Assets

Section 201.6(c)(2)(ii)(A) of the Disaster Mitigation Act of 2000 (DMA-2000) requires that the risk assessment describe the jurisdiction's vulnerability to the hazard. This description shall include an overall summary for the hazard and its impact on the community. If best available data allows, vulnerability should be described in terms of the type and number of existing and future buildings, infrastructure, and critical facilities located in identified hazard areas.

Linn County Vulnerability Summary[15]

The two types of earthquakes of great concern in Linn County: crustal fault earthquakes and subduction zone earthquakes. A crustal fault earthquake with an intensity of 5 to 7 on the Richter Scale could be expected to cause moderate to extensive damage to un-reinforced masonry structures in Linn County. Linn County is also vulnerable to a subduction zone earthquake off the Oregon Coast, where the Juan de Fuca Plate is subducting under the Oregon portion of the Continental Plate. This area is known as the Cascadia Subduction Zone, which extends under the Coast Range to the Willamette Valley.

An earthquake in the Cascadia Subduction Zone could be as high as 8 or 9 on the Richter scale. Significant and severe damage could occur to even the most well constructed buildings in the county. Buildings constructed of un-reinforced masonry and buildings built before 1970 would be the most severely damaged. The Linn County Road Department has identified over 326 bridges and over 1139 miles of county roads that would be subjected to severe damage. Secondary hazards, such as hazardous materials releases, structure fires, power loss and dam failures could multiply the adverse effects of a subduction zone earthquake.

Earthquake Community Hazards and Impacts

Earthquake damage occurs because structures cannot withstand severe shaking and other geologic activities associated with earthquakes. Buildings, airports, schools, and lifelines including water, sewer, storm water and gas lines, transportation systems, electricity, and communication networks suffer damage in earthquakes and can cause death or injury to humans.

The welfare of homes, businesses, and public infrastructure is very important. Addressing the integrity of buildings, critical facilities, and infrastructure, and understanding the potential costs to government, businesses, and individuals as a result of an earthquake are challenges that Linn County must address.

There are numerous bridge crossings that lead to private structures on private and public lands that could be affected by seismic activity preventing the use of the bridge during an emergency.

Earthquake Related Hazards

Ground Shaking

Ground shaking is the motion felt on the earth's surface caused by seismic waves generated by an earthquake. It is the primary cause of earthquake damage. The strength of ground shaking depends on the magnitude of the earthquake, the type of fault, 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. The DOGAMI generated Relative Ground Shaking Amplification Susceptibility Map for Linn County is included at the end of this chapter.

Surface Fault Ruptures

Earthquakes are caused by the sudden movement, or rupture, of a fault. As the rupture zone progresses upward to the earth's surface it can cause surface fault ruptures. The result is often displacement or offset of the ground surface. Generally, the larger the earthquake, the greater the potential for surface fault rupture. It is generally considered impractical to design structures to withstand damage under the stress of surface fault rupture. Additionally, once a structure is located astride a fault, it is impossible to mitigate the surface fault rupture hazard unless the structure is relocated.[16]

Earthquake-Related Landslides

Earthquake-induced landslides are secondary earthquake hazards that occur from ground shaking. They can destroy roads, buildings, utilities, and other critical facilities necessary to respond to and recover from an earthquake. Many communities in Oregon, including Linn County, are likely to encounter such risks, especially in areas with steep slopes. As sloped lands to the northeast and southwest are developed, earthquake related landslides will begin to pose a bigger threat to homes and infrastructure. The DOGAMI generated Relative Slope Stability Susceptibility Map for Linn County, which shows earthquake induced landslide potential, is included at the end of this chapter.

Liquefaction

Liquefaction occurs when ground shaking causes wet granular soils to change from a solid to a liquid state. This causes a loss of soil strength and three potential types of ground failure: lateral spreading, flow failure, and loss of bearing strength. Buildings and their occupants are at risk when the ground can no longer support buildings and structures.[17] Areas of susceptibility to liquefaction include areas with high ground water tables and sandy soils.[18] The DOGAMI generated Relative Liquefaction Susceptibility Map for Linn County, which shows earthquake induced liquefaction potential, is included at the end of this chapter.

Amplification

Soils and soft sedimentary rocks near the earth's surface can modify ground shaking caused by earthquakes. One of these modifications is amplification. Amplification increases the magnitude of the seismic waves generated by the earthquake. Amplification depends on the thickness of geologic materials and their physical properties. Buildings and structures built on soft and unconsolidated soils can face greater risk.[19] Amplification can also occur in areas with deep, sediment filled basins. The DOGAMI generated Relative Ground Shaking Amplification Susceptibility Map for Linn County is included at the end of this chapter.

Direct Earthquake Impacts

Buildings

The built environment is susceptible to damage from earthquakes. Buildings that collapse can trap and bury people, putting lives at risk and creating great costs to clean up the damages. In most Oregon communities, the majority of buildings were built before 1993 when building codes were not as strict, and many were built before 1973 when the state building codes did not include seismic standards. Unreinforced masonry buildings are particularly vulnerable to earthquake events when compared to wood frame buildings.

Upgrading existing buildings to resist earthquake forces is more expensive than meeting code requirements for new construction. 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. Therefore, the number of buildings at risk remains high. The lack of funding for such activity is a major issue.

Damage to Lifelines

Lifelines are the connections between communities and outside services. They include water and gas lines, transportation systems, electricity, and communication networks. Ground shaking and amplification can cause pipes to break, power lines to fall, roads and railways to crack or move, and radio and telephone communication to cease. Transportation disruptions make it 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.

Infrastructure and Communication

An earthquake can greatly damage bridges and roads, hampering the movement of people and goods. Damaged infrastructure strongly affects the economy of the community – it disconnects people from work, school, food, and leisure, and separates businesses from their employees, customers, and suppliers.

Bridge Damage

Even modern bridges can sustain damage during earthquakes, leaving them unsafe for use. Some bridges have failed completely due to strong ground motion. Bridges are a vital transportation link – with even minor damages making some areas inaccessible. Because bridges vary in size, materials, siting, and design, any given earthquake will affect them differently. Bridges built before the mid-1970's have a significantly higher risk of suffering structural damage during a moderate to large earthquake compared with those built after 1980 when design improvements were made. Much of the interstate highway system was built in the mid to late 1960's.

Linn County is bordered on the west by the Willamette River and on much of the north by the Santiam River system. Bridge crossings connect Linn County to Benton County at downtown Albany (U.S. Highway 20) and at Downtown Corvallis (State Highway 34). Another Willamette River crossing connects Linn County to Lane County at downtown Harrisburg. Important Santiam River system crossings connect Linn County to Marion County on Interstate 5, and at the communities of Stayton, Lyons, Mill City and Gates. In all these cases connections to critical facilities such as hospitals, police and fire and rescue agencies will be impaired in the event of a bridge failure.

Disruption of Critical Services

Critical facilities include police stations, fire stations, hospitals, shelters, and other facilities that provide important services to the community. These facilities and their services need to be functional after an earthquake event. Many critical facilities are housed in older buildings that are not up to current seismic codes.

Indirect Earthquake Impacts

Businesses

Seismic activity can cause great loss to businesses - both large-scale corporations and small retail shops. When a company is forced to stop production for just a day, the economic loss can be tremendous, especially when its market is at a national or global level. Seismic activity can create economic loss that presents a burden to small shop owners who may have difficulty recovering from their losses. Most businesses could remain closed for only two days before suffering serious economic hardship.

Individual Preparedness

A 1999 DOGAMI survey shows that about 39 percent of respondents think an earthquake will occur in Oregon within the next 10 years. Only 28 percent of Oregon residents say they are prepared for an earthquake, and 22 percent have earthquake insurance. In addition, only 24 percent correctly identified what to do during an earthquake.[20]

Because the potential for earthquake occurrences and earthquake-related property damage is relatively high, increasing individual preparedness is a significant need. Strapping down heavy furniture, water heaters, and expensive personal property as well as being insured for earthquake, are just a few steps individuals can take to prepare for an earthquake.

Death and Injury

Death and injury can occur both inside and outside of buildings due to falling equipment, furniture, debris, and structural materials. Downed power lines and broken water and gas lines can also endanger human life. Deaths can be prevented with proper building design and individual preparedness.

Debris

Following damage to structures, much time is spent cleaning up brick, glass, wood, steel or concrete building elements, office and home contents, and other materials. Developing strong debris management strategies can assist in post-disaster recovery.

Fire

Downed power lines or broken gas mains can trigger fires. When fire stations suffer structural or lifeline damage, quick response to suppress fires is less likely. Therefore, it is necessary for fire stations and critical facilities to be well protected from natural disasters. It is also necessary that the water system be well protected so that water for fire fighting will be available if needed. In the San Francisco earthquake of 1906, 85 percent of the total damage was caused by post-earthquake structural fires that could not be effectively fought because of earthquake damage to the water system.

Earthquake HAZUS

The Department of Geology and Mineral Industries (DOGAMI) has provided the county with its Hazards U.S. (HAZUS) global output reports and earthquake-induced hazard maps for Linn County. The Linn County Geologic Hazards, Earthquake and Landslide Hazard Maps, and Future Earthquake Damage Estimates are included in ***Appendix D*** of this plan.

The HAZUS reports include separate models and data for two worst-case earthquake scenarios and their potential impacts on Linn County: (1) a magnitude 6.7 crustal earthquake on the Mill Creek Fault in northern Linn County/southern Marion County; and (2) a magnitude 9.0 earthquake of the Cascadia Subduction zone off the Oregon and Washington coast.

Vulnerable Assets

The HAZUS reports in ***Appendix D*** include information on the types and numbers of buildings, infrastructure, critical facilities, and lifeline facilities in Linn County. Each earthquake model also includes tables showing expected building damage by occupancy and type; expected damage to essential and transportation facilities; expected utility system facility and pipeline damage; and expected potable water and electric system performance.

Building Damage

The Mill Creek crustal fault earthquake model estimates that about 12,431 thousand buildings will be at least moderately damaged. This is over 34 percent of the total number of buildings in the region. There are an estimated 2,671 buildings that will be completely destroyed. Table 4 on page 20 of the HAZUS report in ***Appendix D*** summarizes the expected damage by general occupancy for the buildings in the region. Table 5 on page 20 of the HAZUS appendix summarizes the expected damage by general building type.

The Cascadia subduction earthquake model estimates that about 10,372 buildings will be at least moderately damaged. This is over 29 percent of the total number of buildings in the region. There are an estimated 2,470 buildings that will be completely destroyed. Table 4 on page 40 of the HAZUS appendix summaries the expected damage by general occupancy for the buildings in the region. Table 5 on page 40 of the HAZUS appendix summarizes the expected damage by general building type.

Essential Facility Damage

Currently, the region has 71 hospital beds available for use. The Mill Creek crustal fault earthquake model estimates that on the day of the earthquake, only 3 hospital beds (4 percent) will remain available for use by patients already in the hospital and those injured by the earthquake. After one week, 20 percent of the beds will be back in service. By 30 days, 62 percent will be operational. Table 6 on page 21 of the HAZUS appendix summarizes the expected damage to essential facilities.

The Cascadia subduction earthquake model estimates that on the day of the earthquake, 63 hospital beds (90 percent) are available for use by patients already in the hospital and those

injured by the earthquake. After one week, 90 percent of the beds will be back in service, and by 30 days, 90 percent will be operational. Table 6 on page 41 of the HAZUS appendix summarizes the expected damage to essential facilities.

Transportation and Utility Lifeline Damage

Transportation and utility lifeline damage estimates for the Mill Creek crustal fault earthquake model are shown in Table 7 through Table 10 on pages 22 and 23 of the HAZUS appendix. The model estimates that 12 of 122 bridges in the county will have at least moderate damage and that 119 of 122 bridges will be at least 50 percent functional after 7 days. The model shows that at day 7 utility system facilities will be at least 50 percent functional but that as many as 117 households may be without potable water and 3,254 households may be without electric power. The model shows that 776 households may still be without electric power at day 30.

Transportation and utility lifeline damage estimates for the Cascadia Subduction zone earthquake model are shown in Table 7 through Table 10 on pages 42 and 43 of the HAZUS appendix. The model estimates no significant damage to transportation systems and only minor damage to utility facility systems. The model shows that 259 household may still be without potable water at day 3 and none without water by day 7.

It is important to note that the estimated damage to roads and bridges pertains only to the lifeline routes in Linn County. The lifeline route accounts for only 122 bridges located in Linn County. It does not include roughly 200 other Linn County bridges, city bridges, and private bridges that all provide a vital economic link as well as emergency link to other parts of the county.

Vulnerability: Estimating Potential Losses

Section 201.6(c)(2)(*ii)*(B) of the Disaster Mitigation Act of 2000 (DMA 2000) requires that the risk assessment include an estimate of the potential dollar losses to vulnerable structures. The DOGAMI HAZUS earthquake models in ***Appendix D*** include potential building-related, transportation lifeline, utility lifeline, and utility system economic loss estimates.

The total economic loss estimated in Linn County for the Mill Creek crustal fault earthquake is $1,700,280,000. The total economic loss estimated for the Cascadia Subduction zone earthquake is $1,310,630,000. These estimates include building and lifeline related losses based on the region's available inventory.

Information about potential losses and the methodology used to estimate them is found in ***Appendix D,*** on pages 27-30 (Mill Creek crustal fault earthquake) and on pages 47-49 (Cascadia Subduction zone earthquake).

These estimates should be updated taking into account all other bridges and roads in Linn County that are not lifeline routes as well as private, city and state roads and bridges.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

Mill Creek Crustal Earthquake Losses

The total building-related losses in the Mill Creek crustal fault earthquake model were $1,315,720,000. Ten percent of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 66 percent of the total loss. Table 12 on page 27 of ***Appendix D*** provides a summary of the losses associated with the building damage.

Cascadia Subduction Zone Earthquake Losses

The total building-related losses in the Cascadia Subduction zone earthquake model were $1,150,680,000. Thirteen percent of the estimated losses were related to the business interruption of the region. The largest loss was sustained by the residential occupancies which made up over 51 percent of the total loss. Table 12 on page 47 of ***Appendix D*** provides a summary of the losses associated with the building damage.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows:

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum; the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum; and 5:00 PM represents peak commute time.

Mill Creek Crustal Earthquake Casualties

Table 11 on page 26 of ***Appendix D*** provides a summary of injury and casualty estimates for the Mill Creek crustal fault earthquake model. The greatest number of injuries and casualties are

expected with the 2:00 p.m. earthquake scenario. The least number of injuries and casualties is expected with the 2:00 a.m. scenario. Level 1 injury estimates range from 650 to 838. Level 2 injuries requiring hospitalization range from 156 to 248. Life-threatening Level 3 injury estimates range from 14 to 49 and casualty estimates range from 25 to 74.

Cascadia Subduction Zone Earthquake Casualties

Table 11 on page 46 of ***Appendix D*** provides a summary of injury and casualty estimates for the Cascadia Subduction zone earthquake model. The greatest number of injuries and casualties are expected with the 2:00 p.m. earthquake scenario. The least number of injuries and casualties is expected with the 2:00 a.m. scenario. Level 1 injury estimates range from 563 to 960. Level 2 injuries requiring hospitalization range from 139 to 290. Life-threatening Level 3 injury estimates range from 14 to 46 and casualty estimates range from 25 to 90.

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages.

Tables 13 and 14 on pages 28 and 29 of ***Appendix D*** provide a detailed breakdown of the expected lifeline losses resulting from the Mill Creek crustal fault earthquake model. Tables 13 and 14 on pages 48 and 49 of ***Appendix D*** provide a detailed breakdown of the expected lifeline losses resulting from the Cascadia Subduction zone earthquake model.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 15 (***Appendix D*** page 30 and page 50) presents the results of the region for the given earthquake.

Existing Mitigation Programs

Existing mitigation activities include current mitigation programs and activities that are being implemented by city, county, regional, state, or federal agencies and organizations.

Local Programs

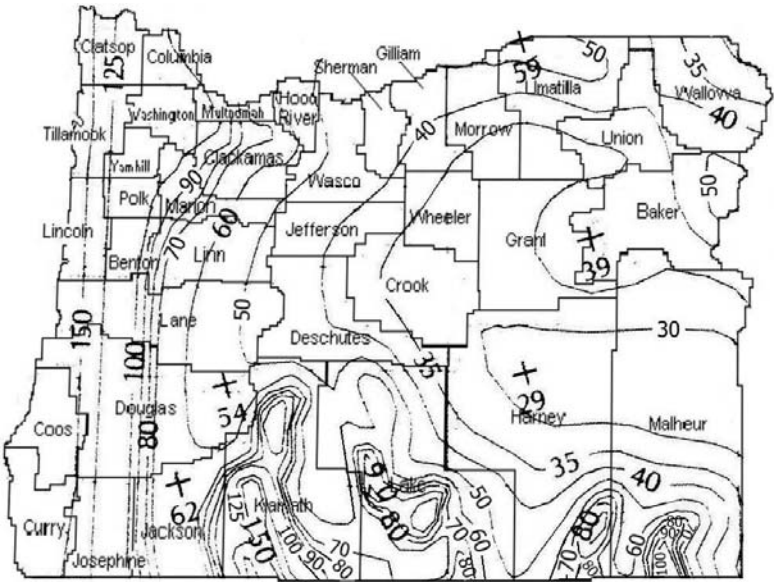
All building permit applications reviewed and issued by the Linn County Planning and Building Department must show compliance with the applicable standards in the state Uniform Building Code (UBC) and the Oregon Structural Specialty Code including engineering standards designed to protect against earthquake damage. Development permit applications for property within potential mass movement areas must also include a geo-technical report prepared by a registered engineer affirming site suitability and indicating landslide mitigation design standards, if necessary.

State Resources

State Building Codes[21]

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, addition to, or change of use of an existing structure. The One and Two Family Dwelling Code (effective April 1, 2005 *Oregon Residential Specialty Code*) and the Oregon Structural Specialty Code (both included in the State Building Code) prescribe seismic design requirements based on the seismology of the region. These codes are State of Oregon amended editions of national model codes from the International Code Council. These codes are based on maps that identify the various seismic parameters and classifications (seismic design category per ICC codes) for Oregon.

Figure 10-1
Seismic Zones in Oregon



Source: Oregon Building Codes Division

The Oregon Structural Specialty Code (OSSC) is based on the 2003 edition of the International Building Code (IBC) published by the International Code Council and amended by the State of Oregon. The IBC contains specific regulations for establishing seismic design category for buildings.[22] Within these standards are 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 (*ORS 455.447*).

The OSSC requires a site-specific seismic hazard report for buildings that are essential facilities (i.e. hospitals, fire and police stations, emergency response facilities), special occupancy structures (i.e. large schools, prisons), major occupancy structures (multi-storied buildings and parking structures) and hazardous facilities (i.e. structures containing toxics or explosives).

The seismic hazard report required by the OSSC must take into consideration factors such as the seismicity of the area, soil characteristics including amplification and liquefaction potential, any known faults, and potential landslides besides taking into account other local factors that can be seismically induced such as tsunami. The findings of the seismic hazard report must be considered in the design of the building. The Dwelling Code (Oregon Residential Specialty Code effective April 1, 2005) simply incorporates prescriptive requirements for the construction of various parts of a building including foundation reinforcement and framing connections[23]

The 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 to house a more hazardous use. 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.

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. The local building official is responsible for enforcing these codes. Although there is no statewide building code for substandard structures, local communities have the option of adopting one to mitigate hazards in existing buildings. The State has adopted regulations to abate buildings damaged by an earthquake in Oregon Administrative Rules (OAR) 918- 470. *Oregon Revised Statutes (ORS) 455.020* and *ORS 455.390-400* also allow municipalities to create local programs to require seismic retrofitting of existing buildings within their communities. The building codes do not regulate public utilities and facilities constructed in public right-of-ways such as bridges that are regulated by the Department of Transportation.

Senate Bill 13 (2001): Seismic Event Preparation

Signed by Governor John Kitzhaber on June 14, 2001, Senate Bill 13 requires each state and local agency and persons employing 250 or more full-time employees to develop seismic preparation procedures and inform their employees about the procedures. Further, the Bill requires agencies to conduct drills in accordance with Office of Emergency Management guidelines. These drills must include “familiarization with routes and methods of exiting the building and methods of duck, cover, and hold during an earthquake.”

Senate Bill 14 (2001): Seismic Surveys for School Buildings

Governor Kitzhaber signed Senate Bill 14 on July 19, 2001. It requires the State Board of Higher Education to provide for seismic safety surveys of buildings that have a capacity of 250 or more persons and that are routinely used for student activities by public institutions or departments under the control of the board. A seismic safety survey is not required for any building that has previously undergone a seismic safety survey or that has been constructed to the state building code standards in effect for the seismic zone classification. If a building is found to pose an undue risk to life and safety during a seismic event, a plan shall be developed for seismic rehabilitation or other seismic risk reducing activities. (Plans are subject to available funding.) All seismic rehabilitation or other actions to reduce seismic risk must be completed before January 1, 2032.

DOGAMI and the Oregon University System joined to design a pilot program to begin the process to fulfill *ORS 455.400* (2001). Through university maintenance funds and FEMA Pre-Disaster Mitigation grants, they have initiated seismic safety surveys of university buildings and selected several particularly vulnerable buildings for seismic safety upgrades.

Senate Bill 15: Seismic Surveys for Hospital Buildings

Governor Kitzhaber signed Senate Bill 15 on July 19, 2001. It requires the Health Division to provide for seismic safety surveys of hospital buildings that contain an acute inpatient care facility. Seismic surveys shall also be conducted on fire stations, police stations, sheriffs' offices, and similar facilities subject to available funding. The surveys should be completed by January 1, 2007. A seismic survey is not required for any building that has undergone a survey or that has been constructed to the state building code standards in effect for the seismic zone classification at the site. If a building is evaluated and found to pose an undue risk to life and safety during a seismic event, the acute inpatient care facility, fire department, fire district or law enforcement agency using the building shall develop a plan for seismic rehabilitation of the building or for other actions to reduce the risk. (Again, plans are subject to available funding.) All seismic rehabilitations or other actions to reduce the risk must be completed before January 1, 2022.

Earthquake Awareness Month

April is Earthquake Awareness Month. During the month, the State Office of Emergency Management encourages individuals to strap down computers, heavy furniture, and bookshelves.

Earthquake Education

Earthquake education in schools is ongoing in Oregon. Public schools are required to conduct periodic earthquake drills and educate students on how to respond when an earthquake event occurs (*ORS 455.447 and ORS 336.071*).

Federal Resources

National Earthquake Hazards Reduction Program (NEHRP)

The NEHRP's mission includes improved understanding, characterization, and prediction of hazards and vulnerabilities; improved model building codes and land use practices; risk reduction through post-earthquake investigations and education; development and improvement of design and construction techniques; improved mitigation capacity; and accelerated application of research results. The Act designates FEMA as the lead agency of the program and assigns several planning, coordinating, and reporting responsibilities.

National Earthquake Loss Reduction Program (NEP)

The NEP was formed as a result of the report "Strategy for National Earthquake Loss Reduction" prepared by the Office of Science and Technology Policy (OSTP) in April 1996. The NEP "aims to focus scarce research and development dollars on the most effective means for saving lives

and property and limiting the social disruptions from earthquakes, coordinate federal earthquake mitigation research and development and emergency planning in a number of agencies beyond those in NEHRP to avoid duplication and ensure focus on priority goals, and cooperate with the private sector and with state and local jurisdictions to apply effective mitigation strategies and measures." The NEP does not replace NEHRP but encompasses a wider range of earthquake hazard reduction activities than those supported by the NEHRP agencies and provides a framework within which these activities can be more effectively coordinated.

The National Earthquake Technical Assistance Program (NETAP)

The NETAP is a technical assistance program created to provide ad hoc, short-term architectural and engineering support to state and local communities as they are related to earthquake mitigation. The program was designed to enhance state and local communities' ability to become more resistant to seismic hazards. This assistance cannot be used for actions that are covered under the State's and Territories Performance Partnership Agreement (PPA). This program assists in carrying out the statutory authorities of the National Earthquake Hazards Reduction Act of 1977, as amended.

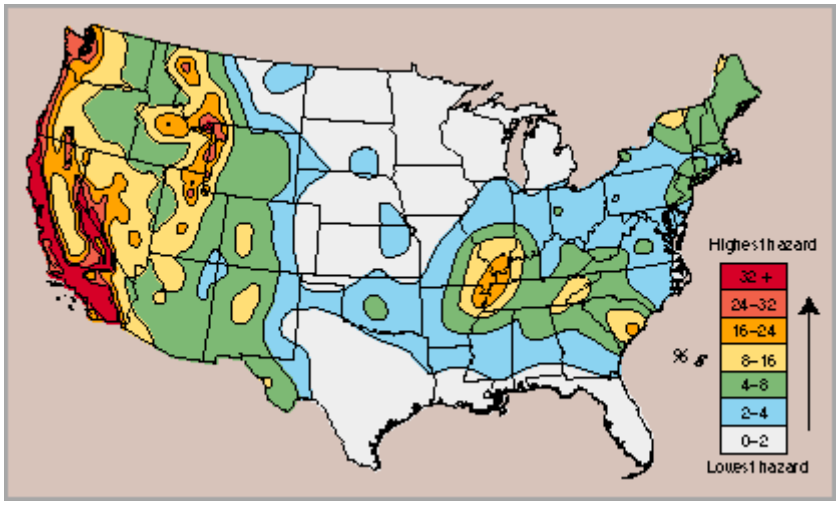
Technical assistance under the NETAP is available for use by the state/local communities within the 45 eligible and or participating seismic states and U.S. territories. This assistance is provided at no cost to the requesting local government. Examples of NETAP projects are seismic retrofit and evaluation training, evaluation of seismic hazards critical and essential facilities, post earthquake evaluations of buildings, and development of retrofit guidance for homeowners.

National Seismic Hazard Mapping Project

National maps of the earthquake shaking hazard in the United States have been produced since 1948. The 1996 U.S. Geological Survey shaking-hazard maps for the United States are based on current information about the rate at which earthquakes occur in different areas and on how far strong shaking extends from quake sources.

Scientists revise these maps as new earthquake studies improve their understanding of this hazard. After thorough review, professional organizations of engineers in turn update the seismic-risk maps and seismic design provisions contained in building codes. More than 20,000 cities, counties, and local government agencies use building codes, such as the International Building Code, to help establish the construction requirements necessary to preserve public health and safety in earthquakes.

The following national earthquake hazard map is found at:
http://quake.wr.usgs.gov/prepare/factsheets/RiskMaps/HazMap.gif



2005 Earthquake Mitigation Action Items Progress

The Earthquake Mitigation Action Items that were part of the 2005 Natural Hazard Mitigation Plan are listed below with a description of progress or status made on some action items. Those items not listed in this section have either been deferred and are part of the 2010 Natural Hazard Mitigation Plan or deleted.

Long-term Action Items

EQ-LT #2: Action 2.4.3. Complete a seismic vulnerability assessment of all County-owned bridges on lifeline routes and prioritize vulnerable bridges

Coordinating Organization:	Road Department
Internal Partners:	County Engineer; Board of Commissioners; Sheriff
External Partners:	DOGAMI; ODOT; OEM; 911 Coordinator; Fire Marshall
Timeline:	3-5 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.4. Implement structural and non-structural mitigation of publicly owned facilities and infrastructure.

Status: In 1997, CH2M Hill under contract to ODOT completed a prioritization of bridges in Oregon for seismic retrofit. This included all bridges in Linn County. The prioritization was based on routes essential to emergency response, economy, detour length, and sole access. Cost estimates were also provided to provide a retrofit or replace the bridge. Then

Linn County has replaced 16 bridges with funding from FHWA and the OTIA program as administered by ODOT. Bridges have also been improved and replaced using Linn County road funds.

The Linn County Road Department is in the process of updating its bridge inventory as it pertains the prioritization completed in 1997 and improvements that have been made since that time. Linn County also uses the 1997 prioritization as one method to identify bridge improvement projects. As one example, federal funding is presently being obtained to complete a seismic retrofit, structural rehabilitation and scour protection for the North Santiam River Bridge on Stayton Scio Road. Engineering design and construction is expected to be complete in 2013.

Since the 1997 bridge study, methods for determining seismic vulnerability have been developed. However, funding and resources have not been made available to complete a new assessment of Linn County Bridges. A new bridge assessment would be worthwhile considering the recent evaluation of Linn County' susceptibility to damage from Earthquakes.

Since this is an ongoing project, the Steering Committee deferred this action item.

Earthquake Mitigation Action Items

The earthquake mitigation action items were identified and prioritized by the Mitigation Plan Steering Committee during open meetings with input from stakeholders and other interested members of the public. The action items provide direction on specific activities that organizations and residents in Linn County can undertake to reduce risk and prevent loss from severe weather events. There are three short-term and four long-term earthquake hazard action items described below.

Short-term Action Items

EQ-ST #1: Action 2.2.2. Rerun DOGAMI HAZUS model with local refined data

Coordinating Organization:	GIS Department
Internal Partners:	Emergency Management; Planning and Building; Assessor
External Partners:	DOGAMI; FEMA
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.2. Support the enhancement of County vulnerability assessment activities.

EQ-ST #2: Action 2.4.1. Develop a program to implement non-structural retrofit of County staff offices and workspaces

Coordinating Organization:	Safety Committee
Internal Partners:	General Services; County Insurance Carrier; Board
External Partners:	OR-OSHA
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.4. Implement structural and non-structural mitigation of publicly owned facilities and infrastructure

EQ-ST #3: Action 3.3.1. Assist K-12 schools, child care facilities and private schools to develop vulnerability assessment and mitigation projects to improve safety

Coordinating Organization:	Educational Service District
Internal Partners:	Emergency Management
External Partners:	School Districts; Private Schools; Red Cross; Commission on Children and Families; DOGAMI; OEM
Timeline:	1-3 years
Plan Goals Addressed:	Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships
Plan Objective:	Objective 3.3. Develop partnerships with external partners for hazard specific mitigation projects.

Long-term Action Items

EQ-LT #1: Action 2.4.2. Complete a seismic vulnerability assessment of all County-owned structures and prioritize vulnerable publicly owned structures

Coordinating Organization:	County Engineer
Internal Partners:	General Services; Board of Commissioners; Building Official; Assessor; Safety Committee
External Partners:	DOGAMI; OEM
Timeline:	3-5 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.4. Implement structural and non-structural mitigation of publicly owned facilities and infrastructure.

EQ-LT #2: Action 2.4.3. Implement structural mitigation projects for prioritized, vulnerable publicly owned structures identified in EQ-LT #1.

Coordinating Organization: General Services
Internal Partners: Road Department; Commissioners; Building Official; Assessor; Safety Committee
External Partners: DOGAMI; ODOT; OEM; FEMA; US-DOT
Timeline: 3-5 years
Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective: Objective 2.4. Implement structural and non-structural mitigation of publicly owned facilities and infrastructure

EQ-LT #3: Action 2.4.4. Complete a seismic vulnerability assessment of all County-owned bridges on lifeline routes and prioritize vulnerable bridges

Coordinating Organization: Road Department
Internal Partners: County Engineer; Board of Commissioners; Sheriff
External Partners: DOGAMI; ODOT; OEM; 911 Coordinator; Fire Marshall
Timeline: 3-5 years
Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective: Objective 2.4. Implement structural and non-structural mitigation of publicly owned facilities and infrastructure.

EQ-LT #4: Action 2.4.5. Implement structural mitigation projects for prioritized, vulnerable publicly owned structures and bridges identified in EQ-LT #3.

Coordinating Organization: County Engineer
Internal Partners: Road Department; General Services; Commissioners; Building Official; Assessor; Safety Committee
External Partners: DOGAMI; ODOT; OEM; FEMA; US-DOT
Timeline: 3-5 years
Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective: Objective 2.4. Implement structural and non-structural mitigation of publicly owned facilities and infrastructure.

Earthquake Hazard Endnotes

[1] Oregon State Natural Hazard Mitigation Plan (OR-SNHMP) (Region 3) Mid/Southern Willamette Valley Hazards Assessment, Jan. 2009, pp R3-5

2 U.S. Bureau of Census, Profile of Housing Characteristics 2000

3 Wong, Ivan G and Bott Jacqueline D.J. (November 1995). A look back at Oregon's earthquake history, 1841- 1994. Oregon Geology 57 (6). 125.

4 Ibid.

5 Hill, Richard. "Geo Watch Warning Quake Shook Portland 40 Years Ago." The Oregonian, October 30, 2002

6 United States Geologic Survey, Earthquake Hazard Program. http://neic.usgs.gov/neis/eq_depot/2004/eq_041226/; March 21, 2005

7 Oregon State Natural Hazard Mitigation Plan (OR-SNHMP) (Region 3) Mid/Southern Willamette Valley Hazards Assessment, Jan. 2009, pp R3-5

8 Hill, Richard. "Geo Watch Warning Quake Shook Portland 40 Years Ago." The Oregonian, October 30, 2002

9 Humboldt State University; http://sorrel.humboldt.edu/~geodept/earthquakes/shaky2_recent.html; March 21, 2005

10 . Richard."Geo Watch Warning Quake Shook Portland 40 Years Ago." The Oregonian, October 30, 2002

11 Ibid.

12 Oregon State Natural Hazard Mitigation Plan (OR-SNHMP) (Region 3) Mid/Southern Willamette Valley Hazards Assessment, Jan. 2009, pg. R3-6, R3-7

13 Ibid. pg. R3-7

[14] State of Oregon Department of Geologic and Mineral Industies, *Implementation of 2005 Senate Bill 2 Relating to Public Safety, Seismic Safety and Seismic Rehabilitation or Public Buildings*, May 22, 2007,iv

15 Linn County Emergency Management Agency 2004 Hazard Analysis, pg. 5-6.

16 California Department of Conservation, California Geological Survey, 2002; Guidelines for Evaluating the Hazard of Surface Fault Rupture, Note 49.

17 Planning for Natural Hazards: The Oregon Technical Resource Guide, Department of Land Conservation and Development (July 2000), Ch. 8, pp.7

18 City of Portland Natural Hazard Mitigation Plan, 2004

19 Ibid.

20 Community Planning Workshop, 2002

21 Planning for Natural Hazards: The Oregon Technical Resource Guide, Department of Land Conservation and Development (July 2000), Ch. 8, pp.13

22 Washington County Natural Hazard Mitigation Plan, 2000.

23 United States Geological Survey, Geologic Division, Earthquake Information: reducing hazards, http://quake.wr.usgs.gov, October 19, 1999

Section 12:
Multi-Hazard

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2005 Multi-Hazard Mitigation Action Items

The Multi-Hazard Mitigation Action Items that were part of the 2005 Natural Hazard Mitigation Plan are listed below with a description of progress or status on each item. Those items not listed in this section have either been deferred and are part of the 2011 Natural Hazard Mitigation Plan or deleted.

2005 Short-term Action Items

MH-ST #1: Action 1.1.1. Develop formal agreements with internal and external partners to work together on risk reduction efforts in the County

Coordinating Organization:	Board of County Commissioners
Internal Partners:	Emergency Management
External Partners:	COG; Cities; State Agencies; Non-profit Organizations
Timeline:	Ongoing
Plan Goals Addressed:	Goal 1. Enhance coordination and communication among Linn County stakeholders to implement the Plan.
Plan Objective:	Objective 1.1. Establish and maintain methods to ensure plan implementation.

Status: The 2010 Steering Committee members decided to defer this action item since there were more formal agreements that could be obtained. Currently Linn County Emergency Management has the current agreements:

- *Inter-County Mutual Aid Agreement – Counties of Benton, Clackamas, Lincoln, Marion, Polk, Multnomah and Yamhill. This agreement is to facilitate and encourage Emergency Assistance among Counties in the form of supplemental personal, equipment, materials or other support.*
- *Memorandum of Understanding between Linn County Sheriff's Office and the United States Department of Energy for Emergency Preparedness and Response – US Department of Energy, National Energy Technology Laboratory & Albany Research Center. Linn County Sheriff will provide law enforcement and emergency management assistance on request and the Albany Research Center will provide named resources on request.*
- *Intergovernmental Agreement for Telecommunications Services – State of Oregon, Department of Administrative Services. An agreement to allow Linn County to use the State's telecommunications backbone network.*
- *Memorandum of Understanding between Linn County Linn-Benton-Lincoln Educational Service District and it's school districts, Linn County Health Department, Linn County Council of Integrated Child and Family Services. An agreement to take action to establish and conduct activities that will help ensure safe schools.*
- *Memorandum of Cooperation and Support between Albany Fire Department, Benton County Government, Benton County Sheriff's Office, City of Albany, Corvallis Fire Department, Corvallis School District, Linn-Benton Community College, Oregon State University, Philomath School district 17J, Samaritan*

Regional Health Services & Suislaw National Forest. The agreement is to jointly provide public information coordination and support in emergency situations, to include establishing and implementing a joint information center, as needed.

MH-ST #3: Action 1.2.1 Encourage and support the development of local community plan supplements to the County Natural Hazard Mitigation Plan

Coordinating Organization: Board of County Commissioners
Internal Partners: Emergency Management; Planning and Building Dept
External Partners: Cities; OEM; DOGAMI; FEMA
Timeline: Ongoing
Plan Goals Addressed: Goal 1. Enhance coordination and communication among Linn County stakeholders to implement the Plan
Plan Objective: Objective 1.2. Provide leadership to promote, communicate, and support disaster safety messages and activities.

Status: The Linn County Planning and Building Department provided several opportunities for cities to participate in the Linn County Natural Hazard Steering Committee meeting and provide any information or input to the update of the Natural Hazard Mitigation Plan. Five Cities have participated in the update process and are working on addendums to the Linn County Plan. Since several other cities in Linn County have not developed addendums the Linn County Steering Committee deferred this action item,

MH-ST #5: Action 1.2.3. Develop public officials information kit that can be distributed to elected officials and community decision makers. The kit should include information regarding the Natural Hazard Mitigation Plan and Steering Committee and its activities as well as facts and figures on the Natural Hazards the County is facing

Coordinating Organization: Emergency Management
Internal Partners: County Departments
External Partners: State Agencies; FEMA
Timeline: 1-3 years
Plan Goals Addressed: Goal 1. Enhance coordination and communication among Linn County stakeholders to implement the Plan
Plan Objective: Objective 1.2. Provide leadership to promote, communicate, and support disaster safety messages and activities

Status: This action item has been modified to better serve the community's needs and would be more realistic to accomplish. The Linn County Steering Committee modified and deferred this action item.

MH-ST #6: Action 2.1.1. Provide mitigation awareness training for county planning and public works staff, including GIS technicians

Coordinating Organization:	Emergency Management
Internal Partners:	County Departments
External Partners:	Oregon Emergency Management; State Agencies; FEMA; ONHW; Fire Marshall, Insurance Companies
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.1. Incorporate mitigation into planning and policy development.

Status: The County has identified specific training opportunities available through the FEMA Independent Study program and announcements will prepare to the Roadmaster and Director of Planning and Building for dissemination to their staff members. As natural hazard mitigation training is announced by training providers, the Linn County Emergency Management Officer will forward the announcements to the Roadmaster and Director of Planning and Building for dissemination to their staff members.

MH-ST #7: Action 2.1.2 Develop a continuity of government plan that details how core governmental operations will be maintained in the event of an emergency

Coordinating Organization:	Linn County Administrative Officer
Internal Partners:	Emergency Management; Elected Officials; County Departments
External Partners:	OEM; FEMA
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.1. Incorporate mitigation into planning and policy development.

Status: In January 2010, Linn County began participating in a six-county grant award initiative to provide COG and Coop planning for each of the participating counties and their cities. An initial COOP Plan training workshop was conducted twice for Linn County government and all 13 Cities in February 2010. A mid-term training will be conducted in June 2010 Once completed, the individual COGs and COOPs will be updated regularly as changes occur.

MH-ST #9: Action 2.3.1. Update the Emergency Operations Plan

Coordinating Organization:	Emergency Management
Internal Partners:	County Administrator; Sheriff; Road Department; Elected Officials;
External Partners:	Cities; COG; 911 Coordinator; State Police; Utility Companies; OEM
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.3. Ensure continuity of County emergency service functions.

Status: Oregon Administrative Rules require each County Emergency Operations Plan to be updated within a five year period. The deadline for the Linn County update is July 2012. The County is currently working on a revision of the Basic Plan portion of the EOP. In addition, and emergency management volunteer is preparing drafts of the 15 Emergency Support Annexes that will be implemented in the new EOP**.**

MH-ST #10: Action 2.3.2. Consolidate the mitigation plan, Emergency Operations Plan, recovery plans, and continuity of government plan into a Unified Disaster Plan

Coordinating Organization:	Emergency Management
Internal Partners:	County Administrator; Sheriff; Road Department; Elected Officials;
External Partners:	Cities; COG; 911 Coordinator; State Police; Utility Companies; OEM
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.3. Ensure continuity of County emergency service functions.

Status: The currently approved EOP and NHMP constitute the County's Emergency Management Plan. When the County's Continuity of Government (COG) plan is completed, it and the associated County Departmental/Office COOPs will become part of the County Emergency Management Plan. Current County Emergency Management staffing levels and workload limitations imposed by Federal and State compliance requirements preclude initiating a Recovery Plan within the near future. However, note that short term recovery is addresses in the EOP as the disaster recovery process is transitional.

MH-ST #11: Action 2.3.3. Identify and evaluate county-owned emergency transportation routes and determine which roads and bridges are critical to the transportation network

Coordinating Organization:	Road Department
Internal Partners:	Emergency Management; Sheriff
External Partners:	911 Coordinator; State Police; OEM; Fire Marshall
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.3. Ensure continuity of County emergency service functions.

Status: The Linn County Road Department has been working in cooperation with the Oregon Department of Transportation to identify county wide emergency transportation routes and bypass routes in the event of an emergency whether it be associated with an accident or a natural disaster. Flood plains are reviewed in identification of these routes. Linn County GIS provides maps to document these routes. When weak points are found in these routes such as a bridge that cannot support legal loads, road and bridge improvements are developed, designed and implemented as funding allows. This is an ongoing process to provide continual improvement to the County wide Transportation network. A set of maps are available from the Linn County Road Department.

2005 Long-term Action Items

MH-LT #3: Action 2.1.3. Evaluate current zoning codes to incorporate mitigation principles

Coordinating Organization:	Planning & Building Department
Internal Partners:	Emergency Management; Planning Commission; Board of Commissioners
External Partners:	OEM
Timeline:	3-5 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.1. Incorporate mitigation into planning and policy development.

Status: This action item was modified to encompass the entire Linn County Development Code. Linn County is in the process of updating the Linn County Floodplain ordinance and should be adopted September 2010. There are still other elements of the Linn County Development code that could be evaluated to incorporate mitigation principles; this action item has been deferred.

Multi-Hazard Mitigation Action Items

Multi-hazard mitigation action items are action items that address two or more of the natural hazards addressed in this plan: flood, landslide, wildfire, severe weather, and earthquake.

The Multi-hazard action items were identified and prioritized by the Mitigation Plan Steering Committee during open meetings with input from stakeholders and other interested members of the public. The action items provide direction on specific activities that organizations and residents in Linn County can undertake to reduce risk and prevent loss from multiple types of hazard events.

There are 12 short-term and 8 long-term multi-hazard action items described below.

Short-term Action Items

MH-ST #1: Action 1.1.1. Develop formal agreements with internal and external partners to work together on risk reduction efforts in the County

Coordinating Organization:	Board of County Commissioners
Internal Partners:	Emergency Management
External Partners:	COG; Cities; State Agencies; Non-profit Organizations
Timeline:	Ongoing
Plan Goals Addressed:	Goal 1. Enhance coordination and communication among Linn County stakeholders to implement the Plan.
Plan Objective:	Objective 1.1. Establish and maintain methods to ensure plan implementation.

MH-ST #2: Action 1.1.2. Explore funding opportunities with internal and external partners to implement the actions identified in the plan

Coordinating Organization:	Emergency Management
Internal Partners:	Board of Commissioners
External Partners:	OEM; FEMA; ONHW; DOGAMI; COG
Timeline:	Ongoing
Plan Goals Addressed:	Goal 1. Enhance coordination and communication among Linn County stakeholders to implement the Plan
Plan Objective:	Objective 1.1. Establish and maintain methods to ensure plan implementation.

MH-ST #3: Action 1.2.1 Encourage and support the development of local community plan supplements to the County Natural Hazard Mitigation Plan

Coordinating Organization:	Steering Committee
Internal Partners:	Emergency Management; Planning and Building Dept
External Partners:	Cities; OEM; DOGAMI; FEMA
Timeline:	Ongoing
Plan Goals Addressed:	Goal 1. Enhance coordination and communication among Linn County stakeholders to implement the Plan
Plan Objective:	Objective 1.2. Provide leadership to promote, communicate, and support disaster safety messages and activities.

MH-ST #4: Action 1.2.2. Develop County protocols and strategies for the dissemination of media messages that focus on individual responsibility for disaster safety and risk reduction

Coordinating Organization:	Public Information Officer
Internal Partners:	Planning and Building Dept; Board of Commissioners
External Partners:	State Agencies; FEMA
Timeline:	1-3 years
Plan Goals Addressed:	Goal 1. Enhance coordination and communication among Linn County stakeholders to implement the Plan
Plan Objective:	Objective 1.2. Provide leadership to promote, communicate and support disaster safety messages and activities

MH-ST #5: Action 1.2.3. Distribute information regarding the Natural Hazard Mitigation Plan to public officials and community leaders, and provide updates on hazard vulnerability and County hazard mitigation activities.

Coordinating Organization:	Steering Committee
Internal Partners:	County Departments
External Partners:	State Agencies; FEMA
Timeline:	1-3 years
Plan Goals Addressed:	Goal 1. Enhance coordination and communication among Linn County stakeholders to implement the Plan
Plan Objective:	Objective 1.2. Provide leadership to promote, communicate, and support disaster safety messages and activities

MH-ST #6: Action 2.1.1. Provide mitigation awareness training for county staff

Coordinating Organization:	Emergency Management
Internal Partners:	County Departments
External Partners:	Oregon Emergency Management; State Agencies; FEMA; ONHW; Fire Marshall, Insurance Companies
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.1. Incorporate mitigation into planning and policy development.

MH-ST #7: Action 2.1.2 Develop a continuity of government plan that details how core governmental operations will be maintained in the event of an emergency

Coordinating Organization:	Linn County Administrative Officer
Internal Partners:	Emergency Management; Elected Officials; County Departments
External Partners:	OEM; FEMA
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.1. Incorporate mitigation into planning and policy development.

MH-ST #8: Action 2.2.1. Develop an inventory of county assets including replacement costs

Coordinating Organization:	General Services
Internal Partners:	Linn County Property Management; Treasurer; Assessor; GIS
External Partners:	OEM
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.2. Support the enhancement of County vulnerability assessment activities.

MH-ST #9: Action 2.3.1. Update the Emergency Operations Plan

Coordinating Organization:	Emergency Management
Internal Partners:	County Administrator; Sheriff; Road Department; Elected Officials;
External Partners:	Cities; COG; 911 Coordinator; State Police; Utility Companies; OEM
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.3. Ensure continuity of County emergency service functions.

MH-ST #10: Action 2.3.2. Consolidate the mitigation plan, Emergency Operations Plan, recovery plans, and continuity of government plan into a Unified Disaster Plan

Coordinating Organization:	Emergency Management
Internal Partners:	County Administrator; Sheriff; Road Department; Elected Officials;
External Partners:	Cities; COG; 911 Coordinator; State Police; Utility Companies; OEM
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.3. Ensure continuity of County emergency service functions.

MH-ST #11: Action 2.3.3. Identify and evaluate county-owned emergency transportation routes and determine which roads and bridges are critical to the transportation network

Coordinating Organization:	Road Department
Internal Partners:	Emergency Management; Sheriff
External Partners:	911 Coordinator; State Police; OEM; Fire Marshall
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.3. Ensure continuity of County emergency service functions.

MH-ST #12: Action 3.1.1. Maintain a public awareness campaign aimed at homeowners, children, the elderly and non-English speaking residents to make them aware of what they can do to prepare for natural hazard events

Coordinating Organization:	Emergency Management
Internal Partners:	Board of Commissioners
External Partners:	Red Cross; COG; Cities; LB-ESD; United Way; State Agencies; Hospitals; Insurance Companies; Children and Families Commission
Timeline:	1-3 years
Plan Goals Addressed:	Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships.
Plan Objective:	Objective 3.1. Increase citizen awareness and promote risk reduction activities through education and outreach.

MH-ST #13: Action 1.2.4. Develop and maintain a database of current action items.

Coordinating Organization:	Emergency Management
Internal Partners:	Planning & Building Department
External Partners:	OEM
Timeline:	3-5 years
Plan Goals Addressed:	Goal 1. Enhance coordination and communication among Linn County stakeholders to implement the Plan.
Plan Objective:	Objective 1.2. Provide leadership to promote, communicate, and support disaster safety messages and activities.

Long-term Action Items

MH-LT #1: Action 1.1.3. Establish mitigation benchmarks to assist in evaluating and updating the plan

Coordinating Organization:	Steering Committee
Internal Partners:	Planning & Building Dept; Emergency Management
External Partners:	State Agencies
Timeline:	3-5 years
Plan Goals Addressed:	Goal 1. Enhance coordination and communication among Linn County stakeholders to implement the Plan.
Plan Objective:	Objective 1.1. Establish and maintain methods to ensure plan implementation.

MH-LT #2: Action 2.1.3. Evaluate current development codes to incorporate mitigation principles

Coordinating Organization:	Planning & Building Department
Internal Partners:	Emergency Management; Planning Commission; Board of Commissioners
External Partners:	OEM
Timeline:	3-5 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.1. Incorporate mitigation into planning and policy development.

MH-LT #3: Action 2.1.6. Develop a scour protection plan for Linn County Bridges

Coordinating Organization:	Road Department
Internal Partners:	Emergency Management; Planning & Building; Linn County GIS, Linn County Surveyors
External Partners:	State and Federal Agencies
Timeline:	ongoing
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.1. Incorporate mitigation into planning and policy development.

MH-LT #4: Action 2.2.1. Develop a risk analysis for each section identified in the Linn County Natural Hazard Mitigation Plan

Coordinating Organization:	Steering Committee
Internal Partners:	Linn County Departments
External Partners:	State and Federal Agencies
Timeline:	1-3 years
Plan Goals Addressed:	Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective:	Objective 2.2. Support the enhancement of County vulnerability assessment activities.

MH-LT #5: Action 2.2.7. Geo-code the location, type, occupancy, footprint and elevation data for buildings, infrastructure, and critical facilities in natural hazard areas

Coordinating Organization: GIS
Internal Partners: Assessor; Planning & Building; Emergency Management; Road Department
External Partners: FEMA; DOGAMI; OEM; Cities; Insurance Companies
Timeline: 3-5 years
Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective: Objective 2.2. Support the enhancement of County vulnerability assessment activities.

MH-LT #6: Action 2.2.10. Develop a County wide list of and evaluate for flood, scour, seismic and structural integrity of all bridge crossings leading to private structures on private and public lands.

Coordinating Organization: Emergency Management
Internal Partners: Linn County Road Department
External Partners: Private land owners and public agencies
Timeline: ongoing
Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective: Objective 2.2. Support the enhancement of County vulnerability assessment activities.

MH-LT #7: Action 2.2.12. Develop a risk analysis for each section identified in the Linn County Natural Hazard Mitigation Plan.

Coordinating Organization: Steering Committee
Internal Partners: Linn County Departments
External Partners: State and Federal agencies
Timeline: ongoing
Plan Goals Addressed: Goal 2. Protect life, the built environment and natural systems through County policies, procedures and services.
Plan Objective: Objective 2.2. Support the enhancement of County vulnerability assessment activities.

MH-LT #8: Action 3.2.1. Encourage small businesses to develop recovery plans in the event of a disaster and to implement non-structural mitigation

Coordinating Organization:	Emergency Management
Internal Partners:	Chamber of Commerce; Business Development Coordinator
External Partners:	COG; LBCC Business Development; Insurance Companies; Cities
Timeline:	3-5 years
Plan Goals Addressed:	Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships
Plan Objective:	Objective 3.2. Develop collaborative programs that encourage local businesses to plan for disasters.

MH-LT #9: Action 3.3.5. Implement a routine bridge inspection program for bridges identified in Action Item 2.2.10 to ensure the bridges continue to be structurally sound.

Coordinating Organization:	Fire Marshall
Internal Partners:	Linn County Road Department
External Partners:	Linn County Fire Defense Board; Cities
Timeline:	ongoing
Plan Goals Addressed:	Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships
Plan Objective:	Objective 3.2. Develop collaborative programs that encourage local businesses to plan for disasters.

MH-LT #10: Action 3.3.7. Create a database of local private resources including equipment, labor, special expertise and operating area as well as contact information that could be mobilized rapidly in event of fire, earthquake, flood or severe weather impact.

Coordinating Organization:	Emergency Management
Internal Partners:	Linn County Road Department
External Partners:	ODOT; ODF; Private timber owners; private land owners
Timeline:	ongoing
Plan Goals Addressed:	Goal 3. Protect life, the built environment, the economy and natural resources through community-wide partnerships
Plan Objective:	Objective 3.2. Develop collaborative programs that encourage local businesses to plan for disasters.

Appendix A:
Public Participation

Public participation is an important component in identifying hazard risks, impacts and hazard mitigation activities contained in this natural hazards mitigation plan. Public participation offers citizens the chance to voice their ideas, interests and opinions. Oregon's land use system addresses the need for public process in Statewide Land Use Planning Goal 1: Citizen Involvement. The citizen involvement goal ensures the opportunity for citizens to be involved in the planning process.

The Federal Emergency Management Agency's (FEMA) Disaster Mitigation Act of 2000 (DMA2000) includes requirements for involving the public in natural hazard mitigation planning. The DMA2000 states:

> *"An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:*
>
> > *1. An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.*
> >
> > *2. An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and no-profit interests to be involved in the planning process."*[1]

2005 Public Participation

For the development of the 2005 natural hazards mitigation plan, the public was notified and engaged in the planning process in three ways: (1) a nine-member steering committee was established comprised of the nine regular Planning Commission members; (2) a focus group survey was sent to 99 identified stakeholders, experts and interested parties; and (3) the public was invited to participate in all steering committee meetings and public workshops through the issuance of press releases and published public notices.

2005 Steering Committee

The Hazard Mitigation Plan Steering Committee guided the development of the plan and participated in major decision-making including goal setting and identifying and prioritizing action items. The steering committee was comprised of the nine regular Planning Commission members, representing a broad cross-section of Linn County residents from various professions and regions of the county. The committee members' knowledge of community issues helped ensure the plan was specific and relevant to the county. Members of the 2005 steering committee were:

Name	Linn County Region: Profession	Years on Commission
Robert Bronson	Harrisburg: Insurance Agent	23 years
David Furtwangler	Lebanon: Forestry Consultant	2 years
Scott Mackie	Lacomb: Building Contractor	6 years
Jerome Magnuson	Albany: Farmer	10 years
John McKinney	Lebanon: Building Contractor	12 years
Gary Metts	Scio: Technology Coordinator	14 years
William Tucker	Lacomb: Real Estate Agent/Farmer	8 years
Mary VanAgtmael	Scio: Industrial Millwright Contractor	6 years
Ronald Walsh	Corvallis: Chemist -- Teledyne Wah Chang	23 years

The steering committee held a series of six planning meetings. Public and agency participation was solicited and encouraged at each planning meeting. To increase public awareness and participation, the county sent press releases and public notices soliciting public input to the 10 statewide, local and regional newspapers serving Linn County residents, and to individual citizens who requested inclusion in the mailing list.

The Steering Committee members have a great deal of knowledge and familiarity with the history and impacts of natural hazard events throughout Linn County. The steering committee guided development of the plan by setting plan goals, identifying stakeholders, involving the public, and developing and prioritizing action items.

The steering committee met on the following dates:

Steering Committee Meeting #1: November 9, 2004

Andre LeDuc of the Oregon Natural Hazards Workgroup (ONHW) and Bill Burns of the Oregon Department of Geology and Mineral Industries (DOGAMI) provided the Steering Committee with an overview of the Disaster Mitigation Act of 2000 (DMA2000) background, planning process and plan requirements. The Planning and Building Department mitigation plan project manager presented a staff report explaining the county's Pre-Disaster Mitigation (PDM) Grant; the mitigation plan scope of work; work program; project schedule; and the natural hazards questionnaire.

Steering Committee Meeting #2: January 11, 2005

The steering committee reviewed draft chapters covering plan Section 1: Introduction and Planning Process; Section 2: Community Profile; and Section 6: Flood hazards. The committee members reviewed flood, precipitation and watershed maps; discussed the issues and data in the plan chapters; provided feedback; and recommended chapter edits. The committee also discussed the ONHW risk assessment training.

Steering Committee Meeting #3: April 12, 2005

On March 3, 2005 the Steering Committee was sent drafts of Section 7: Landslide Hazards; and Section 8: Wildfire Hazards. The committee members reviewed these sections and prepared feedback and chapter edits for the April 12, 2005 meeting.

The Steering Committee developed the draft plan mission, goals, objectives and action items. Krista Mitchell of the ONHW facilitated the Goal Setting and Action Item Development Workshop. Participants included the Steering Committee and representatives from the cities of Albany, Lebanon, and Scio; the Oregon Department of Forestry; DOGAMI; the County Roadmaster; the County Building Official; the Planning and Building Department Director; the Linn County Emergency Management Coordinator; and other interested citizens.

Steering Committee Meeting #4: May 17, 2005

The Steering Committee reviewed the draft Section 9: Severe Weather Hazards and the responses to the Focus Group Survey. Krista Mitchell of the ONHW facilitated the follow-up goal and action item meeting. The Steering Committee approved the draft plan goals with minor amendments. The Committee approved the draft plan objectives with minor amendments. The Committee discussed each of the original 49 draft action items. The Committee approved, struck or revised many of the draft actions to develop a draft action item matrix.

Steering Committee Meeting #5: June 14, 2005

The Steering Committee reviewed the revised action item matrix and corresponding action item proposal forms. The committee modified several action items and adopted several new actions. The committee adopted action items, assigned the lead organizations, identified internal and external partners, and discussed implementation for one-half of the draft action items.

Steering Committee Meeting #6: June 28, 2005

The Steering Committee reviewed the revised action item matrix and corresponding action item proposal forms. The committee modified several action items and adopted several new actions. The committee adopted action items, assigned the lead organizations, identified internal and external partners, and discussed implementation measures.

Public Workshops

The public was encouraged to participate in all the steering committee meetings and public workshops. Time was set aside at each meeting for public participation. Public participation provided valuable inputs addressing experiences and concerns relating to natural hazard impacts in Linn County, possible mitigation strategies, and goal setting and action item priorities.

Focus Group Survey

A contact list of 117 possible stakeholders and interested parties was developed that included representatives from state and other governmental agencies; each incorporated city in the county; the special taxing districts, including education, public safety and water districts; county department heads; private utility companies; other interested private businesses; various citizen groups and clubs; and other interested private citizens.

The individuals identified on the stakeholder list were invited to participate in the steering committee meetings and were sent a short survey soliciting information on their experiences and understanding of natural hazards in Linn County; the effectiveness of current mitigation activities; and recommendations for future hazard mitigation policies and activities.

The survey was sent to 99 identified experts, stakeholders and interested citizens. Recipients were asked to respond to nine general natural hazard-related questions as they pertain to flood, storm, windstorm, landslide, wildfire, earthquake, volcanic, or other natural hazards in Linn County. A total of 14 identified stakeholders responded to the survey. The survey results were compiled to help formulate various sections of the plan, and were presented to the steering committee to help identify goals and hazard specific action items.

Survey Respondent Comments: Natural Hazard Mitigation Survey

Question 1: What types of natural hazards impact your residence, place of work, or local community?

- All the above (Lebanon Community School Dist.)
- Wind storms, heavy rain, snow melt (Mill City RFPD)
- Floods, windstorms (high winds/tornado), winter storms (snow, ice), volcanic ash, earthquake (City of Albany)
- Windstorms, severe winter storms, floods, landslides and wildfires have caused destruction of our power system, thereby causing a loss of power to our customers (Consumers Power)
- Windstorms, floods, snow and ice, wildfires, possible earthquake (Linn Co. Surveyor)
- Floods, storms, windstorms (Linn Co. Clerk)
- Floods, severe winter storms, windstorms, West Nile virus (Linn Co. Extension)
- Windstorms, wildfire, earthquake (City of Idanha)
- Floods, windstorm, ice (City of Harrisburg)
- Floods, windstorms, ice (Santiam Canyon School Dist.)
- Potentially all of them (City of Sweet Home)
- Wind, ice storms, and flooding impact my residence and community; downed trees cut power for days and block roads for hours (City of Sweet Home)
- Wildfire, debris torrents, landslides (Sweet Home Dept. of Forestry)
- All of the above (Linn Benton Lincoln ESD)

Question 2: How have you personally been impacted by natural hazard events in Linn County?

- Yes (Lebanon Community School Dist.)
- We get called to all events in and around our district (Mill City FRPD)
- The City of Albany has been impacted by floods, ice, snowstorms, and windstorms
- Yes, Consumers Power has experienced destruction of its electrical facilities in Linn County due to natural hazard events.
- Windstorms have blown trees on buildings and fences, knocked out power. Ice and snow have made travel to work or home difficult at times each winter. Heavy rains have washed out or flooded roads preventing travel (Linn Co. Surveyor)
- Windstorm damage to my house (falling tree limbs) and flooding (Linn Co. Clerk)

- During the flooding of 1996, highway 34 from Albany in Linn County to Corvallis was closed. Consequently, there was much additional traffic traveling on highway 20 to Corvallis and lengthy delays in travel. Many of our OSU Extension Service events scheduled during those weeks has to be cancelled due to the flooding conditions. There was an increase in requests for information on well water testing, purifying water, tree damage, etc. In January 0f 1996, we had an ice storm that caused hazardous travel conditions on our county highways. In 1004, West Nile virus spread to Linn County and resulted in many calls from customers seeking information. (Linn Co. Extension)
- Yes (City of Idanha)
- Yes, windstorm property damage (City of Harrisburg)
- Yes, a severe windstorm in February 2002 caused several thousand dollars worth of damage (Santiam Canyon School Dist.)
- Yes (City of Sweet Home)
- Yes, I have gone without power for days and been unable to leave my property during storms (City of Sweet Home)
- Responsible for wildfire suppression for Linn Forest Protective Association and resources within the South Cascade District, Sweet Home Unit (Sweet Home State Forestry)
- Winter storm damage, mainly to trees (Linn Benton Lincoln ESD)

Question 3: Please identify significant past natural disaster events, such as severe windstorms, ice storms, or flooding that have impacted Linn County?

- Windstorm of February 2002, winter snows (Lebanon Community School Dist.)
- In 1996, heavy snow melt caused severe high water, numerous high wind storms in the past 4-5 years, freezing rain/ice storms in 2003 (Mill City RFPD)
- 1996 – floods, 2004 – ice and snow, 1995-2003 – windstorms (City of Albany)
- In the February 2002 windstorm, 35 transmission poles plus dozens of distribution poles in the Harrisburg areas were blown down. In the December 29-31, 2003 snow storm and the January 5-7, 2004 ice storm many hundreds of service wires and wire spans between poles, plus many poles were downed by falling trees and branches (Consumers Power)
- 1962 – Columbus Day windstorm; 1964 – flooding around Christmas; 1969 – snowstorm in January; 1973 – freeze with snow; 1989 – snowstorm and freeze; December 1996 – wind and rainstorm, flooding, power outages; 2004 – winter storm with ice and snow (Linn Co. Surveyor)
- I cannot recall the specific dates (Linn Co. Clerk)
- 1962 – windstorm (Columbus Day storm); 1996 – flooding (Linn Co. Extension)
- Earthquake, flood, wildfire, windstorm (City of Idanha)
- February 2003 – windstorm; 1996 flooding (City of Harrisburg)
- Yes, a severe windstorm in February 2002 caused several thousand dollars worth of damage (Santiam Canyon School Dist.)
- Floods (1964, 1996, 1997); windstorm (1992), ice and snow (City of Sweet Home)
- January 2004 snow and ice storm; 1996 flood (City of Sweet Home)
- 1987 – Calapooia fire (2000 acres); 1998 – Thomas Creek fire (80 acres); 2001 – Island Inn fire (29 acres); 2003 – Overton Gap fire (40 acres); 1996 – floods; 2002 – February windstorm (Sweet Home Forestry Unit)
- In the 2 ½ years I have lived here, only one winter storm caused damage (Linn Benton Lincoln ESD)

Question 4: What current activities, actions or projects are beneficial in reducing risks and preventing losses from natural hazard events in Linn County?

- None that come to mind (Lebanon Community School District)
- Some trimming of trees around power lines (Mill City RFPD)
- Tree limb trimming by power companies, building regulations pertaining to 100 year flood zone, earthquake zone building code, drainage requirements, road requirements for urban fire (City of Albany)
- Placing power lines underground will reduce risk due to wind, ice and snow, but will increase the risk due to earthquake. However, the cost to place lines underground system wide is prohibitive. Risks can also be reduced by replacing small brittle copper wire with stronger aluminum wire and by a more aggressive tree trimming program. CPI is proactively working to identify and replace aging plans where sound engineering practices identify the cost effectiveness of doing so. (Consumers Power)
- Hazard free removal along roads and power lines, road improvements on culverts and bridges and shoulder widening, planning and design of roads and buildings in mountainous areas to prevent slides or washouts, planning for not building in flood prone areas. (Linn Co. Surveyor)
- NA (Linn Co. Clerk)
- In September 1004, OSU Extension agriculture program leader Bill Braunworth released an emergency response handbook/folder of 18 extension publications and 7 internal documents, a CD-ROM with the digital files and a copy of the FEMA publication "Are You Ready?" This emergency response handbook of reference materials is available for checkout by individuals or groups from the OSU Extension Service, Linn County office. Another important resource is the Linn County Emergency Management Director, Jim Howell, has been very involved in activities for emergency preparedness. For example, he hosted an emergency preparedness drill for Linn County employees. Linn County Citizen Corps and Linn-Benton Neighborhood Emergency Training, part of FEMA; Brownsville Area Emergency Management Advisory Commission. (Linn Co. Extension)
- Dealing with trees that may impact power and phone lines (City of Harrisburg)
- Monthly fire and earthquake drills, monthly safety committee meetings, crisis and emergency management plan in place, close communication with local rescue officials, radio and TV broadcast services; we also serve as a public shelter for certain emergencies. (Santiam Canyon School District)
- Sweet Home is improving small watershed's ability to handle flood waters; individual property protection from floods (City of Sweet Home)
- Trimming/cutting/transplanting trees in locations that affect power lines and roads. Work on Ames Creek (City of Sweet Home)
- We have recently concluded a $100,000 national fire plan grant for fuels reduction and community education extending from Brownsville south to Lane County line along the valley and foothills. Preparing to begin a $250,000 national fire plan grant for community education and fuels reduction starting at Brownsville and extending north along the foothills. (Sweet Home Forestry Dist.)
- I'm not aware of any (Linn Benton Lincoln ESD)

Question 5: What new activities, actions, or projects can reduce risks and prevent loss from future natural hazard events in Linn County?

- None that come to mind (Lebanon Community School Dist.)
- Cleaning of ditches and creeks would help on flooding. Taking out problem trees around electrical lines would help power outages. (Mill City RFPD)
- Tree limb trimming by power companies, building regulations pertaining to 100 year flood zone, earthquake zone building code, drainage requirements, road requirements for urban fire (City of Albany)
- Risks could be reduced by creating wider right-of-ways in utility corridors, but to do so taxes cooperation of landowners and special interest groups. (Consumers Power)
- More diligent removal of dangerous trees, and road improvement for better drainage. Better planning for slide and flood zone areas. (Linn Co. Surveyor)
- NA (Linn Co. Clerk)
- There is limited cell/radio service communications – no local news/weather broadcasts are available in this area (City of Idanha)
- Improve communications between agencies and share ideas and best practices; shut down the storms! (Santiam Canyon School Dist.)
- Reconnection of flood plains (City of Sweet Home)
- Continue work on waterways and drainage areas. Continue to work on trees at risk of causing damage. (City of Sweet Home)
- Continue to apply for national fire plan grants; enhance public education and involvement in fire protection and hazard fuels reductions adjacent to structures (Sweet Home Forestry Dept.)

Question 6: How can agencies, organizations, or individuals coordinate their efforts to reduce natural hazard risks in Linn County?

- Don't know (Lebanon Community School Dist.)
- Working together in rural areas to help small communities deal with these problems (Mill City RFPD)
- By developing a hazard mitigation plan for Linn County and cities, developing or using existing preparedness programs for citizens, get community organizations involved in preparedness programs (City of Albany)
- Improve communication between agencies, specifically providing a list of contacts and phone numbers that CPI can use to communicate with Linn County during such events (Consumers Power)
- Have a link on Linn County web site for input from the public to report possible hazards or risks (Linn Co. Surveyor)
- Better communication (Linn Co. Clerk)
- The public meetings are a good start. Have you considered a specialized Linn County web page for information dissemination. Consider an emergency preparedness summit meeting. (Linn Co. Extension)
- Coordinate putting utilities underground (City of Harrisburg)
- Someone needs to be responsible to take the lead and be accountable to make sure things are getting done (Santiam Canyon School Dist.)

- We all compete for the same funds, that makes it hard. More activities coordinated by Linn County Emergency Management. (City of Sweet Home)
- Be involved in citizen corp and other community groups and have multi-agency meetings on County wide issues. (City of Sweet Home)
- With our fire plan grants we involve landowners, fire districts, federal counterparts (BLM & USFS) (Sweet Home Forestry Dept.)
- Flow of information – if the county would provide information to help reduce risk, our agency could distribute to employees and their families (Linn Benton Lincoln ESD)

Question 7: Please list one or more important goals for pre-disaster natural hazard planning in Linn County.

- Don't know (Lebanon Community School Dist.)
- Preventative measures: cleaning ditches and creeks; cutting problem limbs and trees (Mill City RFPD)
- Integrate existing regulatory documents and programs; identify potential funding sources; improve collaborative programs between public, private, and community organizations (City of Albany)
- Public education is a very important goal. Vital services like electricity, water and telephone require right-of-ways that are accessible at all times and that can be maintained economically (Consumers Power)
- Weather warnings or road hazard signs with radio station information or phone numbers to call for updates placed on main roads throughout Linn County, like the State has on freeways (Linn Co. Surveyor)
- Better communication (Linn Co. Clerk)
- Develop a master list of local emergency contact information (including websites) specific to Linn County, including local chapter of the American Red Cross, city and county government officials, local shelters, food banks, hospitals, ambulance services, local media (radio stations, newspapers, and TV stations), key contact names including key volunteers (Linn County Extension)
- There is limited cell/radio service communications – no local news/weather broadcasts are available in this area (City of Idanha)
- To get by with as little loss as possible; to handle the disaster(s) with as little confusion as possible (Santiam Canyon School Dist.)
- Citizen preparedness (City of Sweet Home)
- Obtain others/citizens views and experiences as to where risks are and what would reduce the risk (City of Sweet Home)
- Prevent the catastrophic loss of homes and structures through education and fuels reduction when wildfires impinge upon the populated areas within our district (Sweet Home Dept. of Forestry)
- Transportation planning: assume a natural disaster occurred during a work day… where do people go and how do they get there? (Linn Benton Lincoln ESD)

Question 8: Would you like to be notified of scheduled hazard mitigation planning meetings?

- No thank you (Lebanon Community School Dist.)

- Yes (Mill City RFPD)
- Yes (City of Albany)
- Yes (Consumers Power)
- Yes (Linn Co. Surveyor)
- Like many, I now have little knowledge about this subject and end up reacting and coping with the effects of these kind of events. Many years ago, Linn County had a disaster planning team that included the elected officials. I believe the County Clerk's role was coordinating shelter activities in the event of a disaster (Linn Co. Clerk)
- Yes (Linn Co. Extension)
- Yes (City of Harrisburg)
- Yes (Santiam Canyon School Dist.
- Yes (City of Sweet Home)
- Yes (Sweet Home Dept. of Forestry)
- Yes (Linn Benton Lincoln ESD)

Question 9: Please provide names of anyone who you believe may be able to help identify or implement natural hazard mitigation strategies or activities in Linn County.

- Pacific Power and Light; City of Mill City (Mill City RFPD)
- Darrel Tedisch (City of Albany)
- Greg Nervino (451-6514), James Ramseyer (929-8531), Brad Kunda (929-8598) (Consumers Power)
- Darren Lane, Linn Co. Roadmaster; Linn County Commissioners; Dave Burright, Linn County Sheriff (Linn County Surveyor)
- Like many, I now have little knowledge about this subject and end up reacting and coping with the effects of these kind of events. Many years ago, Linn County had a disaster planning team that included the elected officials. I believe the County Clerk's role was coordinating shelter activities in the event of a disaster (Linn Co. Clerk)
- Jim Howell, Linn Co. Emergency Mgmt; Bill Braunworth, OSU Extension Agriculture Program Leader (541-737-1317) (Linn County Extension)
- Idanha City Council, Idanha/Detroit RFPD (City of Idanha)
- Tim Bunnell, Community Development Superintendent for Harrisburg (City of Harrisburg)
- Don Hoover, District Maintenance Mgr and member of the Mill City fire board (503-897-4057) (Santiam Canyon School Dist.)
- Ann Stein (466-5081) (City of Sweet Home)

2010 Public Participation

Steering Committee

The Hazard Mitigation Plan Steering Committee guided the development of the plan and participated in major decision-making including goal setting and identifying and prioritizing action items. The committee members' knowledge of community issues helped ensure the plan will be specific and relevant to the county.

The steering committee held a series of five planning meetings. Public and agency participation was solicited and encouraged at each planning meeting. To increase public awareness and participation, the county sent press releases and to the local newspaper serving Linn County residents, conducted a household preparedness survey and a stakeholder survey. Notice of update and request for comments was posted on the Linn County website.

In 2010 the county established a list of 112 stakeholders and interested parties. The stakeholder list included representatives from state and other governmental agencies; each incorporated city in the county; the special taxing districts, including education, pubic safety and water districts; county department heads; private utility companies; other interested private businesses; various citizen groups and clubs; and other interested private citizens. The individuals identified on the stakeholder list were invited to participate in the steering committee meetings and were sent a short survey soliciting information on their experiences and understanding of natural hazards in Linn County; the effectiveness of current mitigation activities; and recommendations for future hazard mitigation policies and activities.

The Steering Committee members have a great deal of knowledge and familiarity with the history and impacts of natural hazard events throughout Linn County. The steering committee guided development of the plan by setting plan goals, identifying stakeholders, involving the public, and developing and prioritizing action items. Members of the 2010 steering committee were:

Name	**Representing**
Steve Barnett	GIS Department
Mike Beaver	Linn County Fire Defense Board
Brian Carroll	Parks Department
David Furtwangler	Planning Commission
John Hixson	Building Official/Floodplain Admin
Jim Howell	Emergency Management Coordinator
Chuck Knoll	Road Department/County Engineer
Darrell Tedish	City of Albany
Mary VanAgtmael	Planning Commission
Robert Wheeldon	Planning & Building Director

The steering committee met on the following dates:

January 28, 2010:
The Steering Committee decided what public strategies and opportunities to include during the 2010 update. Staff was directed to prepare a press release, provide information on the Linn County website with the ability to comment on the plan, conduct a household preparedness survey and a stakeholder's survey. The household preparedness survey was conducted by

Oregon Partnership for Disaster Resilience (OPDR) between February 19, 2010 and March 19, 2010. The survey and results can be found at the end of Appendix A. The stakeholders survey was conducted by OPDR and the Community Planning Workshop (CPW) on March 19, 2010. The survey summary can be found at the end of Appendix A.

Between the January and March meetings Steering Committee members reviewed all hazard assessments from the 2005 Linn County Natural Hazard Mitigation Plan and submitted comments to staff to edit for the 2010 update.

March 3, 2010:

The Steering Committee decided that prior to the next meeting (April 15, 2010); each member would review the remaining hazard assessments and risk assessment sections, and submit edits and comments to staff. The Steering Committee directed staff to compile all edits and comments of those sections and distribute them to the Steering Committee for review and discussion at the April 15 meeting.

April 15, 2010:

The Steering Committee discussed and approved draft sections distributed after the March 3, 2010 meeting. The committee then reviewed all action items in the Natural Hazard Mitigation Plan. They discussed and decided if each item was completed and if the action item needed to be deferred or deleted for the update. Ideas for new action items were discussed and committee members were asked to develop those new action items and submit them to staff. Staff was directed to distribute those items to the entire Steering Committee for discussion at the next meeting.

The Steering Committee re-evaluated the mitigation plan goals and mission. The Steering Committee found that the goals and mission are still consistent with the intent of the plan and consistent with the State of Oregon Natural Hazards Mitigation Plan. Staff led an exercise to prioritize the goals of the plan. The dot prioritization activity determined the ranking of the hazards in the plan and the ranking of the goals. The outcome established an action item priority score, which can be found on the Linn County Natural Hazard Mitigation Plan Action Item Matrix.

May 5, 2010:

The Steering Committee discussed and approved new mitigation action items. The committee members directed staff complete all edits of the NHMP and distribute the final draft versions to the committee members. The Steering Committee decided review the final draft of all sections and meet to discuss any changes in July.

July 29, 2010:

The Steering Committee reviewed all sections of the Linn County Natural Hazard Mitigation Plan update and asked staff to forward the final draft to the Planning Commission. The purpose of the Planning Commission meeting is to take public input and make a recommendation plan.

All agendas, minutes, meeting materials and sign in sheets can be found at the end of this appendix.

Appendix A Endnotes

[1] Code of Federal Regulations. 44CFR201 and 44CFR206

LINN COUNTY PLANNING AND BUILDING DEPARTMENT
Steve Michaels, Director

Room 114, Linn County Courthouse
PO 100 Box, Albany, Oregon 97321
Phone 541-967-3816, 1-800-319-3816
Fax 541-926-2060 www.co.linn.or.us

PRESS RELEASE

FOR IMMEDIATE PUBLICATION

Linn County Receives Grant for Natural Hazard Mitigation Planning

The Linn County Board of Commissioners has approved an agreement with the Oregon Partnership for Disaster Resilience (OPDR) to update the Linn County Natural Hazard Mitigation Plan. The Hazard Mitigation Plan update will address chronic natural hazards such as floods, severe winter storms, windstorms, landslides, and wildfires, as well as catastrophic hazards such as earthquakes and volcanoes.

The County's Natural Hazard Mitigation Plan identifies goals, actions items and resources designed to reduce risk and lessen impacts from future natural disaster events. Mitigation activities identified in the plan are intended to provide a number of benefits, including reduced loss of life, property, essential services, and critical facilities; reduced economic hardship; reduced short-term and long term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased eligibility for state and federal funding for recovery and reconstruction projects.

Federal rules require the County to have an approved natural hazards mitigation action plan to qualify for pre-disaster hazard mitigation grants. The Linn County Natural Hazard Mitigation Plan was adopted in 2005 and is due for its 5 year update by November 2010. The plan will also qualify the county to receive certain post-disaster relief funds in the event a natural disaster occurs.

The project is funded by a $20,000 grant through the federal Pre-Disaster Mitigation Competitive Grant Program for pre-disaster mitigation planning and projects addressing natural hazards. The county is contributing an additional $7,000 in matching funds. The grant program is administered by the University of Oregon on behalf of the Community Service Center (Partnership for Disaster Resilience).

The County is asking for the public's input in the planning process by taking an on-line household preparedness survey. Please visit http://opdr.uoregon.edu/mitigation/current/region3updates to take the Linn County household preparedness survey. Anyone who is interested in participating in the process and would like additional information is asked to contact Olivia Glantz at the Linn County Planning and Building Department at 541-967-3816.

PRE-DISASTER MITIGATION

Valley residents can take part in online survey

BY ALEX PAUL
ALBANY DEMOCRAT-HERALD

Mid-valley residents are invited to participate in a online household preparedness survey as part of a larger natural hazard mitigation planning program, according to Robert Wheeldon, director of the Linn County Planning and Building Department.

Starting today, families can complete the survey at http://opdr.uoregon.edu/mitigation/current/region3updates. The survey will be online for one month.

Linn County has received a $20,000 grant from the Pre-Disaster Mitigation Competitive Grant Program to help pay for a long-term pre-disaster mitigation plan. The county will add $7,000. The current plan, developed in 2005, can be found at the county's website www.co.linn.or.us.

"We are required to update the plan every five years," Wheeldon said. "It's important. It helps us identify what the risks are from things such as floods, windstorms, landslides, wildfires, or earthquakes."

The goal, Wheeldon added, is to be able to mitigate such catastrophes by having programs in place concerning transportation, communication and available facilities.

"I think we're actually going to find that we have done many of the things identified as needs in the last plan," Wheeldon said. "For example, we have a community wildfire protection plan in place."

Having a plan in place may help reduce the loss of life, property or services and decrease economic hardships.

The plan must be completed by November. Having a plan in place qualifies the county for post-disaster relief funds in the event of a natural disaster.

"We hope to identify items that might be helpful that aren't on the current list," Wheeldon said.

In addition to Wheeldon, members of the local steering committee include: Steve Barnett, Linn County GIS manager; Mike Beaver, Linn County Fire Defense Board; Brian Carroll, Linn County Parks and Recreation director; John Hixson, Linn County building official; Jim Howell, Linn County Emergency Management Coordinator; Chuck Knoll, Linn County Road Engineer; Darrell Tedisch, Albany Emergency Management Specialist; Mary VanAgtmael, Linn County Planning Commissioner. Project manager is Olivia Glantz, assistant planner.

Albany Democrat-Herald

Linn County Pre-Disaster Mitigation Planning
PRESS RELEASE

DATE: July 20, 2010
TO: Linn County Public Information Offices
CC:
FROM: Linn County Planning and Building Director
SUBJECT: Press Release for Linn County Pre-Disaster Mitigation Plan Update – Notice and Opportunity for Public Comment

For Immediate Release

Linn County seeks public input on update to
Multi-Jurisdictional Natural Hazards Mitigation Plan

(Albany, OR) – Linn County is currently in the process of updating the existing multi-jurisdictional Natural Hazards Mitigation Plan. This work is being performed in cooperation with the Oregon Partnership for Disaster Resilience and Oregon Emergency Management utilizing funds obtained from the Federal Emergency Management Agency (FEMA) Pre-Disaster Mitigation Grant Program. With re-adoption of the plan, Linn County will maintain its eligibility to apply for federal funding towards natural hazard mitigation projects.

A natural hazards mitigation plan provides communities with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects. A draft version of the updated Linn County Natural Hazards Mitigation Plan will be available for public comment between July 20 and August 24, 2010. Copies of the plan will be available on the Linn County.

If you have any questions regarding the Linn County Natural Hazards Mitigation Plan or the update process in general, please call Oilvia Glantz, Planner at (541) 967-3816 X 2368 or email at oglantz@co.linn.or.us .

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Wire reports

Associated Press

plane that crashed

Jennifer Ann Rivelli, 34, of Brownsville was arrested Saturday on charges of first-degree sex abuse and unlawful sexual penetration. She was arraigned Monday and posted security that day.

The charges stem from an alleged February 2008 incident involving a 14-year-old girl known to Rivelli.

LINN COUNTY SHERIFF

Domestic arrest — At about 8 p.m. Tuesday, dispatch received a 911 hangup from the 41700 block of Kingston-Jordan Drive. A deputy investigated and determined a couple were going through a divorce and were fighting about that and the husband took the phone away from the wife and broke it when she tried to call law enforcement. He also allegedly physically threw the woman out of the house. She landed on her buttocks and said she was OK. Children were present.

Jeffrey Keith Bethel, 32, of Stayton, was arrested on charges of felony fourth-degree domestic assault, domestic abuse – harassment and interfering with making a report. He was lodged at Linn County Jail and was expected in circuit court today.

Target practice — An off-duty deputy was hunting nutria at about 6:30 p.m. Tuesday in the 38800 block of Santiam Highway when he says, bullets started "zinging" past him. Another deputy checked the area and found two men shooting several firearms with an inadequate backstop. The men were cited and released for reckless endangering.

SWEET HOME POLICE

Windows shattered — At about 6:35 a.m. Tuesday, a resident in the 1600 block of Elm Street called police saying someone just broke her sliding glass door and another window. An officer responded but didn't locate the vandal. A report was taken for first-degree criminal mischief.

LOTTERIES

MEGA MILLIONS (Tue.)
2-7-10-16-29
Megaball 8
Mega Multiplier 4

OREGON PICK 4 (Tue.)
1 p.m., 6-0-5-9
4 p.m., 4-7-0-4
7 p.m., 7-0-8-6
10 p.m., 8-7-2-8

OREGON LUCKY LINES (Tue.)
3-8-9-15-17-22-27-30

on the north side of the Jamboree festival site at 1641 Long St.

Admission is free.

horses and old barns. Her works are available in large, framed sizes, or as cards.

Richard Armstrong of

you deeply and compels you to move ... to touch it, look at it, and appreciate something within yourself."

Hazard plan draft available

A draft version of the updated Linn County Natural Hazards Mitigation Plan is available for public viewing and comment on the Linn County website http://www.co.linn.or.us/ through Tuesday, Aug. 24.

Copies of the plan will be available on the Linn County website.

Linn County is updating the existing multi-jurisdictional Natural Hazards Mitigation Plan.

This work is being performed in cooperation with the Oregon Partnership for Disaster Resilience and Oregon Emergency Management utilizing funds obtained from the Federal Emergency Management Agency Pre-Disaster Mitigation Grant Program.

With re-adoption of the plan, Linn County will maintain its eligibility to apply for federal funding towards natural hazard mitigation projects. A natural hazards mitigation plan provides communities with a set of goals, action items, and resources designed to reduce risk from future natural disaster events.

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

If you have any questions regarding the plan or the update process in general, call county planner Oilvia Glantz at 541-967-3816, extension 2368 or email at oglantz@co.linn.or.us .

Democrat-Herald

Albany Democrat-Herald

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Advertising: ads@dhonline.com
News: news@dhonline.com
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Telephone numbers
Classified ..... (541) 812-6112
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All other departments ..... (541) 926-2211
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News FAX ..... (541) 926-4799

Supervisory Personnel
Martha Wells ..... Publisher
Hasso Hering ..... Editor
Karen Petersen ..... City Editor
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Albany Democrat Herald
Wed 7/28/10 PG A-2

LINN COUNTY PLANNING AND BUILDING DEPARTMENT

Robert Wheeldon, Director

Room 114, Linn County Courthouse
PO Box 100, Albany, Oregon 97321
Phone 541-967-3816, 1-800-319-3816
Fax 541-926-2060 www.co.linn.or.us

NOTICE IS HEREBY GIVEN that on **August 10, 2010 at 7:00 p.m.** in the Old Armory Building on the corner of 4th Avenue and Lyon Street, Albany Oregon a public meeting will be held before the **Linn County Planning Commission** (Commission). The meeting is to afford interested parties an opportunity to be heard on the following matter. The Commission will make a recommendation on this matter to the Board.

SUMMARY: The purpose of the meeting is to discuss the update of the Natural Hazards Pre-Disaster Mitigation Plan for rural Linn County. The mitigation plan addresses the natural hazards such as floods, severe winter storms, windstorms, landslides, drought and wildfires, as well as catastrophic hazards such as earthquakes and volcanoes. The purpose of the natural hazards mitigation plan is to protect life and property and reduce damages resulting from natural disasters by reducing vulnerability to natural hazard risks. The updated mitigation plan will identify cost-effective hazard mitigation activities and projects that would reduce the impacts of natural disasters in rural Linn County. Linn County approved a natural hazard mitigation plan in November 2005. Federal rules require the county to update the natural hazards mitigation action plan every five years to qualify for pre-disaster hazard mitigation grants. The plan will also qualify the county to receive certain post-disaster relief funds when a natural disaster occurs. The Linn County Natural Hazard Mitigation Steering Committee has updated the 2005 Natural Hazard Mitigation plan, through a series of public workshops over the past 6 months. The Planning Commission will review and take comments from the public on the updated document and make a recommendation to the Board of Commissioners. The Board of Commissioners will present the completed hazards mitigation plan to FEMA for review and approval in the fall of 2010. The plan can be viewed on the county website at http://www.co.linn.or.us/ under the announcements.

COMMENTS:_____

_____

_____

BY _____ **AGENCY (IF ANY)**_____ **DATE**_____

==========

STAFF CONTACT PERSON: Olivia Glantz; (541)967-3816, ext.2368

LINN COUNTY		STATE OF OREGON			OTHER
x EHP	x Sheriff	_ DEQ	x ODOT/OSHD	x ODFW	x School All
x Parks	x Bldg. Off./Flood	x DOGAMI	x ODSF		x Landowners
x Assessor	x Roads	x DSL	x DLCD		x City of Albany, Brownsville, Gates, Halsey
x GIS	x Surveyor	_ Water	_ Parks		Harrisburg, Idanha, Lebanon, Lyons
x RFPD All R/F		x State Fire Marshal	x Other FEMA, Oregon Showcase		Mill City, Millersburg, Scio, Sodaville
					Sweet Home, Tangent, Waterloo

LINN COUNTY
OREGON

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Employment

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Maps (GIS)

Linn County Fair

Linn County is dedicated to serving the needs of the public. This site contains meeting calendars, agendas, office contact information, regulations, maps and air photos, as well as email addresses for the Commissioners. Let us hear from you - We appreciate citizen input and comments.

Enjoy the web site. We are here to serve you!

Hot Topics and Alerts

- none at this time

Announcements

Idanha recall election results

Youth Wage Grant

- Application
- Fact Sheet
- Reimbursement Form
- http://www.oregon.gov/BOLI/
- http://www.uscis.gov/files/form/I-9.pdf

The Linn County Board of Commissioners with assistance from the Oregon Partnership for Disaster Resilience (OPDR) is updating the Linn County Natural Hazard Mitigation Plan. The Hazard Mitigation Plan update will address chronic natural hazards such as floods, severe winter storms, windstorms, landslides, and wildfires, as well as catastrophic hazards such as earthquakes and volcanoes. You are invited to provide comments on the draft plan.

> The Linn County Natural Hazard Document can be obtained here.
>
> Interested parties may submit comments on the Linn County Natural Hazard Mitigation Plan, by clicking on the following link: comment. Comments can also be mailed to PO Box 100, Rm 114, Albany Or.

H1N1 (Influenza) Information and Updates

Visit Linn!!!! Visitor information available at the Linn County Fair and Expo Center. The Kiosk is located in the main lobby.

Floodplain Viewer – Search by address or tax lot to compare FEMA's current and proposed floodplain.

Linn County Feral Cat Sterilization Program - Grant Agreement

Linn County Government departments are open to serve the public, unless announcements to the contrary are made.

> **Courthouse Closure Notification:** Local radio stations that the County will notify if we have to close or otherwise modify the County operating hours are:
>
> - KLOO AM 1340
> - KRKT 99.9 FM

LINN COUNTY PLANNING AND BUILDING DEPARTMENT
Robert Wheeldon, Director

Room 114, Linn County Courthouse
PO 100 Box, Albany, Oregon 97321
Phone 541-967-3816, 1-800-319-3816
Fax 541-926-2060 www.co.linn.or.us

Memorandum

To: John Hixson, Building Official
Darrin Lane, Road Master
Chuck Knoll, County Engineer
Russ Williams, General Services Director
Steve Barnett, GIS Manager
Brian Carroll, Parks Director
Jim Howell, Emergency Management Coordinator
Ralph Wyatt, CAO
George Crosiar, State Fire Marshall
Linn County Fire Defense Board
Linn-Benton Educational Services District

From: Olivia Glantz, Assistant Planner

Date: 01/04/2010

Re: Linn County Natural Hazard Mitigation Plan 2010 update

The Linn County Planning and Building Department together with Linn County Emergency Management needs your help.

Federal rules require the County to have an approved natural hazard mitigation action plan. A hazard mitigation plan is required for the County to receive pre-disaster hazard mitigation grants and certain post-disaster relief funds in the event a natural disaster occurs.

The Linn County Natural Hazard Mitigation Plan was adopted in November 2005. The five-year update of the Plan is due by November 2010.

The hazard mitigation plan includes a matrix of identified hazard mitigation action items. A copy of the action item matrix is enclosed. Please review the list of action items and let us know if you are aware of any items that have been accomplished or are in progress.

You will also receive an email asking you to take an online stakeholders survey as part of the plan update process. Please take the time to take the survey as it will help in creating a complete update of this document.

If you have any questions please feel free to contact Olivia Glantz at 541-967-3816 X 2368, or at **oglantz@co.linn.or.us**.

Thank you,

LINN COUNTY PLANNING AND BUILDING DEPARTMENT
Robert Wheeldon, Director

Room 114, Linn County Courthouse
PO 100 Box, Albany, Oregon 97321
Phone 541-967-3816, 1-800-319-3816
Fax 541-926-2060 www.co.linn.or.us

Memorandum

To: Linn County Cities

From: Olivia Glantz, Assistant Planner

Date: 01/22/2010

Re: Linn County Natural Hazard Mitigation Plan 2010 update

Linn County is updating its Natural Hazard Mitigation Plan (NHMP). The NHMP identifies goals, action items and resources designed to reduce risk and lessen impacts from future natural disaster events. The Linn County NHMP was adopted in 2005 in compliance with the Disaster Mitigation Act of 2000 and is due for its five year update by November 2010.

A city must have a FEMA-approved Hazard Mitigation Plan or adopt an addendum to the Linn County NHMP to be eligible for FEMA's Pre-Disaster Mitigation Grant program, which provides funding for pre-disaster risk reduction activities, or for FEMA's Hazard Mitigation Grant Program, which provides funding for post-disaster risk reduction activities. Developing a city addendum to the County's mitigation plan requires less work than creating a separate stand-alone plan and would bring the city into compliance with the Disaster Mitigation Act.

The purpose of this memorandum is to invite you to participate in the County's NHMP update and to make you aware of an opportunity for your city to obtain training and assistance in developing a hazard mitigation plan or addendum for your jurisdiction.

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center is conducting a series of four training sessions to assist local governments in updating or developing their hazard mitigation plans. The first training session will be held on **Thursday, January 28, 2010, beginning at 1:00 p.m. at the Marion County Public Works Building, 5155 Silverton Road NE, in Salem**.

The Linn County NHMP Steering Committee will convene immediately following the training session to begin the plan update process. You are invited to attend both the OPDR training session and the Steering Committee meeting. The training session begins at 1:00 p.m. and the Steering Committee meeting is scheduled to adjourn at 4:30 p.m. By participating in two work sessions with the County Steering Committee, the City can complete three of the four requirements under the Disaster Mitigation Act.

Technical assistance and funding to help you develop a hazard mitigation plan or addendum may be available to your jurisdiction from the OPDR through a FEMA Pre-Disaster Mitigation Planning Grant. For more information on technical assistance and available funding please contact Josh Bruce, OPDR Project Director, at jdbruce@uoregon.edu or 541-346-7326.
We will also be sending you an email asking you to take an online stakeholders survey as part of the plan update process. Please take the time to take the survey as it will help in creating a complete update of this document.

If you have any questions please feel free to contact Olivia Glantz at 541-967-3816 X 2368, or at **oglantz@co.linn.or.us**.

Thank you,

Olivia Glantz
Assistant Planner

C: Albany
Brownsville
Gates
Halsey
Harrisburg
Idanha
Lebanon
Lyons
Mill City
Millersburg
Sodaville
Scio
Sweet Home
Tangent
Waterloo

LINN COUNTY PLANNING AND BUILDING DEPARTMENT
Robert Wheeldon, Director

Room 114, Linn County Courthouse
PO 100 Box, Albany, Oregon 97321
Phone 541-967-3816, 1-800-319-3816
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Agenda

To: Linn County Steering Committee
Steve Barnett, Linn County GIS Manager
Mike Beaver, Linn County Fire Defense Board (Sweet Home Rural Fire)
Brian Carroll, Linn County Parks and Recreation Director
David Furtwangler, Linn County Planning Commissioner
John Hixson, Linn County Building Official
Jim Howell, Linn County Emergency Management
Chuck Knoll, Linn County Road Department
Darrel Tedisch, City of Albany Emergency Management Specialist
Mary VanAgtmael, Linn County Planning Commissioner
Robert Wheeldon, Linn County Planning and Building Director

From: Olivia Glantz, Assistant Planner

Date: 01/28/2010

Re: Linn County Natural Hazard Mitigation Plan 2010 update

- Review Public Participation Options
- Discuss the process and how to proceed to update the Linn County Natural Hazard Mitigation Plan
- Review of Hazard Assessments
- Work Plan

If you have any questions please feel free to contact Olivia Glantz at 541-967-3816 X 2368, or at **oglantz@co.linn.or.us**.

LINN COUNTY PLANNING AND BUILDING DEPARTMENT

Robert Wheeldon, Director

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Phone 541-967-3816, 1-800-319-3816
Fax 541-926-2060 www.co.linn.or.us

Minutes

Date: 02/10/2010

Re: Linn County NHMP 2010 update – January 28, 2010 meeting

The next training session and Committee meeting is scheduled for March 3, 2010 from 1:00 p.m. to 4:30 p.m. at the Linn County Fair and Expo Center, Conference Rooms.

Prior to the March 3rd meeting, the Steering Committee will review the Hazard Profile, Vulnerability Assessment and Risk Analysis sections of the following hazard chapters for which you would like to provide comments, updates or proposed edits:

Flood Hazard Assessment	Pages: 6-10 through 6-16
Landslide Hazard Assessment	Pages: 7-11 through 7-16
Wildfire Hazard Assessment	Pages: 8-6 through 8-11
Severe Weather Risk Assessment	Pages: 9-5 through 9-14
Earthquake Risk Assessment	Pages: 10-4 through 10-14

Written comments, updates and edits will be discussed at the March 3rd meeting.

Public Involvement strategy:

The Steering Committee identified several opportunities to involve the public in the process. Those opportunities include a press release explaining the hazard mitigation plan project, conducting a Household Survey, publish the Linn County Natural Hazard Plan on the Linn County Website with a request for public comments and a stakeholder's survey.

Work Plan:

The work plan is to be consistent with the attached time table provided by Oregon partnership.

Key Dates: March 3, 2010 – Second Steering Committee Meeting and Training

April 14, 2010 – Third Training Session with Steering Committee Meeting to be scheduled

May 3, 2010 (week of) – Fourth Training Session and Steering Committee Meeting to follow or to be scheduled.

June 7, 2010 (week of) – Complete update

Cities:

The Planning and Building Department sent a memo on January 22, 2010 to all 15 cities located within Linn County. The memo invited each city to participate in the County's plan update process and provided the cities with contact information to develop a city addendum. A follow-up email to all cities was sent on January 29, 2010 providing information to contact Oregon Partnership for Disaster Resilience to obtain assistance in developing an addendum.

Y28

January 28th, 2010 Steering Committee Mtg

Name	Agency	Email	Phone
Chuck Knoll	Linn Co Road	cknoll@co.linn.or.us	967-39
Dave Furtwangler	Linn Co Planning Comm Cascade Timber	dfurtwangler@cascadetimber.com	
Brian Carroll	Linn Co. Parks	bcarroll@co.linn.or.us	541 367-21 967-3917 (ext:2
JOHN S. HIXSON	PLANNING & BUILDING.	JHIXSON@CO.LINN.OR.US.	
Cliff Wooten	Scio Planning Comm	cliffjean6@smt-net.com	503-394-308
Carolyn Neve	Scio Planning Com	cneve@smt-net.com	503-394-29
Karla Caudell	City of Halsey	karla@cityofhalsey.com	541-331-53
Ryan Taylor	City of Scio / Mill City	rtaylor352@yahoo.com	805 291 6495
Steve Barnett	Linn Co	sbarnett@co.linn.or.us	541-924-6903
Mary M. VanAgtmael	Scio Plan Comm/ Linn Co. Plan/ Scio/Constituee RFPO Cert	maryv@smt-net.com	503 394-2453 o 503 394-3224 home 503 932-3531 cell
Mike Beaver	Linn Co. Fire Defense	mbeaver@centurytel.net	541-367-5882 wa
Georgia Edwards	City of Tangent	georgia@cityoftangent.org	541-928-10
Jim Howell	Linn County Emergency mgt	jhowell@le.linn.or.us	541-967-39
Brady Harrington	city of Sodaville	sodavillemayor@gmail.com	541-258-8882

TOPS 35500

LINN COUNTY PLANNING AND BUILDING DEPARTMENT
Robert Wheeldon, Director

Room 114, Linn County Courthouse
PO 100 Box, Albany, Oregon 97321
Phone 541-967-3816, 1-800-319-3816
Fax 541-926-2060 www.co.linn.or.us

STEERING COMMITTEE MEETING AGENDA

March 3, 2010

1. INTRODUCTION:

The purpose of this Steering Committee meeting is to review the Hazard Profile, Vulnerability Assessment and Risk Analysis sections of the following hazard chapters for which you would like to provide comments, updates or proposed edits:

Flood Hazard Assessment	Pages: 6-10 through 6-16
Landslide Hazard Assessment	Pages: 7-11 through 7-16
Wildfire Hazard Assessment	Pages: 8-6 through 8-11
Severe Weather Risk Assessment	Pages: 9-5 through 9-14
Earthquake Risk Assessment	Pages: 10-4 through 10-14

Hazard Identification:

- Are there any newly identified hazards that need to be incorporated in to the plan?
- What new hazard events occurred in the past five years or that were not included in the 2005 plan?
- Is there any additional information or plans that can assist the Steering Committee in updating the plan? ie Community Wildfire Protection Plan
- Are there new probability assessments that can be incorporated into the risk assessment?

Vulnerability Assessment:

- Any information of number and type of existing and future buildings, infrastructure, and critical facilities in hazard areas?

- New buildings?

- Potential impacts of future land development?

- Potential dollar losses?

Risk Analysis:

- Comments and Concerns on the risk analysis portions of the plan?

2. QUESTIONS/COMMENTS –

3. NEXT MEETING: Training - April 14, 2010 from 1pm – 5pm, located in Benton County
Schedule Steering Committee Meeting

Stage 3 of the update process is to review the mitigation strategy.

- Identify new mitigation action items
- Review existing mitigation actions items, do they need to be deleted or deferred in the update? Have they been completed?
-

On pages 31-38 of the *Natural Hazard Mitigation Plan Updates: How-to Guide* is guidance for these tasks.

Have the goals of the mitigation plan changed?

Goal #1: Enhance coordination and communication among Linn County stakeholders to implement the Plan

Goal #2: Protect life, the built environment and natural systems through County policies, procedures and services

Goal #3: Protect life, the built environment, the economy and natural resources through community-wide partnerships

I will have the revisions submitted in today's meeting to each member prior to the April meeting for review and approval.

4. GRANT BILLING

Please fill out the attached timesheet with any time you spent working on reviewing the chapters since the January 28th meeting and any supply cost you may have encored. Remember, this is for the "matching funds" need from the County for the Grant.

LINN COUNTY PLANNING AND BUILDING DEPARTMENT

Robert Wheeldon, Director

Room 114, Linn County Courthouse
PO 100 Box, Albany, Oregon 97321
Phone 541-967-3816, 1-800-319-3816
Fax 541-926-2060 www.co.linn.or.us

Minutes

Date: 03/15/2010

Re: Linn County NHMP 2010 update – March 3, 2010 meeting

The next training session and Committee meeting is scheduled for April 14, 2010 from 1:00 p.m. to 4:30 p.m. The location will be in Benton County and has not been determined at this time.

The Steering Committee decided to review, edit the following sections and submit comments/edits to Olivia Glantz no later than **March 17th, 2010**. The Steering Committee will review the Hazard Profile, Vulnerability Assessment and Risk Analysis sections of the following hazard chapters for which you would like to provide comments, updates or proposed edits:

Flood Hazard Assessment	Pages: 6-10 through 6-16
Landslide Hazard Assessment	Pages: 7-11 through 7-16
Wildfire Hazard Assessment	Pages: 8-6 through 8-11
Severe Weather Risk Assessment	Pages: 9-5 through 9-14
Earthquake Risk Assessment	Pages: 10-4 through 10-14

Staff will compile all comments and edits of the above sections and have drafts for review no later than April 14th, 2010.

Phase 3:

After reviewing the Risk Assessment sections and forwarding the comments and edits to me, you have been asked to review the mitigation strategy of the plan.
The Mitigation strategy can be found in each section:

Flood Hazard Mitigation Programs	Page 6-16 – 6-19
Landslide Mitigation Programs	Page 7-20 – 7-23
Wildfire Mitigation Programs:	Page 8-15 – 8-20
Severe Weather Mitigation Program:	Page 9-14 – 9-15
Earthquake Mitigation Program:	Page 10-17 – 10-22

Work Plan:

The work plan is to be consistent with the attached time table provided by Oregon partnership.

Key Dates: April 14, 2010 – Third Training Session located in Benton County

April 15, 2010 - Steering Committee Meeting 1:00pm at the Linn County Basement Conference Room

May 3, 20 (week of) – Fourth Training Session and Steering Committee Meeting to follow or to be scheduled.

June 7, 2010 (week of) – Complete update

Attendance:

Steve Barnett, Linn County GIS Manager
Mike Beaver, Linn County Fire Defense Board (Sweet Home Rural Fire)
Brian Carroll, Linn County Parks and Recreation Director
David Furtwangler, Linn County Planning Commissioner
John Hixson, Linn County Building Official
Chuck Knoll, Linn County Road Department
Darrel Tedisch, City of Albany Emergency Management Specialist
Mary VanAgtmael, Linn County Planning Commissioner
Robert Wheeldon, Linn County Planning and Building Director
Karen Corrington, City of Sodaville
Seaton McLennan, City of Tangent
Georgia Edwards, City of Tangent

Steering Committee Meeting
March 3, 2010
Linn County Fair and Expo

Name	Address	Phone	Email
Karen Corrington City of Sodaville	30723 Sodaville Rd Lebanon, OR 97355	(541) 258-8882	sodaville@ centurytel.net
Brian Carroll Linn County	3010 Ferry St SW Albany, OR 97322	(541) 967-3917 x-2950	BCarroll@co.linn.or.us
Steve Barnett Linn County	~~[illegible]~~ PO Box 100 Albany OR 97321	541 924-6963	Sbarnett@co.linn.or.us
Mike Beaver Linn Co. Fire Defense	1099 Long St. Sweet Home Or 97386	(541) 367-5882	mbeaver@centurytel.net
Dave Furtwangler Planning Comm.	PO Box 446 Sweet Home, OR 97386	541 367-2111	dfurtwangler@cascadetimber.co
Mary M. Van Agtmael Linn Co. Plan. Comm	P.O. Box 122 Scio OR 97374	(503) 394-2453 off 394-3224 hm	maryv@smt-net.com
John S. Hixson LINN COUNTY	P.O. Box 100 ALBANY OR 97321	541 967-3816	JHixson@co.linn.or.us.
* SEATON MCLENNAN TANGENT	P.O. Box 257 TANGENT	541 926-9790	S.mclennan@ comcast.net
* Georgie Edwards Tangent	P.O. Box 251 Tangent, OR 97389-0251	541 928-1020	georgia@cityoftangent.org

* please include us ~~at~~ as attending this meeting in your minutes + please send us (email) a copy of the minutes of this meeting. Also please include us in any other mailings for this Steering committee

LINN COUNTY PLANNING AND BUILDING DEPARTMENT
Robert Wheeldon, Director

Room 114, Linn County Courthouse
PO 100 Box, Albany, Oregon 97321
Phone 541-967-3816, 1-800-319-3816
Fax 541-926-2060 www.co.linn.or.us

STEERING COMMITTEE MEETING AGENDA

April 15, 2010

1. INTRODUCTION:

The purpose of this Steering Committee meeting is to review the existing mitigation action items and identify new action items for the following hazards:

Flood Hazard

Landslide

Wildfire Hazard

Severe Weather

Earthquake Risk

Drought

Discuss the status of each action item. Are there any new action items that need to be added to the plan?

2. Dot Prioritization activity.

3. QUESTIONS/COMMENTS –

4. NEXT MEETING: Training - Schedule Steering Committee Meeting

4. GRANT BILLING

Please fill out the attached timesheet with any time you spent working on reviewing the chapters since the March 3rd meeting and any supply cost you may have encored. Remember, this is for the "matching funds" need from the County for the Grant.

LINN COUNTY PLANNING AND BUILDING DEPARTMENT

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Minutes

Date: 05/03/2010

Re: Linn County NHMP 2010 update – April 15, 2010 meeting

The Steering Committee reviewed the existing mitigation action items for the following hazards:

Flood Hazard	**Severe Weather**
Landslide	**Earthquake Risk**
Wildfire Hazard	**Drought**

Each Action item was deferred, completed or deleted. The Steering Committee agreed on the final deferred action items, the status of action items that were in progress or completed were discussed and will be reflected in the update.

New Action Items:

The Steering Committee decided to prepare new action item forms and email to Olivia no later than April 29th, 2010. The action items will then be consolidated and distributed to all Steering Committee members for review before the next meeting on May 5th, 2010.

Dot Prioritization activity:

The Steering Committee participated in a dot prioritization activity to determine the ranking for the Hazards in the plan and ranking of the goals for the Linn County Natural Hazard Mitigation Plan.

The work plan is to be consistent with the attached time table provided by Oregon partnership.

Key Dates: May 5, 2010 –Training Session with Steering Committee Meeting to follow

May or June – Steering Committee Meeting?

June 7, 2010 (week of) – Complete update

Attendance:

Steve Barnett, Linn County GIS Manager
Mike Beaver, Linn County Fire Defense Board (Sweet Home Rural Fire)
David Furtwangler, Linn County Planning Commissioner
John Hixson, Linn County Building Official
Chuck Knoll, Linn County Road Department
Darrel Tedisch, City of Albany Emergency Management Specialist
Mary VanAgtmael, Linn County Planning Commissioner
Robert Wheeldon, Linn County Planning and Building Director
Seaton McLennan, City of Tangent
Georgia Edwards, City of Tangent

April 15th, 2010 - LC Steering Committee Meeting

1pm-3pm

Name	Email	Phone	Agency
Olivia Glunt			
Cliff Wooten	cliffjean@smt-net.com	503-394-3089	Scio Planning
Darrel Tedisch	darrel.tedisch@cityofalbany.net	541-917-7725	City of Albany
Georgia Edwards	georgia@cityoftangent.org	541-928-1020	Tangent
Seaton McLennan	s.mclennan@comcast.net	"	"
Jim Howell	jhowell@le.linn.or.us	541-9673954	LCSO
ROBERT WHEELDON			
Mary McVaughtmaes			
Steve Bacigalupi	sbacigalupi@co.linn.or.us	541 924-6903	Linn County GIS
Mike Beaver		541-367-5882	Linn Fire Defense Board
JOHN SHIRSON			
Dave Furtwangler	dfurtwangler@cascadetimber.com	541 367-2111	Linn Planning Commn
C Luck Knoll	—	—	—

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Fax 541-926-2060 www.co.linn.or.us

STEERING COMMITTEE MEETING AGENDA

May 5, 2010

1. INTRODUCTION:

The purpose of this Steering Committee meeting is to discuss new mitigation action items for the following hazards:

Flood Hazard

Landslide

Wildfire Hazard

Severe Weather

Earthquake Risk

Drought

Discuss the status of each action item, previously submitted and any action items proposed at the meeting.

2. Schedule Next Meeting.

3. Goal 4 of the Linn County Natural Hazard Mitigation Plan

4. QUESTIONS/COMMENTS –

5. GRANT BILLING

Please fill out the attached timesheet with any time you spent working on the Linn County Natural Hazard Mitigation Plan since the April 15th meeting. Remember, this is for the "matching funds" need from the County for the Grant.

LINN COUNTY PLANNING AND BUILDING DEPARTMENT

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Minutes

Date: 06/10/2010

Re: Linn County NHMP 2010 update – May 5, 2010 meeting

The Steering Committee discussed and approved new mitigation action items for the following hazards:

Flood Hazard	**Severe Weather**
Landslide	**Earthquake Risk**
Wildfire Hazard	**Drought**

The Steering Committee decided to remove the previously discussed Goal 4 of the Linn County Natural Hazard Mitigation Plan

Staff requested the timesheets for those on the Steering Committee.

The next Steering Committee Meeting was scheduled for July 29th, 2010 to review the final draft document to recommend to the Planning Commission for review.

Key Dates: July 29, 2010 – Steering Committee Meeting

August 10, 2010 – Draft NHMP public hearing with Planning Commission

Attendance:

Mike Beaver, Linn County Fire Defense Board (Sweet Home Rural Fire)
David Furtwangler, Linn County Planning Commissioner
John Hixson, Linn County Building Official
Chuck Knoll, Linn County Road Department
Darrel Tedisch, City of Albany Emergency Management Specialist
Mary VanAgtmael, Linn County Planning Commissioner
Robert Wheeldon, Linn County Planning and Building Director

May 5, 2010 Steering Committee

Name	Department	Phone
JOHN HIXSON	LC. BUILDING	541 967 3816
Chuck Knoll	LC Road Dept	541 967 3919
Darrel Tedrick	City of Albany	541-917-7725
Mike Beaver	Linn County Fire Defense	541-367-5882
Dave Fortwangler	Linn County Planning Comm	541-367-2111
Mary McVanel Grimes	Linn Co. Plan	503 394-2453
Robert Wheeldon	Linn County Planning	541-967-3816

New action items

1. Provide a County Wide List and Evaluate for Flood, Scour, and Seismic and Structural Integrity all Bridge Crossings on Private and Public Lands. Complete a status list of each bridge and post the bridge accordingly for use by emergency response as appropriate. Implement a routine bridge inspection program for these bridges to ensure this status list stays current and bridges are kept safe.
   - Lead Organization - Fire Marshall
   - Technical Support - Linn County Engineer (as funding allows)
   - Partners - Private Landowners, Public Landowners (potential or primary Source of funding by State fire code.)

   Note: Currently there is not any such list. Also, private bridges are required to be inspected once per year under current state fire code. This is not occurring. A death occurred with a bridge failure in the Cascadia Area in about 2000.

2. Complete a County Wide Reassessment of the Linn County Flood Maps using current Topographical maps, and current engineering and GIS technology for hydraulic modeling of flood events. Incorporate recent improvements to roads and bridges that would have provided mitigation for flooding.
   - Lead Organization - Linn County Planning
   - Partner - Technical Support and Engineering - County Engineer (As funding Allows)
   - Partner - Linn County Surveyor (As funding allows)
   - Partner - GIS Department (As funding allows)

3. Implement a Scour Protection Plan for Linn County Bridges.
   - Lead Organization - Linn County Engineer and staff
   - Partner - Bridge Maintenance Supervisor

Proposed Action Item Identification:

ST: 3.1.1 Needs to be a short term action item proposed under Sodaville Addendum to the Linn County Mitigation Plan, Goal 1, Objective 1.

Proposed Action Title/Description:

Acquire a new water source and install the needed piping from new well to 6" water feed line located at Well #4.

Rationale for Proposed Action Item:

- City of Sodaville Addendum lists the acquiring another water source to eliminate the need to haul in water from other sources to meet basic household water needs of citizens during summer months. The current 5 wells all drop off in water production in the summer months when the water table drops. 4 of the 5 wells are located in the same aquifer. Engineering, Well Drillers, and the State of Oregon Water Resources have all informed use we should drill a new well in an area other than the area that the current 5 wells are located.
- The City of Sodaville has had to put water customers on Household Use Only water restrictions for several years now. We have water hauled in to supplement the water supply, just to maintain basic household needs.
- The City of Sodaville is in the Linn Rural Fire District. We have a 150,000 gallon water tank. If a fire breaks out the Fire Departments Pump truck is dispatched, which carries 3200 to 4000 gallons of water. The City has Fire Hydrants installed, but we have limited supply, so Fire Protection is minimal at best.
- The City of Sodaville in located in an area which has large groves of trees and surrounded by forest type areas. The City is a multi elevation area, which makes fire a hazard, as fir always runs up.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community. Developing and implementing programs to reduce the potential for Wild Fires can assist the City in mitigating its overall risk to the community.

Ideas for Implementation:

- Location area for a new well has already been determined.
- Engineering has been hired and a preliminary plan has been drafted.
- Estimated Cost Analysis has been completed.
- Acquire funding through Grants/Loans.

Coordinating Organization:	**City of Sodaville City Council**

Internal Partners:	**External Partners:**	
Sodaville Water Utility	Kirby & Crawford Inc. Oregon Water Resources United Pipe	Nuggent Well Drilling Oregon Dept. of Water Bid Selected Contractor

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	**$650,000.00**
ASAP		

Proposed Action Item Identification:		
LT: 3.2.1 This will be a Long Term and ongoing action item proposed under Sodaville Addendum to the Linn County Mitigation Plan, Goal 2, Objective 1.		
Proposed Action Title/Description:		
Develop partnerships to implement programs to reduce heavy undergrowth in treed areas, and reduce the amount of noxious vegetation which could aid in wildfire fuels.		
Rationale for Proposed Action Item:		
• City of Sodaville Addendum lists Wild Fire as a threat to life, and property. • The City of Sodaville is in the Linn Rural Fire District. We have a 150,000 gallon water tank. If a fire breaks out the Fire Departments Pump truck is dispatched, which carries 3200 to 4000 gallons of water. The City has Fire Hydrants installed, but we have limited supply, so Fire Protection is minimal at best. • The City of Sodaville in located in an area which has large groves of trees and surrounded by forest type areas. The City is a multi elevation area, which makes fire a hazard, as fire always runs up. • The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community. Developing and implementing programs to reduce the potential for Wild Fires can assist the City in mitigating its overall risk to the community.		
Ideas for Implementation:		
• Develop a plan to work at eliminated vegetation which could be a fire hazard, as described in City of Sodaville Ordinance 02-02, Section 5.10 and 5.11. • Develop and prioritize a scheduling plan to address each area identified. • Budget funds each year to fund the prioritized list of areas identified.		
Coordinating Organization:	**City of Sodaville City Council**	
Internal Partners:		**External Partners:**
Sodaville Park Maintenance Sodaville Volunteer Group		OSU Extension Service
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	ONGOING	

Proposed Action Item Identification:		
ST: 2.2.6 Would be a Short Term Action Propose under Goal 2 Objective 2.2		
Proposed Action Title/Description:		
DR-ST #1: Action 2.2.6 Provide technical services of county-based agencies on effective methods of water use curtailment.		
Rationale for Proposed Action Item:		
•		
Ideas for Implementation:		
•		
Coordinating Organization:	**Board Of Commissioners**	
Internal Partners:		**External Partners:**
Planning and Building; Emergency Management; Parks and Recreation Department		NRCS; Department of Agriculture; WRD; Local Water Districts
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
ongoing		
Status		

Proposed Action Item Identification:		
LT: 3.1.2 Would be a Long Term Action Proposed under Goal 3 Objective 3.1		
Proposed Action Title/Description:		
DR-LT #1: Action 3.1.2 Support local agencies' training on water conservation measures to farmers and ranchers, including drought management practices for crops and livestock.		
Rationale for Proposed Action Item:		
•		
Ideas for Implementation:		
• Cooperation with OSU extension services and agricultural organizations prominent and respected within the farming and ranching community, build on existing outreach methods with the goal of providing water conservation/drought management training to farmers and ranchers.		
Coordinating Organization:		
Internal Partners:		**External Partners:**
Planning and Building		OSU Extension Services; NRCS; Farm Bureau; WRD;ODFW
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	2-5 Years	
Status		

Proposed Action Item Identification:		
ST: 3.1.4 Would be a Short Term Action proposed under Goal 3 Objective 3.1		
Proposed Action Title/Description:		
Increase public education related to landslide hazards by distributing DOGAMI landslide informational brochure.		
Rationale for Proposed Action Item:		
• *DOGAMI produced an information brochure on landslide hazards.*		
Ideas for Implementation:		
• Distribute the DOGAMI landslide informational brochure.		
Coordinating Organization:	**Emergency Management**	
Internal Partners:		**External Partners:**
Planning and Building Department; Road Department		DOGAMI; OEM;
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
Ongoing		
Status		

Proposed Action Item Identification:

ST: 3.3.5 Would be a Short Term Action proposed under Goal 3 Objective 3.3

Proposed Action Title/Description:

Partner with the Oregon Department of Forestry and Rural Fire Districts to promote home site assessment programs for the wildfire hazard

Rationale for Proposed Action Item:

- In a self-completed hazard analysis, Linn County reported itself as having an above average wildland-urban interface fire (WUI) risk of 183 out of 240. Promoting home site assessments for locations within Linn County's WUI can assist property owners in identifying their vulnerability to WUI fire and identifying mitigation activities. Assisting property owners with this may increase the likelihood that property owners would share responsibility for WUI fire mitigation on their properties and implement mitigation activities. Such actions can assist the County in reducing its overall WUI fire risk.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates that Linn County's probability for a future WUI fire is high (that the county would be likely to have a major WUI fire event in the next 10-35 years) and the county's vulnerability to a future WUI fire is medium. Promoting home site assessments for locations within Linn County's WUI can assist property owners in identifying their vulnerability to WUI fire and identifying mitigation activities. Assisting property owners with this may increase the likelihood that property owners would share responsibility for WUI fire mitigation on their properties and implement mitigation activities. Such actions can assist the County in reducing its overall WUI fire risk.
- The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(*ii*)]. Promoting home site assessment programs would be a way to conduct outreach to inform homeowners of the county's risk to WUI fire and keep them involved in the County's efforts to mitigate that risk.

Ideas for Implementation:

- Determine if the home site asessments would be free for homeowners; free if they participate in a County survey, attend a community forum, etc.; or offered at a reduced cost to homeowners.
- Work with partners to identify at-risk communities to target for the program.
- Work with partners to develop home site assessment programs. Components of the program could include:
  - Determining what the assessments of home sites would include, and who would be responsible for conducting them.
  - Determining if there is a need to prioritize at-risk communities based on vulnerability, and begin the program in the most vulnerable, highest priority communities first.
  - Identifying and developing the most appropriate methods of communication to reach at-risk homeowners.
- Identify funding sources to fund the program.

Coordinating Organization:	**Linn County Emergency Management**

Internal Partners:	**External Partners:**
Land Management	ODF Rural Fire Districts State Fire Marshall Local Cities OEM

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
1-2 Years		
Status		

Proposed Action Item Identification:		
LT:2.2.9		
Proposed Action Title/Description:		
LS-LT #: **Action 2.2.9** Implement Linn County existing development standards for structures located within a "mass movement area".		
Rationale for Proposed Action Item:		
•		
Ideas for Implementation:		
•		
Coordinating Organization:	**Linn County Planning and Building**	
Internal Partners:		**External Partners:**
GIS Department, Emergency Management		DOGAMI
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	ongoing	
Status:		

Proposed Action Item Identification:		
ST: 2.2.8 Would be a Short Term Action Propose under Goal 2 Objective 2.2		
Proposed Action Title/Description:		
LS-LT #: **Action 2.2.8** Discuss options for LIDAR mapping to identify debris flow areas in Linn County.		
Rationale for Proposed Action Item:		
•		
Ideas for Implementation:		
•		
Coordinating Organization:	**GIS Department**	
Internal Partners:		**External Partners:**
Board Of Commissioners		DOGAMI
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	2-4 years	
Status		

Proposed Action Item Identification:

Proposed Action Title/Description:

Develop a partnership to identify areas where required visual buffers along designated scenic highways have potential blowdown issues endangering life and infrastructure.

Rationale for Proposed Action Item:

- State forest practices rules require visual buffers of trees along scenic highways to maintain the aesthetic qualities provided by forests.
- Only ODOT can determine whether there may be an undue risk in certain areas that would require removal of the trees.

(include additional rational as used in the example action.)

Ideas for Implementation:

- Develop a partnership between ODOT, ODF, private timber companies and private landowners that would inventory and summarize areas of high hazard for blowdown after removal of adjacent standing timber.
- Develop a timeline with scheduled harvest to minimize visual impacts but to maintain safety.
- Identify ownership of potential hazard trees.
- Identify party responsible for harvest activity.
- Develop educational material for County residents and neighbors

Coordinating Organization:	**Linn County Emergency Management**

Internal Partners:		**External Partners:**
Road Department		ODOT ODF Private Timber Owners Private landowners
		If available, estimated cost:
Short Term (0-2 years)	Long Term(2-4 or more years)	
	Ongoing	

Proposed Action Item Identification:		
Proposed Action Title/Description:		
Create database of local private resources including equipment, labor, special expertise and operating area as well as contact information that could be mobilized rapidly in event of fire, earthquake, flood or severe weather impacts.		
Rationale for Proposed Action Item:		
• Linn County has experienced impacts from each of the above mentioned events. • The county and public agencies may not have appropriate equipment or an adequate labor force during emergency situations. • Many private organizations already have resources located closer to impact areas and may be providing these services to their own, neighbors or clients property.		
Ideas for Implementation:		
• Consider an incident command structure and provide training that would coordinate resources included in the database. • Allow updating by private organizations through use of online technology accessable following registration of the organization. • Develop educational resources for private organizations wishing to participate in the database that will identify goals, implementation and updating requirements. • Develop inspection and evaluation procedures of the potential resources. • Determine database fields that would provide adequate information to make product useful. • Develop training exercises to test capabilities and prepare for actual events.		
Coordinating Organization:	**Linn County Emergency Management**	
Internal Partners:		**External Partners:**
Road Department County Information Technology Dept. Sheriffs Dept.		Rural and City Fire Dept. Private Roadbuilders and contractors, Logging Companies, Timber Co.'s Aggregate Companies, Fire fighting companies
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	Ongoing	

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STEERING COMMITTEE MEETING AGENDA

July 29, 2010

1. INTRODUCTION:

The purpose of this Steering Committee meeting is to review and discuss the final draft versions of the Natural Hazard Mitigation Plan.

2. Recommend the Plan with Edits to the Planning Commission to take further Public Comment.

4. QUESTIONS/COMMENTS –

5. GRANT BILLING

6. Schedule next Steering Committee Meeting to Review and documents progress.

LINN COUNTY PLANNING AND BUILDING DEPARTMENT

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Fax 541-926-2060 www.co.linn.or.us

Minutes

Date: 07/30/2010

Re: Linn County NHMP 2010 update – July 29, 2010 meeting

The Steering Committee discussed the final draft Natural Hazard Mitigation Plan. Robert Wheeldon moved to recommend the draft to the Linn County Planning Commission. John Hixson second the motion and passed 6-0.

Staff requested the timesheets for those on the Steering Committee.

The next Steering Committee Meeting was scheduled for July 29th, 2010 to review the final draft document

Attendance:

David Furtwangler, Linn County Planning Commissioner
John Hixson, Linn County Building Official
Darrel Tedisch, City of Albany Emergency Management Specialist
Mary VanAgtmael, Linn County Planning Commissioner
Robert Wheeldon, Linn County Planning and Building Director
Jim Howell, Linn County Emergency Management

July 29, 2010; 1:00pm
Linn County Natural Hazard Mitigation Plan
Steering Committee Meeting

Name	Agency	Email	Phone
Mary M Van Ostrand	Linn Co. Plan Comm.		(503) 394-2453
[illegible]	" "		541 367-2111
Jim Howell	Linn County (Sheriff) Emergency Management	jhowell@co.linn.or.us	541-967-3954
Darrel Tedisch	City of Albany	darrel.tedisch@cityofalbany.net	541 917-7725
Robert Wheeldon			
JOHN HIXSON			

LINN COUNTY PLANNING AND BUILDING DEPARTMENT

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AGENDA

August 10, 2010; 7:00 pm

Linn County Planning Commission
Old Armory Building, George Miller Room B
(Corner of 4th Avenue and Lyon Street, Albany, Oregon)

Call to Order

Approval of Minutes of June 8, 2010

Case Scheduled for Hearing:

BC10-0003; Amendments to the Linn County Comprehensive Plan (Plan) text in LCC Chapter 903, Natural Resources Element Code, to adopt the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) for Linn County, Oregon and Incorporated areas, dated September 29, 2010 as the official data source for determining if a property is within a flood hazard area; and to amend the Floodplain Management Code (LCC 870) regulating new development and structures within flood hazard areas. The applicable decision criteria for a Plan text amendment are identified in Linn County Code (LCC) 921.872. The criteria are: (A) The amendment is consistent with the intent of the applicable section(s) of the Comprehensive Plan; and (B) The amendment is consistent with the statewide planning goals.

Other Business

A public meeting to review the 2010 update of the Linn County Natural Hazards Pre-Disaster Mitigation Plan. The Planning Commission will review the plan, take comments from the public on the draft plan update, and make a recommendation to the Board of Commissioners. Once approved by the Board of Commissioners, the plan will be forwarded to FEMA for review and approval in the fall of 2010. The mitigation plan addresses the natural hazards such as floods, severe winter storms, windstorms, landslides, drought and wildfires, as well as catastrophic hazards such as earthquakes and volcanoes. The purpose of the Hazard Mitigation Plan is to protect life and property and reduce damages resulting from natural disasters by reducing vulnerability to natural hazard risks. The updated mitigation plan will identify cost-effective hazard mitigation activities and projects that would reduce the impacts of natural disasters in rural Linn County. Linn County first approved the Natural Hazard Mitigation Plan in November 2005. Federal rules require the County to update the natural hazards mitigation action plan every five years. A current Hazard Mitigation Plan qualifies the County for pre-disaster hazard mitigation grants. The plan also qualifies the County to receive certain post-disaster relief funds when a natural disaster occurs. The Linn County Natural Hazard Mitigation Plan Steering Committee has updated the 2005 Natural Hazard Mitigation plan over the past 6 months through a series of public workshops.

General Discussion

Adjournment

LINN COUNTY PLANNING AND BUILDING DEPARTMENT
Robert Wheeldon, Director

Room 114, Linn County Courthouse
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Phone 541-967-3816, Fax 541-926-2060
www.co.linn.or.us

Memorandum

To: Planning Commission

From: Olivia Glantz, Assistant Planner

Date: 08/03/2010

Re: Linn County seeks public input on update to Multi-Jurisdictional Natural Hazards Mitigation Plan

---

Linn County is updating its multi-jurisdictional Natural Hazards Mitigation Plan. This work is being performed in cooperation with the Oregon Partnership for Disaster Resilience and Oregon Emergency Management utilizing funds obtained from the Federal Emergency Management Agency (FEMA) Pre-Disaster Mitigation Grant Program. With re-adoption of the plan, Linn County will maintain its eligibility to apply for federal funding of natural hazard mitigation projects. The natural hazards mitigation plan (NHMP) identifies actions that strengthen the community's ability to withstand the damaging effects of natural hazards.

Mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. Example mitigation actions from Linn County's plan include:

- Action 3.3.3. Conduct community based fuel reduction demonstration projects in the interface.
- Action 2.4.1. Develop a program to implement non-structural retrofit of County staff offices and workspaces.

Linn County's NHMP is a multi-jurisdictional plan because some of the county's incorporated cities have included addenda in the NHMP. Cities currently developing addenda include: Lyons, Scio, Sodaville, and Tangent. Each addendum has its own risk assessment and set of action items unique to that community. Each city is currently developing its mitigation plan addendum to be consistent with the county NHMP.

Why dose Linn County need a Natural Hazard Mitigation Plan?

Without a federally and locally approved NHMP, a community is *not* eligible for the following federal disaster mitigation funds.

- Pre-Disaster Mitigation Grant Program: provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. PDM grants are nationally competitive.
- Hazard Mitigation Grant Program: provides grants to state and local governments and other eligible recipients to implement long-term hazard mitigation measures

and projects after a major disaster declaration. The purpose of HMGP funds is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery period following a disaster. HMGP funds are available to communities within states that have recently received Presidential Disaster Declarations. HMGP funds are prioritized for communities that are directly affected by a disaster, but communities outside of the disaster declaration are typically eligible as well.

- Flood Mitigation Assistance: assists states and communities in implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program.

Note: Cities with approved addenda are individually eligible for the federal funding listed above.

Background: Planning Process

Linn County first adopted its NHMP in November 2005. Mitigation plans are required to be updated every five years to remain eligible for federal grant funding. The 2010 update of the Linn County Natural Hazards Mitigation Plan was funded by a 2009 Pre-Disaster Mitigation (PDM) Planning Grant. The PDM planning grant was developed in partnership with the Oregon Partnership for Disaster Resilience (OPDR) and Oregon Emergency Management to create or update mitigation plans for the mid-Willamette Valley. Plan update efforts began in the winter of 2009.

The following representatives served as steering committee members for the Linn County natural hazard mitigation plan update process:

Steve Barnett, Linn County GIS Manager
Mike Beaver, Linn County Fire Defense Board
Brian Carroll, Linn County Parks and Recreation Director
David Furtwangler, Linn County Planning Commissioner
John Hixson, Linn County Building Official
Jim Howell, Linn County Emergency Management
Chuck Knoll, Linn County Road Department
Darrel Tedisch, City of Albany Emergency Management Specialist
Mary VanAgtmael, Linn County Planning Commissioner
Robert Wheeldon, Linn County Planning and Building Director

The planning process and associated resources used to update Linn County's Natural Hazards Mitigation Plan were developed by OPDR.

Staff is requesting that the Planning Commission take public input on the draft and recommend the draft to the Linn County Board of Commissioners and take any public input at the public hearing.

CASE NUMBER AND NAME Natural Hazard Mitigation Plan

This is a participant notification sheet for the above listed case. Only persons that testify orally or in writing can be provided with a notice of decision. **Please print your name and complete address.** If this information is illegible, incomplete, or inaccurate, no notice can be provided.

PLEASE PRINT NAME	MAILING ADDRESS, CITY AND STATE	Do you wish to speak for or against this request?	
		FOR	AGAINST
~~[illegible]~~ NA	~~[illegible] Albany OR 97321~~		
Gary L Dahlquist	1540 NW Harden Ln Albany OR 97321	NA	NA

Memo
To: Federal Emergency Management Agency (FEMA)

From: Linn County

Date: August 10, 2010

Re: List of changes to the 2005 Linn County NHMP for the 2010 Plan Update

Purpose
This memo describes the changes made to the 2005 Linn County Natural Hazards Mitigation Plan (NHMP) for the 2010 update of the Linn County NHMP. It serves as a record of major changes made for each NHMP section.

Project Background
In February 2010, Linn County contracted with the Oregon Partnership for Disaster Resilience (the Partnership) to update the 2005 Linn County Natural Hazards Mitigation Plan. The Disaster Mitigation Act of 2000 requires communities to update their mitigation plans every five years to remain eligible for Pre- Disaster Mitigation (PDM) program funding, Flood Mitigation Assistance (FMA) program funding, and Hazard Grant Mitigation Program (HGMP) funding. The County updated the risk assessment, discussed the plan goals and action items in the 2005 NHMP, developed new goals and action items for the 2010 update, and reviewed all changes made for the 2010 update prior to submittal to FEMA. The Partnership assisted Linn County by providing plan update trainings and technical assistance.

The County has made several major changes to the 2010 NHMP. The major changes are documented and summarized in this memo for each section of the mitigation plan.

2010 Update Changes by Section
The sections below discuss only *major* changes made to the 2005 Linn County Natural Hazard Mitigation Plan for the 2010 plan update. Major changes include the replacement or deletion of large portions of text, changing the location of sections, and new additions to the plan. If a section is not addressed, then it can be assumed that sections in the 2010 update are similar to like sections in the 2005 NHMP.

Cover Page and Acknowledgments

1. The Cover Page for the Linn County NHMP has been revised to include 2010 update information and the agencies involved in developing the plan update.

2. The Acknowledgments have changed to reflect the participants involved in the 2010 update. The participant list in the 2005 NHMP included representatives of agencies that provided input during the meetings held to develop the 2005 Linn County NHMP.

Executive Summary:

1. **Page i:** "How is the Plan Organized?" updated the names of the sections to be consistent with the titles in the document.

2. **Page ii:** "Who Participated in Developing the Plan?" updated to recognize who participated in the 2010 update.

Action Item Matrix:

Action Items. The 2010 update includes 45 action items. They are a combination of new action items addressing issues committee members identified in the April 15, 2010 hazard identification meeting, and action items from the 2005 NHMP that had not yet been completed. The status of each action item, whether it is a deferred (continuing) action or a new action, is indicated in the status column of the matrix. The 2005 actions that are included in the update as current action items have been revised as needed. All action items can be found in Appendix B.

Section 1 Introduction

Section 1.0 includes an introduction and purpose for the plan, summarizes the process for developing the 2005 NHMP and the 2010 update. The major changes in Section 1 include the following:

1. "Planning Process and Methodology" was edited to reflect the document is an update to the 2005 NHMP and the 2010 update. The members of the 2010 Steering Committee are identified and those members of the participating Cities. A summary of the process the County followed to update the plan was added.
2. "Linn County Communities" – Those Cities participating and developing addendums were identified.
3. "Public Participation" was revised to include a summary of the planning process for the 2005 NHMP and the 2010 update.
4. "Stakeholder Survey" was revised to include the summary of the survey taken in 2005 and include the survey in 2010.
5. "Hazard Research" has an added section for the 2010 update and identifies a new drought hazard section.
6. "Hazard Assessment" was changed to add the 2010 update information.

Section 2: Community Profile

Section 2 describes Linn County in a variety of ways. This section highlights demographic, employment, housing, transportation, and land use characteristics of the county. Changes made to this section for the 2010 update include:

1. Climatic, geographic, demographic, employment, housing, transportation, critical facilities, and land use information was updated to incorporate the latest information.

2. Information about Linn County's government structure, existing plans, and organizations that could assist with implementing natural hazard mitigation actions was added for the 2010 update.

Section 3: Risk Assessment

1. **page 3-1**: added 2010 hazard identification information. "hazard identification" added drought to the update.

Section 4: Action Plan

1. **page 4-1:** added the 2010 Steering Committee process for reviewing the mission, goals and objectives.
2. **page 4-5:** the priority of the goals changed based on the Steering Committee votes during the 2010 update. The ranking of the hazards changed based on the Steering Committee votes during the 2010 update.
3. **page 4-6:** ranking system changed based on voting on previous page.

Section 5: Plan Implementation and Maintenance:

The formatting and organization of this section has been changed.

1. **page 5-1:** Implementing the plan has been shortened and summarized. Co-Convener has been added along with the responsibilities of each of the conveners.
2. **page 5-2:** "Coordinating Body" was changed to reflect the responsibilities and role of the Steering Committee. Added the members of the Steering Committee are listed under "Members".
3. **page 5-3:** "Plan Maintenance" was moved from page 5-8 and includes the annual meeting tasks, prioritization process for the action items.
4. **page 5-4:** updated the methodology for prioritizing items.
5. Section 5 deletions: The Policies, Functional Plans, Community Plan, Implementing Measures, Planning Maps have been deleted from this section.

Section 6 Flood

For 2010 update, most of the changes involved adding new information relevant to Linn County. The changes made to this section include the following:

1. **page 6-2:** "History of Floods in Linn County" two paragraphs were moved under "causes and characteristics"
2. **page 6-3:** first paragraph was moved under "Hazard Assessment".
3. **pages 6-3 – 6-4:** table 6-1 was updated with current data.
4. **page 6-7:** "Dam Failure Flooding" updated dam information to with current data.
5. **page 6-9:** "Probability of Flood Risk" added tlast paragraph
6. **page 6-10:** "Community Rating System" updated the CRS program ratings for the City of Albany and Scio. Added the Linn County BFE standard to build above 2 feet.
7. **page 6-11:** "Hazard Identification" added last paragraph.

8. **page 6-12:** Last paragraph on page added "Recent LIDAR data that has become available…"
9. **page 6-15:** "Riparian Areas" last paragraph under this section was added.
10. **page 6-16:** "Repetitive Flood loss areas" Entire section and table was updated to reflect new repetitive flood loss data.
11. **page 6-17:** "Risk Analysis" updated third and fourth paragraphs under this section to reflect current data and direction from the Steering Committee.
12. **page 6-20:** "National Flood Insurance Program (NFIP)" Second paragraph was added to describe the most recent NFIP statistics.
13. **page 6-20:** "2005 Flood Mitigation Action Items" entire section showing the progress of each action item from the 2005 plan was added.

Section 7 Landslides

For 2010 update, most of the changes involved adding new information relevant to Linn County. The changes made to this section include the following:

1. **page 7-9:** "Natural Causes" added "Heavy Precipitation and rainfall… approximately six inches of rainfall in one day".
2. **page 7-15:** added last paragraph discussing the intense rainfall in Linn County and road systems.
3. **page 7-17:** added third paragraph discussing rainfall in December 1995 and January 1996.
4. **page 7-23:** added section "House Bill 3375(2003)" to update legislation.
5. **page 7-24:** added section "2005 Landslide Mitigation Action Items Progress" to show progress that was made on action items from the 2005 plan.

Section 8 Wildfire

For 2010 update, most of the changes involved adding new information relevant to Linn County. The changes made to this section include the following:

1. **Page 8-2.** Updating new legislation concerning grass seed farmer burning fields.
2. **Page 8-7.** Updating where information was available "US wild Fire Season" table.
3. **Page 8-9.** Updating where information was available "Oregon Seasonal Fire Occurrence" table.
4. **Page 8-10.** Added section with information concerning the Linn County Community Wildfire Protection Plan (CWPP) adopted in 2007.
5. **Page 8-21.** Added section addressing those 2005 action items either in progress or completed. Each action item has a summary of the status and progress. Under each action item it is also stated if the Steering Committee decided to defer, change or delete the action item.

6. **Page 8-23.** Action items are either deleted or updated. The Linn County Fire Defense Board and Steering Committee have not developed any new action items.

Section 9 Severe Weather

For 2010 update, most of the changes involved adding new information relevant to Linn County. The changes made to this section include the following:

1. **Page 9-4.** Grammatical change under "Ice"
2. **Page 9-5.** "Location and Extent of Severe Weather Events"; added September 2007 event.
3. **Page 9-7.** "Table 9-1" added December 2003 – January 2004 event and January – February 2008 event.
4. **Page 9-9.** "Table 9-2" added January 2006 – March 2008 events to the table.
5. **Page 9-11.** "Table 9-3" added September 2007 event
6. **Page 9-12.** "Table 9-4" updated Vulnerability and Probability.
7. **Page 9-13.** "Table 9-5" updated Vulnerability and Probability.
8. **Page 9-16-17.** "2005 Mitigation Action Item Progress" added section to show progress made on action items.

Section 10 Drought

1. **Drought Hazard.** The 2005 NHMP did not include drought. The Linn County Natural Hazard Mitigation Steering Committee decided to include the drought hazard in the 2010 update. The County added information about drought as it relates to Oregon and Linn County.

Section 11 Earthquake

1. **page 11-4:** edited and changed paragraph 5-7 under "Location and Extent of Earthquake Hazard"
2. **page 11-7:** added second paragraph on page discussing rapid visual screening; and updated table 10-2. Incorporated data from DOGAMI's Rapid Visual Screening study completed in 2007,
3. **page 11-8:** updated table 10-3 and table 10-4 with current data.
4. **page 11-9:** updated table 10-5 with current data.
5. **page 11-10:** updated table 10-6 with current data.
6. **page 11-23:** "2005 Mitigation Action Item Progress" added section to show progress made on action items.

Section 12 Multi Hazard

1. **page 12-2:** "2005 Mitigation Action Item Progress" added section to show progress made on action items.

Appendices

Appendix A:

Public Process. Appendix A documents the announcements, agendas, minutes, and sign-in sheets for meetings regarding implementation, maintenance, and updating of the Linn County NHMP.

The 2010 update built upon information included in the 2005 NHMP, so the majority of the work had been completed. The Committee asked for a stakeholders survey for the update process.

1. **page A-10 – A-12:** "2010 Public Participation" is added to this section.

Appendix B:

2010 Linn County NHMP Action Items. Appendix B includes all of the action items from the 2010 NHMP incorporated into action item worksheets. Included with the worksheets is a status bar indicating whether the action item has been completed or not completed. For those actions that have not been completed, the status bar indicates whether the actions are new or have been incorporated into the update and why.

Appendix C:

Economic Analysis on Natural Mitigation Projects: The appendix has been revised and uses the Oregon Partnership for Disaster Resilience appendix for economic analysis.

Appendix D.

DOGAMI Earthquake HAZUS model: The appendix has been changed to show the final HAZUS, whereas the 2005 plan showed the preliminary model.

RECEIVED
JAN 06 2011
By

RECEIVED
JAN -5 2011
LINN COMMISSIONERS

U.S. Department of Homeland Security
Region X
130 228th Street, SW
Bothell, WA 98021-9796

FEMA

December 29, 2010

	Read	Appr	Copy
Roger			
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John			
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Robert wheeldon X

Honorable Roger Nyquist
Chair, Board of County Commissioners
300 Southwest 4th Avenue
Albany, Oregon 97231

Dear Chair Nyquist:

The U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) has approved the ***Linn County Natural Hazard Mitigation Plan*** as a local plan as outlined in 44 CFR Part 201. With approval of this plan, Linn County is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through December 29, 2015.

The plan's approval provides eligibility to apply for hazard mitigation projects through your State. All requests for funding will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted. For example, a specific mitigation activity or project identified in the plan may not meet the eligibility requirements for FEMA funding, and even eligible mitigation activities are not automatically approved for FEMA funding under any of the aforementioned programs. Approved mitigation plans may be eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Additional information regarding the CRS can be found at www.fema.gov/business/nfip/crs.shtm or through your local floodplain manager.

Over the next five years, we encourage your community to follow the plan's schedule for its monitoring and updating, and to develop further mitigation actions. The plan must be reviewed, revised as appropriate, and resubmitted for approval within five years in order to continue project grant eligibility.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact our State counterpart, Oregon Emergency Management Division, which coordinates and administers these efforts for local entities.

Sincerely,

Mark Carey, Director
Mitigation Division

cc: Dennis Sigrist, Oregon Emergency Management

Enclosure

BH:bb

LOCAL MITIGATION PLAN REVIEW SUMMARY

The plan cannot be approved if the plan has not been formally adopted. Each requirement includes separate elements. All elements of the requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a score of "Satisfactory." Elements of each requirement are listed on the following pages of the Plan Review Crosswalk. A "Needs Improvement" score on elements shaded in gray (recommended but not required) will not preclude the plan from passing. Reviewer's comments must be provided for requirements receiving a **"Needs Improvement"** score.

Prerequisite(s) (Check Applicable Box)	**NOT MET**	**MET**
1. Adoption by the Local Governing Body: §201.6(c)(5)		N/A
OR		
2. Multi-Jurisdictional Plan Adoption: §201.6(c)(5)		X
AND		
3. Multi-Jurisdictional Planning Participation: §201.6(a)(3)		X

Planning Process	**N**	**S**
4. Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)		X

Risk Assessment	**N**	**S**
5. Identifying Hazards: §201.6(c)(2)(i)		X
6. Profiling Hazards: §201.6(c)(2)(i)		X
7. Assessing Vulnerability: Overview: §201.6(c)(2)(ii)		X
8. Assessing Vulnerability: Addressing Repetitive Loss Properties. §201.6(c)(2)(ii)		X
9. Assessing Vulnerability: Identifying Structures, Infrastructure, and Critical Facilities: §201.6(c)(2)(ii)(B)		N/A
10. Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)		N/A
11. Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)		N/A
12. Multi-Jurisdictional Risk Assessment: §201.6(c)(2)(iii)		X

*States that have additional requirements can add them in the appropriate sections of the *Local Multi-Hazard Mitigation Planning Guidance* or create a new section and modify this Plan Review Crosswalk to record the score for those requirements.

SCORING SYSTEM

Please check one of the following for each requirement.

N – Needs Improvement: The plan does not meet the minimum for the requirement. Reviewer's comments must be provided.

S – Satisfactory: The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

Mitigation Strategy	**N**	**S**
13. Local Hazard Mitigation Goals: §201.6(c)(3)(i)		X
14. Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)		X
15. Identification and Analysis of Mitigation Actions: NFIP Compliance. §201.6(c)(3)(ii)		X
16. Implementation of Mitigation Actions: §201.6(c)(3)(iii)		X
17. Multi-Jurisdictional Mitigation Actions: §201.6(c)(3)(iv)		X

Plan Maintenance Process	**N**	**S**
18. Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(ii)		X
19. Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)		X
20. Continued Public Involvement: §201.6(c)(4)(iii)		X

Additional State Requirements*	**N**	**S**
Insert State Requirement		N/A
Insert State Requirement		N/A
Insert State Requirement		N/A

LOCAL MITIGATION PLAN APPROVAL STATUS	
PLAN NOT APPROVED	
See Reviewer's Comments	
PLAN APPROVED	X

Local Mitigation Plan Review and Approval Status

Jurisdiction: Linn County	**Title of Plan:** Linn County Natural Hazards Mitigation Plan	**Date of Plan:** September 7, 2010
Local Point of Contact: Olivia Glantz	**Address:** Linn County Oregon 300 SW 4TH AVE Albany, OR 97321	
Title: Assistant Planner		
Agency: Linn County Planning		
Phone Number: (541) 967-3816 ext. 2368	**E-Mail:** oglantz@co.linn.or.us	

State Reviewer:	**Title:**	**Date:**

FEMA Reviewer: Brett Holt	**Title:** Mitigation Planner	**Date:** October 21, 2010
Date Received in FEMA Region X	September 9, 2010	
Plan Not Approved		
Plan Approved	X	

Jurisdiction:	**NFIP Status***			
	Y	**N**	**N/A**	**CRS Class**
1. Linn County	X			

*** Notes:** **Y = Participating** **N = Not Participating** **N/A = Not Mapped**

PREREQUISITE(S)

1. Adoption by the Local Governing Body

Requirement §201.6(c)(5): *[The local hazard mitigation plan **shall** include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE NOT MET	SCORE MET
A. Has the local governing body adopted **new or updated** plan?	N/A			N/A
B. Is supporting documentation, such as a resolution, included?	N/A			N/A
		SUMMARY SCORE		N/A

2. Multi-Jurisdictional Plan Adoption

Requirement §201.6(c)(5): *For multi-jurisdictional plans, each jurisdiction requesting approval of the plan **must** document that it has been formally adopted.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE NOT MET	SCORE MET
A. Does the **new or updated** plan indicate the specific jurisdictions represented in the plan?	pp. 1-3 to 1-4	The list of jurisdictions is provided.		X
B. For each jurisdiction, has the local governing body adopted the **new or updated** plan?		The plan is adopted by the Board of County Commissioners.		X
C. Is supporting documentation, such as a resolution, included for each participating jurisdiction?		A resolution is submitted to FEMA.		X
		SUMMARY SCORE		X

3. Multi-Jurisdictional Planning Participation

Requirement §201.6(a)(3): *Multi-jurisdictional plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process … Statewide plans will not be accepted as multi-jurisdictional plans.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE NOT MET	SCORE MET
A. Does the **new or updated** plan describe **how** each jurisdiction participated in the plan's development?	pp. 1-2 to 1-6	The plan describes how each community participated or will participate. In addition, each jurisdiction is in the process of developing their respective addendum.		X
B. Does the updated plan identify all participating jurisdictions, including new, continuing, and the jurisdictions that no longer participate in the plan?	pp. 1-3 to 1-4	This plan is written for Linn County. Other jurisdictions will add to this at a later date.		X
		SUMMARY SCORE		X

PLANNING PROCESS: *§201.6(b): An open public involvement process is essential to the development of an effective plan.*

4. Documentation of the Planning Process

Requirement §201.6(b): *In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process **shall** include:*
(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Requirement §201.6(c)(1): *[The plan **shall** document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan provide a narrative description of the process followed to prepare the **new or updated** plan?	pp. 1-3 to 1-4, Appendix A	A description of the planning process is provided.		X
B. Does the **new or updated** plan indicate who was involved in the **current** planning process? (For example, who led the development at the staff level and were there any external contributors such as contractors? Who participated on the plan committee, provided information, reviewed drafts, *etc.*?)	pp. 1-3 to 1-4	The plan indicates who was involved in the process.		X
C. Does the **new or updated** plan indicate how the public was involved? (Was the public provided an opportunity to comment on the plan during the drafting stage and prior to the plan approval?)	p. 1-5 and Appendix A	The public was notified of the mitigation update process through press releases, notifications of community preparedness survey, announcements on Linn County's website and stakeholder's survey. The public was invited to participate in Steering Committee meetings.		X
D. **Does the new or updated plan discuss the** opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?	pp. 1-3 to 1-4	A n umber of jurisdictions are said to have participated in the process. ***Recommended Revision (Oct. 2010):*** When the participating jurisdictions develop their addendums, consider including a clear description on how they each participated within their respective addendum.		X
E. Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?	p. 1-6 and throughout the document	The plan describes a review of new studies, and provides a list of references throughout the plan.		X
F. Does the updated plan document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process?	Appendix A	The plan update changes memo in Appendix A lists the changes made to the mitigation plan.		X
		SUMMARY SCORE		X

RISK ASSESSMENT: *§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.*

5. Identifying Hazards

Requirement §201.6(c)(2)(i): *[The risk assessment **shall** include a] description of the type … of all natural hazards that can affect the jurisdiction.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan include **a description** of the types of **all natural hazards** that affect the jurisdiction?	p. 3-1	The plan identifies six natural hazards that affect the community. The plan describes the process to identify the hazards. ***Recommended Revision (Oct. 2010):*** **Wildland Fire** (p. 8-7): Considering updating the 2007 wildland fire statistics to more current numbers. You can view them here http://www.nifc.gov/fire_info/fire_stats.htm. **Drought:** Consider referencing the U.S. Drought Monitor Index. It provides archives, current and future conditions for droughts. http://www.drought.unl.edu/dm/		X
		SUMMARY SCORE		X

6. Profiling Hazards

Requirement §201.6(c)(2)(i): *[The risk assessment **shall** include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan **shall** include information on previous occurrences of hazard events and on the probability of future hazard events.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?	§ 6 - 11	The location of each hazard is identified in the risk assessment chapters of the mitigation plan.		X
B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?	§ 6 - 11	The extent of each hazard is identified in the risk assessment chapters of the mitigation plan.		X
C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?	§ 6 - 11	The risk assessment chapters identify the previous occurrences of each hazard.		X
D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?	§ 6 - 11	The risk assessment chapters indicate the probability of a future occurrence.		X
		SUMMARY SCORE		X

7. Assessing Vulnerability: Overview

Requirement §201.6(c)(2)(ii): *[The risk assessment **shall** include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan include an overall summary description of the jurisdiction's vulnerability to each hazard?	§ 6 - 11	Each risk assessment chapter provides a summary of the community's vulnerability to the hazard.		X
B. Does the new or updated plan address the impact of each hazard on the jurisdiction?	§ 6 - 11	Each risk assessment chapter provides a description of the impacts of the hazard on the jurisdiction.		X
		SUMMARY SCORE		X

8. Assessing Vulnerability: Addressing Repetitive Loss Properties

Requirement §201.6(c)(2)(ii): *[The risk assessment] **must** also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged floods.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan describe vulnerability in terms of the types and numbers of repetitive loss properties located in the identified hazard areas?	p. 6-16	The plan includes a general list of repetitive flood loss properties.		X
		SUMMARY SCORE		X

9. Assessing Vulnerability: Identifying Structures

Requirement §201.6(c)(2)(ii)(A): *The plan **should** describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area … .*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?	§ 6, 7, & 11	Flood, landslide, and earthquake risk assessments describe vulnerability in terms of types and numbers of existing buildings in the hazard area.		X
B. Does the new or updated plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?		N/A		N/A
		SUMMARY SCORE		N/A

10. Assessing Vulnerability: Estimating Potential Losses

Requirement §201.6(c)(2)(ii)(B): *[The plan **should** describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate … .*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan estimate potential dollar losses to vulnerable structures?	§ 7 & 11	Landslide and earthquake risk assessments estimate potential dollar losses due to an earthquake.		X
B. Does the new or updated plan describe the methodology used to prepare the estimate?	p. 11-15 and Appendix D	The losses are from a Level I HAZUS analysis.		X
		SUMMARY SCORE		X

11. Assessing Vulnerability: Analyzing Development Trends

Requirement §201.6(c)(2)(ii)(C): *[The plan **should** describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan describe land uses and development trends?		N/A		N/A
		SUMMARY SCORE		N/A

12. Multi-Jurisdictional Risk Assessment

Requirement §201.6(c)(2)(iii): *For multi-jurisdictional plans, the risk assessment **must** assess each jurisdiction's risks where they vary from the risks facing the entire planning area.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan include a risk assessment for each participating jurisdiction as needed to reflect unique or varied risks?	N/A	Each addendum is in the process of being developed.		N/A
		SUMMARY SCORE		N/A

MITIGATION STRATEGY: *§201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.*

13. Local Hazard Mitigation Goals

Requirement §201.6(c)(3)(i): *[The hazard mitigation strategy **shall** include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A Does the **new or updated** plan include a description of mitigation **goals** to reduce or avoid long-term vulnerabilities to the identified hazards?	p. 4-2	There are three goals and nine objectives for the mitigation plan.		X
		SUMMARY SCORE		X

14. Identification and Analysis of Mitigation Actions

Requirement §201.6(c)(3)(ii): *[The mitigation strategy **shall** include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan identify and analyze a **comprehensive range** of specific mitigation actions and projects for each hazard?	Appendix B	A wide range of mitigation actions and projects for each hazard were developed.		X
B Do the identified actions and projects address reducing the effects of hazards on **new** buildings and infrastructure?	2.1.3, 2.2.3	There are a number of actions that address new buildings and infrastructure. Examples include 2.1.3 and 2.2.3.		X
C. Do the identified actions and projects address reducing the effects of hazards on **existing** buildings and infrastructure?		There are a number of actions that address existing buildings and infrastructure. Examples include 2.1.6, 2.2.5, 2.2.7, 2.2.10, and 2.4.2.		X
		SUMMARY SCORE		X

15. Identification and Analysis of Mitigation Actions: National Flood Insurance Program (NFIP) Compliance

Requirement: §201.6(c)(3)(ii): *[The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan describe the jurisdiction (s) participation in the NFIP?	p. 6-20	A current description of the county's participation in the NFIP is described.		X
B. Does the mitigation strategy identify, analyze and prioritize actions related to continued compliance with the NFIP?	Appendix B	Actions 2.1.4, 2.2.3, and 2.1.5 are related to continue compliance with the NFIP.		X
		SUMMARY SCORE		X

16. Implementation of Mitigation Actions

Requirement: §201.6(c)(3)(iii): *[The mitigation strategy section **shall** include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization **shall** include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated mitigation strategy include how the actions are prioritized? (For example, is there a discussion of the process and criteria used?)	5-3 to 5-5	The prioritization process to implement action items is provided.		X
B. Does the new or updated mitigation strategy address how the actions will be implemented and administered, including the responsible department , existing and potential resources and the timeframe to complete each action?	Appendix B	Each action item has a corresponding coordinating body responsible for its implementation.		X
C. Does the new or updated prioritization process include an emphasis on the use of a cost-benefit review to maximize benefits?	Appendix C, pp. 5-5 to 5-6	The plan explains how a cost-benefit review will be used to maximize benefits.		X
D. Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?	§ 6 - 11	At the end of each risk assessment chapter (with the exception of drought which is a new hazard) there is a description of the status of each mitigation action item from the 2006 plan.		X
		SUMMARY SCORE		X

17. Multi-Jurisdictional Mitigation Actions

Requirement §201.6(c)(3)(iv): *For multi-jurisdictional plans, there **must** be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan include identifiable action items for each jurisdiction requesting FEMA approval of the plan?	N/A	Each addendum is in the process of being developed.		N/A
B. Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?	N/A	Each addendum is in the process of being developed.		N/A
		SUMMARY SCORE		N/A

PLAN MAINTENANCE PROCESS

18. Monitoring, Evaluating, and Updating the Plan

Requirement §201.6(c)(4)(i): *[The plan maintenance process **shall** include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan describe the method and schedule for monitoring the plan, including the responsible department?	pp. 5-1 to 5-3	A convener and coordinating body are responsible for monitoring the plan on an annual basis.		X
B. Does the new or updated plan describe the method and schedule for evaluating the plan, including how, when and by whom (i.e. the responsible department)?	pp. 5-1 to 5-3	A convener and coordinating body are responsible for evaluating the plan on an annual basis.		X
C. Does the new or updated plan describe the method and schedule for updating the plan within the five-year cycle?	p. 5-7	A description is provided for updating the plan on a five-year cycle.		X
		SUMMARY SCORE		X

19. Incorporation into Existing Planning Mechanisms

Requirement §201.6(c)(4)(ii): *[The plan **shall** include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan identify other local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan?	§ 6 - 11	Within each hazard profile, there is a comprehensive list of Linn County planning mechanisms. This is an excellent list.		X
B. Does the new or updated plan include a process by which the local government will incorporate the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?	pp. 4-3 to 4-4, Appendix B	Pages 4-3 to 4-4 describe how plans will be incorporated into existing plans and policies. Appendix B indicates where the mitigation strategy will be incorporated into existing plans and policies.		X
C. Does the updated plan explain how the local government incorporated the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?	§ 6 - 11	At the end of each risk assessment chapter is an explanation of the status of each action item from the 2005 plan. This status describes how the mitigation strategy was incorporated into existing plans and policies.		X
		SUMMARY SCORE		X

Continued Public Involvement

Requirement §201.6(c)(4)(iii): *[The plan maintenance process **shall** include a] discussion on how the community will continue public participation in the plan maintenance process.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan explain how continued public participation will be obtained? (For example, will there be public notices, an on-going mitigation plan committee, or annual review meetings with stakeholders?)	pp. 5-6 to 5-7	The plan explains how continued public involvement will be obtained.		X
		SUMMARY SCORE		X

END OF REVIEW

PARTNERSHIP FOR DISASTER RESILIENCE

OPDR.UOREGON.EDU

Memo

To: Linn County Steering Committee

From: Oregon Partnership for Disaster Resilience

Date: May 13, 2010

Re: Organizational Survey Summary

Background

Linn County is working with the Oregon Partnership for Disaster Resilience and the Community Planning Workshop (CPW) at the University of Oregon to update their Natural Hazards Mitigation Plan (NHMP). The primary purpose of natural hazard planning is to identify community policies, actions, and tools for implementation that will result in a reduction in risk and in impacts from natural hazards. The process of updating an NHMP involves engaging a broad and diverse group of community stakeholders to assist in providing information and identifying achievable mitigation strategies.

Purpose

On March 19, Linn County submitted an organizational survey to a select group of community stakeholders. The organizational survey provided an opportunity for stakeholders and steering committee members to give feedback on issues related to natural hazards mitigation planning in Linn County. The purpose of the survey was to identify the perceptions of natural hazard mitigation planning in Linn County and assess the extent to which organizations are working to achieve mitigation goals. The survey contained 13 questions divided into sections regarding perceived natural hazard threats, mitigation priorities, partnerships and support, and organizational specific information. The total number of responses was 30. The survey responses are summarized in this memo and will help develop strategies to increase organizational participation and cooperation in implementing the updated natural hazards mitigation plan.

Methodology

The survey was designed by CPW in February 2010. It was distributed as a web-based survey using SurveyMonkey in March 2010. Survey participants included key stakeholders identified by the Linn County steering committee, and the committee members themselves.

Respondent Characteristics

The personal information section of the survey asked respondents to identify the organization they represent and the jurisdiction where the organization is located. Of the 26 respondents who indicated their organization's location, 25 (96%) were located in Linn County and one respondent (4%) was from Benton County. Represented organizations include the following:

City Government

City of Brownsville

City of Lyons

City of Lyons

City of Scio

City of Sodaville

City of Sweet Home

City of Tangent

Community Services Consortium

County Planning

Harrisburg School District

Healthcare

Linn Benton Food Share

Linn County

Linn County Board of Commissioners

Linn County Planning & Building

Linn County Sheriff's Office - Emergency Management

Lyons Rural Fire Protection District

Planning and Building

Scio Planning Commission/Linn County Planning Commission

Scio Rural Fire District

Scio School District

Sweet Home Fire & Ambulance District

The City of Halsey

Perceived Natural Hazard Threats

Q1. Please select the hazard that you think is the highest threat to your community (consult the table below for the list of hazards and responses).

The majority of respondents (45%) identified flood and earthquake as the most threatening natural hazard. The next most popular answer was wildfire (13%), severe winter storm/ice storm (10), and severe thunderstorm/high wind (7%).

Natural Hazard	Count	Percent
Drought	1	4%
Earthquake	10	33%
Flood	10	33%
Landslide	0	0%
Severe Winter Storm/Ice Storm	3	10%
Severe Thunderstorm/High Wind	2	7%
Wildfire	4	13%

Total respondents (n=30)

Q2. Please select the hazard that you think is the second highest threat to your community:

The answers for this question were more diverse. The most popular answer of the respondents was flood (38%). The other indicated natural hazards include severe thunderstorm/high wind (20%), earthquake (14%), severe winter storm/ice storm (14%), wildfire (10%), and landslide (4%).

Natural Hazard	Count	Percent
Drought	0	0%
Earthquake	4	14%
Flood	11	38%
Landslide	1	4%
Severe Winter Storm/Ice Storm	4	14%
Severe Thunderstorm/High Wind	6	20%
Wildfire	3	10%

Total respondents (n=30)

Mitigation Priorities

Q3. The following statements will help us identify your community's priorities in regards to natural hazard planning. Please tell us how important each one is to you.

The factors that ranked as highest importance include protecting critical facilities (94%), protecting and reducing damage to utilities (87%), protecting property (63%), and strengthening emergency services (57%). The factors that were ranked lower in the very important category were disclosing risks during real estate transactions (30%), protecting historical landmarks (17%), and enhancing the function of natural features (13%). Very few respondents felt that any factors were unimportant.

	Very Important	Important	Neither	Unimportant	Very Unimportant
Protecting Property	63%	37%	0%	0%	0%
Protecting Critical Facilities	94%	7%	0%	0%	0%
Enhancing the function of natural features	13%	54%	27%	0%	7%
Protecting historical landmarks	17%	43%	30%	10%	0%
Protecting and reducing damage to utilities	87%	13%	0%	0%	0%
Strengthening emergency services	57%	33%	10%	3%	0%
Disclosing risks during real estate transactions	30%	40%	27%	0%	3%

Total respondents (n=30)

Q4. A number of community-wide activities can reduce our risk from hazards. These activities fall into six broad categories. Please tell us how important you think each one is for your community to consider pursuing.

Most respondents felt that all of the categories were important. The categories that ranked highest importance include emergency services (97%), prevention (90%), and public education and awareness (87%). Other important categories include structural projects (70%), property protection (53%), and natural resource protection (53%).

Activity	Very Important	Neither	Unimportant
Prevention	90%	7%	3%
Property Protection	53%	43%	3%
Natural Resource Protection	53%	43%	3%
Structural Projects	70%	27%	3%
Emergency Services	97%	3%	0%
Public Education & Awareness	87%	13%	0%

Total respondents (n=30)

Partnerships and Support

Q5. In your opinion, how would you rank the support for natural hazard mitigation amongst the following entities of your community?

Respondents identified local government agencies as the highest ranked category (41%) with unanimous support for natural hazard mitigation. In general support for natural hazard mitigation is concentrated in the mid-level ranges. There is neither overwhelming support for, nor resistance against natural hazard mitigation. One respondent commented that efforts should be made to raise awareness regarding the benefits of natural hazard mitigation.

	Not Supportive	Supported by Some	Supported by Most	Supported by All
Community Members	0%	63%	30%	7%
Businesses	0%	60%	37%	3%
Non-Governmental Organization	0%	63%	33%	3%
Local Government Agencies	0%	10%	48%	41%
Political Leaders	0%	33%	43%	23%

Total respondents (n=30)

Q6. We would like to understand the partnerships that exist within your community. What kind of partnerships does your organization have with the following entities:

Partnerships between neighboring government agencies appear to be the strongest in Linn County. Respondents identified community groups, political leaders of neighboring communities and private investors as having the weakest partnerships.

	Very strong	Somewhat Strong	Somewhat weak	Weak	Nonexistent
Community/Neighborhood Groups	10%	30%	47%	13%	0%
Private Investors	10%	37%	33%	17%	3%
Nonprofit Organizations	7%	40%	30%	20%	3%
Governmental Agencies of Neighboring Communities	16%	47%	27%	7%	3%
Political Leaders of Neighboring Communities	7%	37%	40%	10%	7%

Total Respondents (n=30)

Organizational Information

Q7. What is your organization currently doing to reduce your community's risk from natural hazards?

The most popular natural hazard mitigation activity among respondents was natural resource preservation (65%). Participating in structural related projects and hosting community education events was the next most popular activities (48%). Participants were given the opportunity to list additional activities. This list included natural hazard mitigation training and conducting stormwater and sewer system upgrades. Three respondents commented that their organization was doing very little in the realm of natural hazard mitigation.

Activity	Percent
Hosting Community Education Events	48%
Participating in Structural Related Natural Hazard Mitigation Project	48%
Working with at Risk Communities	30%
Preserving Natural Resource	65%

Total respondents (n=23)

Q8. Are there any specific risk reduction projects that your organization is interested in implementing internally or assisting other organizations/agencies with externally?

Most participants chose not to answer this question. However, five respondents shared the following statements (n=5):

- Primary emergency management is on life safety issues
- Efforts to protect infrastructure to survive a major event
- Increase of resources for fire suppression
- Protective planning
- Disaster preparedness, first aid/CPR classes

Q9. Are there ways in which your organization can contribute to regional coordination to reduce risk from natural hazards?

The majority of respondents (72%) are proponents of participating in risk reduction education programs and establishing a communication network among neighboring jurisdictions. One participant commented that their organization could assist by passing out natural hazard mitigation related brochures at public events.

Activity	Percent
Develop a coordinated risk reduction strategy with other regional stakeholders	68%
Participate in risk reduction education programs	72%
Establish a mechanism for sharing natural hazard mitigation related information and networking among neighboring jurisdictions.	72%
Assist in developing a regional based natural resource preservation plan	56%

Total respondents (n=25)

Q10. In your opinion, what are some additional or new ways your organization could help your community reduce the risk of future natural hazards?

Only three participants responded to this question. Their comments included the following (n=3):

- On going education
- Help raise awareness
- Update hazard related information (e.g. maps)

Conclusion

This survey identified the perceptions of natural hazard mitigation planning in Linn County and assessed the extent to which organizations are working to achieve mitigation goals. The results of the survey will help develop strategies to increase organizational participation and cooperation in implementing the updated natural hazards mitigation plan.

Linn County Household Preparedness Survey

1. Introduction

February 19, 2010

We need your help!

Linn county is currently engaged in a cooperative planning process to reduce the risks and losses associated with natural disasters. As a part of this process, the Oregon Partnership for Disaster Resilience at the University of Oregon is conducting an online household survey. This survey provides an opportunity for you to share your opinions about preparing for and reducing your household's and your community's risks from natural disasters. The information you provide about your household's needs for disaster preparedness could help the county improve local disaster preparedness and risk reduction activities.

Please take 15-20 minutes to complete this online survey, your opinions are important to us! The questionnaire must be completed by an adult (18 years or older), preferably the homeowner or head of household. The information you provide about your needs for disaster preparedness could help improve public/private coordination of preparedness and risk reduction activities within your community. The deadline to complete the survey is Friday, March 19, 2010.

Your completed survey indicates your willingness to take part in the study and that you are 18 years or older. Your participation in this study is voluntary. If you have questions regarding the survey, please contact the Oregon Partnership for Disaster Resilience at the University of Oregon at (541) 346-7326.

This survey is funded by a 2009 federal Pre-Disaster Mitigation planning grant, and is administered by the Oregon Partnership for Disaster Resilience (Partnership). The Partnership is a coalition of public, private, and professional organizations working collectively toward the mission of creating a disaster resilient and sustainable state. Developed and coordinated by the Community Service Center (CSC) at the University of Oregon, the Partnership employs a service learning model to increase community capacity and enhance disaster safety and resilience statewide. For information on the Partnership, please visit http://opdr.uoregon.edu.

Thank you for your participation! We look forward to hearing your opinions!

Josh Bruce,
Project Director
Oregon Partnership for Disaster Resilience

2. Natural Hazard Household Risk Reduction

Households can do many things to prepare for a natural disaster or emergency. What you have on hand or are trained to do when a disaster strikes can make a big difference in your comfort and safety in the hours and days following a natural disaster or emergency. In addition, modifications to your home, including retrofits to strengthen your home's structure, can protect your home and its contents. The following questions focus on your household's preparedness for disaster events.

Linn County Household Preparedness Survey

1. How concerned are you about the following natural disasters affecting your community?
(Check the corresponding box for each hazard)

	Very Concerned	Somewhat Concerned	Neither Concerned nor Unconcerned	Not Very Concerned	Not Concerned
Drought	☐	☐	☐	☐	☐
Dust Storm	☐	☐	☐	☐	☐
Earthquake	☐	☐	☐	☐	☐
Flood	☐	☐	☐	☐	☐
Landslide / Debris Flow	☐	☐	☐	☐	☐
Wildfire	☐	☐	☐	☐	☐
Household Fire	☐	☐	☐	☐	☐
Volcanic Eruption	☐	☐	☐	☐	☐
Wind Storm	☐	☐	☐	☐	☐
Severe Winter Storm	☐	☐	☐	☐	☐
Tsunami	☐	☐	☐	☐	☐

2. Did you consider the possible occurrence of a natural hazard when you bought/moved into your current home?

◯ Yes

◯ No

3. Does your household have insurance coverage for flood events?

◯ Yes

◯ No

3. Natural Hazard Household Risk Reduction

1. If "NO" for flood, what is the main reason your household does not have insurance for flood events?

- ◯ Not available
- ◯ Deductibles too high/not worth it
- ◯ Not necessary
- ◯ Not located in the floodplain
- ◯ Not familiar with it/don't know
- ◯ Too expensive
- ◯ Other

(please specify)

4. Natural Hazard Household Risk Reduction

1. Does your household have insurance coverage for earthquake events?

- ◯ Yes
- ◯ No

5. Natural Hazard Household Risk Reduction

1. If "NO" for earthquake, what is the main reason your household does not have insurance for earthquake events? (Please check one)

- ◯ Not available
- ◯ Deductibles too high/not worth it
- ◯ Too expensive
- ◯ Not necessary
- ◯ Not familiar with it/don't know
- ◯ Other

(please specify)

6. Natural Hazard Household Risk Reduction

Linn County Household Preparedness Survey

1. In the following list, please check those activities that you have done in your household, plan to do in the near future, have not done, or are unable to do. For Questions F-K, there is also the option to check does not apply, if the preparation action does not apply to a feature of your home. (Please check one answer for each preparedness activity)

	Have Done	Plan To Do	Not Done	Unable To Do	Does Not Apply
A. Attended meetings or received written information on natural disasters or emergency preparedness?	☐	☐	☐	☐	☐
B. Talked with members in your household about what to do in case of a natural disaster or emergency?	☐	☐	☐	☐	☐
C. Developed a "Household/Family Emergency Plan" in order to decide what everyone would do in the event of a disaster?	☐	☐	☐	☐	☐
D. Prepared a "Disaster Supply Kit" (Stored extra food, water, batteries, or other emergency supplies)?	☐	☐	☐	☐	☐
E. In the last year, has anyone in your household been trained in First Aid or Cardio-Pulmonary Resuscitation (CPR)?	☐	☐	☐	☐	☐
F. Have you secured your water heater, cabinets and bookcases to the wall?	☐	☐	☐	☐	☐
G. Have you fit your gas appliances with flexible connections?	☐	☐	☐	☐	☐
H. Used fire-resistant building or roofing materials?	☐	☐	☐	☐	☐
I. Secured your home to its foundation?	☐	☐	☐	☐	☐
J. Braced unreinforced masonry, concrete walls, and chimney?	☐	☐	☐	☐	☐

K. Elevated your home in preparation for floods?	☐	☐	☐	☐	☐

7. Household Risk Reduction

1. Who is your preferred information source to receive information about how to make your household and home safer from natural disasters? (Please check all that apply)

- ☐ Chamber of Commerce
- ☐ University or research institution
- ☐ Schools
- ☐ Fire Department/Rescue
- ☐ Utility company
- ☐ Insurance agent or company
- ☐ University or research institution
- ☐ Government agency
- ☐ American Red Cross
- ☐ Other non-profit organization

2. What is the preferred way for you to receive information about how to make your household and home safer from natural disasters? (Please check all that apply)

- ☐ Fact Sheet/brochure
- ☐ Internet
- ☐ Mail
- ☐ Outdoor advertisements (signs, etc.)
- ☐ Radio
- ☐ Television
- ☐ Magazine
- ☐ Public workshops/meetings
- ☐ Newspapers
- ☐ Other

(please explain)

8. Community Risk Reduction

Linn County Household Preparedness Survey

1. Natural hazards can have a significant impact on a community, but planning for these events can help lessen the impacts. The following statements will help determine citizen priorities for planning for natural hazards. Please tell us how important each one is to you.

	Very Important	Somewhat Important	Neither Important nor Unimportant	Not Very Important	Not Important
A. Protecting private property	○	○	○	○	○
B. Protecting critical facilities (e.g., transportation networks, hospitals, fire stations)	○	○	○	○	○
C. Preventing development in hazard areas	○	○	○	○	○
D. Enhancing the function of natural features (e.g., streams, wetlands)	○	○	○	○	○
E. Protecting historical and cultural landmarks	○	○	○	○	○
G. Protecting and reducing damage to utilities	○	○	○	○	○
H. Strengthening emergency services (e.g.,- police, fire, ambulance)	○	○	○	○	○
I. Disclosing natural hazard risks during real estate transactions	○	○	○	○	○

2. A number of activities can reduce your community's risk from natural hazards. These activities can be both *regulatory* and *non-regulatory*. An example of a regulatory activity would be a policy that limits or prohibits development in a known hazard area such as a floodplain. An example of a non-regulatory activity would be to develop a public education program to demonstrate steps citizens can take to make their homes safer from natural hazards. Please check the box that best represents your opinion of the following strategies to reduce the risk and loss associated with natural disasters.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Not Sure
A. I support a regulatory approach to reducing risk.	○	○	○	○	○	○
B. I support a non-regulatory approach to reducing risk.	○	○	○	○	○	○
C. I support a mix of both regulatory and non-regulatory approaches to reducing risk.	○	○	○	○	○	○
D. I support policies to prohibit development in areas subject to natural hazards.	○	○	○	○	○	○
E. I support the use of tax dollars (federal and/or local) to compensate land owners for not developing in areas subject to natural hazards.	○	○	○	○	○	○
F. I support the use of local tax dollars to reduce risks and losses from natural disasters.	○	○	○	○	○	○
G. I support protecting historical and cultural structures.	○	○	○	○	○	○
H. I would be willing to make my home more disaster-resistant.	○	○	○	○	○	○
I. I support steps to safeguard the local economy following a disaster event.	○	○	○	○	○	○
J. I support improving the disaster preparedness of local	○	○	○	○	○	○

schools.						
K. I support a local inventory of at-risk buildings and infrastructure.	○	○	○	○	○	○
L. I support the disclosure of natural hazard risks during real estate transactions.	○	○	○	○	○	○

9. General Household Information

1. Please indicate your age:

Age

2. Gender:

- ○ Male
- ○ Female

3. Zip Code:

4. Please indicate your level of education:

- ○ Grade School/No Schooling
- ○ Some high school
- ○ High school graduate/GED
- ○ Some college/trade school
- ○ College degree
- ○ Postgraduate degree
- ○ Other

(please specify)

5. How long have you lived in Oregon?

- ◯ Less than a year
- ◯ 1-5 years
- ◯ 5-9 years
- ◯ 10-19 years
- ◯ 20 years or more

6. Do you rent/own

- ◯ Single-family home
- ◯ Duplex
- ◯ Apartment (3-4 units in structure)
- ◯ Apartment (5 or more unit structures)
- ◯ Condominium / townhouse
- ◯ Manufactured home
- ◯ Other

(please specify)

7. If you have lived in Oregon for less than 20 years, in what state did you live before you moved to Oregon?

- ◯ Not Applicable
- ◯ California
- ◯ Idaho
- ◯ Washington
- ◯ Other

(please specify)

10. Final Comments

1. Please feel free to provide any additional comments in the space provided below:

11. Thanks!

Thank you for your participation!

Linn County Household Preparedness Survey

1. How concerned are you about the following natural disasters affecting your community? (Check the corresponding box for each hazard)

	Very Concerned	Somewhat Concerned	Neither Concerned nor Unconcerned	Not Very Concerned	Not Concerned	Response Count
Drought	7.7% (1)	**30.8% (4)**	15.4% (2)	15.4% (2)	**30.8% (4)**	13
Dust Storm	0.0% (0)	7.7% (1)	30.8% (4)	15.4% (2)	**46.2% (6)**	13
Earthquake	**46.2% (6)**	23.1% (3)	7.7% (1)	7.7% (1)	15.4% (2)	13
Flood	**38.5% (5)**	30.8% (4)	7.7% (1)	15.4% (2)	7.7% (1)	13
Landslide / Debris Flow	7.7% (1)	15.4% (2)	30.8% (4)	7.7% (1)	**38.5% (5)**	13
Wildfire	7.7% (1)	23.1% (3)	**38.5% (5)**	15.4% (2)	15.4% (2)	13
Household Fire	30.8% (4)	**38.5% (5)**	15.4% (2)	15.4% (2)	0.0% (0)	13
Volcanic Eruption	0.0% (0)	30.8% (4)	15.4% (2)	15.4% (2)	**38.5% (5)**	13
Wind Storm	**38.5% (5)**	23.1% (3)	15.4% (2)	7.7% (1)	15.4% (2)	13
Severe Winter Storm	**38.5% (5)**	23.1% (3)	23.1% (3)	0.0% (0)	15.4% (2)	13
Tsunami	0.0% (0)	7.7% (1)	30.8% (4)	23.1% (3)	**38.5% (5)**	13
					answered question	**13**
					skipped question	**0**

2. Did you consider the possible occurrence of a natural hazard when you bought/moved into your current home?

	Response Percent	Response Count
Yes	46.2%	6
No	**53.8%**	**7**
	answered question	**13**
	skipped question	**0**

3. Does your household have insurance coverage for flood events?

	Response Percent	Response Count
Yes	30.8%	4
No	**69.2%**	**9**
	answered question	**13**
	skipped question	**0**

4. If "NO" for flood, what is the main reason your household does not have insurance for flood events?

	Response Percent	Response Count
Not available	11.1%	1
Deductibles too high/not worth it	0.0%	0
Not necessary	11.1%	1
Not located in the floodplain	**44.4%**	**4**
Not familiar with it/don't know	11.1%	1
Too expensive	0.0%	0
Other	22.2%	2
	(please specify)	2
	answered question	**9**
	skipped question	**4**

5. Does your household have insurance coverage for earthquake events?

	Response Percent	Response Count
Yes	**69.2%**	**9**
No	30.8%	4
	answered question	**13**
	skipped question	**0**

6. If "NO" for earthquake, what is the main reason your household does not have insurance for earthquake events? (Please check one)

	Response Percent	Response Count
Not available	0.0%	0
Deductibles too high/not worth it	0.0%	0
Too expensive	0.0%	0
Not necessary	0.0%	0
Not familiar with it/don't know	**75.0%**	**3**
Other	25.0%	1
	(please specify)	1
	answered question	**4**
	skipped question	**9**

7. In the following list, please check those activities that you have done in your household, plan to do in the near future, have not done, or are unable to do. For Questions F-K, there is also the option to check does not apply, if the preparation action does not apply to a feature of your home. (Please check one answer for each preparedness activity)

	Have Done	Plan To Do	Not Done	Unable To Do	Does Not Apply	Response Count
A. Attended meetings or received written information on natural disasters or emergency preparedness?	**69.2% (9)**	0.0% (0)	30.8% (4)	0.0% (0)	0.0% (0)	13
B. Talked with members in your household about what to do in case of a natural disaster or emergency?	**61.5% (8)**	0.0% (0)	30.8% (4)	0.0% (0)	7.7% (1)	13
C. Developed a "Household/Family Emergency Plan" in order to decide what everyone would do in the event of a disaster?	30.8% (4)	23.1% (3)	**46.2% (6)**	0.0% (0)	0.0% (0)	13
D. Prepared a "Disaster Supply Kit" (Stored extra food, water, batteries, or other emergency supplies)?	**75.0% (9)**	8.3% (1)	16.7% (2)	0.0% (0)	0.0% (0)	12
E. In the last year, has anyone in your household been trained in First Aid or Cardio-Pulmonary Resuscitation (CPR)?	**53.8% (7)**	0.0% (0)	38.5% (5)	0.0% (0)	7.7% (1)	13
F. Have you secured your water heater, cabinets and bookcases to the wall?	30.8% (4)	15.4% (2)	**53.8% (7)**	0.0% (0)	7.7% (1)	13
G. Have you fit your gas appliances with flexible connections?	**50.0% (6)**	0.0% (0)	16.7% (2)	0.0% (0)	33.3% (4)	12
H. Used fire-resistant building or roofing materials?	30.8% (4)	15.4% (2)	**38.5% (5)**	0.0% (0)	15.4% (2)	13
I. Secured your home to its foundation?	**38.5% (5)**	0.0% (0)	30.8% (4)	7.7% (1)	23.1% (3)	13
J. Braced unreinforced masonry, concrete walls, and chimney?	7.7% (1)	0.0% (0)	23.1% (3)	0.0% (0)	**69.2% (9)**	13
K. Elevated your home in preparation for floods?	7.7% (1)	0.0% (0)	23.1% (3)	0.0% (0)	**69.2% (9)**	13

answered question	13
skipped question	0

8. Who is your preferred information source to receive information about how to make your household and home safer from natural disasters? (Please check all that apply)

	Response Percent	Response Count
Chamber of Commerce	0.0%	0
University or research institution	8.3%	1
Schools	0.0%	0
Fire Department/Rescue	58.3%	7
Utility company	0.0%	0
Insurance agent or company	33.3%	4
University or research institution	8.3%	1
Government agency	**66.7%**	**8**
American Red Cross	25.0%	3
Other non-profit organization	8.3%	1
answered question		12
skipped question		1

9. What is the preferred way for you to receive information about how to make your household and home safer from natural disasters? (Please check all that apply)

	Response Percent	Response Count
Fact Sheet/brochure	**69.2%**	**9**
Internet	61.5%	8
Mail	53.8%	7
Outdoor advertisements (signs, etc.)	7.7%	1
Radio	7.7%	1
Television	23.1%	3
Magazine	7.7%	1
Public workshops/meetings	15.4%	2
Newspapers	46.2%	6
Other	0.0%	0
(please explain)		0
answered question		**13**
skipped question		**0**

10. Natural hazards can have a significant impact on a community, but planning for these events can help lessen the impacts. The following statements will help determine citizen priorities for planning for natural hazards. Please tell us how important each one is to you.

	Very Important	Somewhat Important	Neither Important nor Unimportant	Not Very Important	Not Important	Response Count
A. Protecting private property	**46.2% (6)**	**46.2% (6)**	0.0% (0)	7.7% (1)	0.0% (0)	13
B. Protecting critical facilities (e.g., transportation networks, hospitals, fire stations)	**100.0% (13)**	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	13
C. Preventing development in hazard areas	30.8% (4)	**38.5% (5)**	15.4% (2)	15.4% (2)	0.0% (0)	13
D. Enhancing the function of natural features (e.g., streams, wetlands)	**46.2% (6)**	30.8% (4)	15.4% (2)	0.0% (0)	7.7% (1)	13
E. Protecting historical and cultural landmarks	30.8% (4)	**38.5% (5)**	15.4% (2)	7.7% (1)	7.7% (1)	13
G. Protecting and reducing damage to utilities	**69.2% (9)**	30.8% (4)	0.0% (0)	0.0% (0)	0.0% (0)	13
H. Strengthening emergency services (e.g.,- police, fire, ambulance)	**61.5% (8)**	23.1% (3)	7.7% (1)	7.7% (1)	0.0% (0)	13
I. Disclosing natural hazard risks during real estate transactions	**69.2% (9)**	30.8% (4)	0.0% (0)	0.0% (0)	0.0% (0)	13
					answered question	**13**
					skipped question	**0**

11. A number of activities can reduce your community's risk from natural hazards. These activities can be both *regulatory* and *non-regulatory*. An example of a regulatory activity would be a policy that limits or prohibits development in a known hazard area such as a floodplain. An example of a non-regulatory activity would be to develop a public education program to demonstrate steps citizens can take to make their homes safer from natural hazards. Please check the box that best represents your opinion of the following strategies to reduce the risk and loss associated with natural disasters.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Not Sure	Response Count
A. I support a regulatory approach to reducing risk.	**30.8% (4)**	23.1% (3)	**30.8% (4)**	7.7% (1)	7.7% (1)	0.0% (0)	13
B. I support a non-regulatory approach to reducing risk.	7.7% (1)	**30.8% (4)**	**30.8% (4)**	23.1% (3)	7.7% (1)	0.0% (0)	13
C. I support a mix of both regulatory and non-regulatory approaches to reducing risk.	7.7% (1)	30.8% (4)	**53.8% (7)**	7.7% (1)	0.0% (0)	0.0% (0)	13
D. I support policies to prohibit development in areas subject to natural hazards.	**38.5% (5)**	**38.5% (5)**	7.7% (1)	7.7% (1)	7.7% (1)	0.0% (0)	13
E. I support the use of tax dollars (federal and/or local) to compensate land owners for not developing in areas subject to natural hazards.	7.7% (1)	15.4% (2)	23.1% (3)	23.1% (3)	**30.8% (4)**	0.0% (0)	13
F. I support the use of local tax dollars to reduce risks and losses from natural disasters.	**30.8% (4)**	**30.8% (4)**	**30.8% (4)**	7.7% (1)	0.0% (0)	0.0% (0)	13
G. I support protecting historical and cultural structures.	23.1% (3)	**38.5% (5)**	23.1% (3)	7.7% (1)	0.0% (0)	7.7% (1)	13
H. I would be willing to make my home more disaster-resistant.	**38.5% (5)**	**38.5% (5)**	7.7% (1)	0.0% (0)	0.0% (0)	15.4% (2)	13
I. I support steps to safeguard the local economy following a disaster event.	38.5% (5)	**46.2% (6)**	0.0% (0)	0.0% (0)	0.0% (0)	15.4% (2)	13
J. I support improving the disaster preparedness of local schools.	38.5% (5)	**53.8% (7)**	0.0% (0)	0.0% (0)	7.7% (1)	0.0% (0)	13
K. I support a local inventory of at-risk buildings and infrastructure.	15.4% (2)	**61.5% (8)**	23.1% (3)	0.0% (0)	0.0% (0)	0.0% (0)	13

L. I support the disclosure of natural hazard risks during real estate transactions.	**76.9% (10)**	15.4% (2)	7.7% (1)	0.0% (0)	0.0% (0)	0.0% (0)	13
						answered question	**13**
						skipped question	**0**

12. Please indicate your age:

	Response Average	Response Total	Response Count
Age	**49.23**	**640**	13
		answered question	**13**
		skipped question	**0**

13. Gender:

		Response Percent	Response Count
Male		46.2%	6
Female		**53.8%**	**7**
		answered question	**13**
		skipped question	**0**

14. Zip Code:

	Response Count
	13
answered question	**13**
skipped question	**0**

15. Please indicate your level of education:

	Response Percent	Response Count
Grade School/No Schooling	0.0%	0
Some high school	0.0%	0
High school graduate/GED	7.7%	1
Some college/trade school	15.4%	2
College degree	**53.8%**	**7**
Postgraduate degree	23.1%	3
Other	0.0%	0
(please specify)		0
answered question		**13**
skipped question		**0**

16. How long have you lived in Oregon?

	Response Percent	Response Count
Less than a year	0.0%	0
1-5 years	23.1%	3
5-9 years	7.7%	1
10-19 years	0.0%	0
20 years or more	**69.2%**	**9**
answered question		**13**
skipped question		**0**

17. Do you rent/own

	Response Percent	Response Count
Single-family home	**84.6%**	**11**
Duplex	7.7%	1
Apartment (3-4 units in structure)	0.0%	0
Apartment (5 or more unit structures)	7.7%	1
Condominium / townhouse	0.0%	0
Manufactured home	0.0%	0
Other	0.0%	0
(please specify)		1
answered question		**13**
skipped question		**0**

18. If you have lived in Oregon for less than 20 years, in what state did you live before you moved to Oregon?

	Response Percent	Response Count
Not Applicable	0.0%	0
California	**66.7%**	**2**
Idaho	0.0%	0
Washington	0.0%	0
Other	33.3%	1
(please specify)		1
answered question		**3**
skipped question		**10**

19. Please feel free to provide any additional comments in the space provided below:	
	Response Count
	2
answered question	2
skipped question	11

Appendix B
2010 Action Item Proposal Forms

Proposed Action Item Identification:		
ST: 1.1.1 Would be a Short Term Action proposed under Goal 1 Objective 1.1		
Proposed Action Title/Description:		
Develop formal agreements (such as Memorandums of Understanding, MOUs) with internal (departments) and external partners (e.g. non-profit organizations, cities, and state agencies) to work together on risk reduction efforts in the County.		
Rationale for Proposed Action Item:		
• In a self-completed hazard analysis, Linn County rated itself as having an above average or high risk to the majority of hazards addressed by the NHMP. Developing formal agreements with internal and external partners could assist the partners in collaborating and sharing the responsibility of natural hazard mitigation. Such actions to form collaborative partnerships and commitments to mitigation can assist the County in reducing its risk to the natural hazards addressed by the NHMP. • FEMA How-to-Guide #4 – *Bringing the Plan to Life* encourages communities to confirm and clarify responsibilities through formal agreements in order to implement the plan. • Mutual Aid Agreements are commonly used in the emergency management field to pre-arrange assistance with other agencies or jurisdictions in case of an event. This concept, under the term "Memorandum of Understanding" could be applied to pre-disaster mitigation to confirm collaboration on natural hazard mitigation activities.		
Ideas for Implementation:		
• Create a signature page for the Natural Hazard Mitigation Plan that must be signed by all County department heads indicating that they have received the plan and intent to assist in its implementation • Identify and pursue MOUs with potential external partners such as non-profit organizations or state and federal agencies that may be able to assist in implementing pre-disaster mitigation activities. • Renew MOUs for each calendar year so that they can be updated to reflect the changing needs and conditions of the community and internal and external partners; have both internal and external partners resign the updated MOUs each calendar year.		
Coordinating Organization:	**Linn County Board of Commissioners**	
Internal Partners:		**External Partners:**
Steering Committee Members		COG; Cities; State Agencies Non-profit Organizations OSU Extension Service
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
6 Months – 1 Year		
Status:	Several MOU's and agreements have been developed. Since there are still are internal and external partners to develop agreements with the Steering Committee decided to defer this action item and include it in the 2010 Action Items.	

Proposed Action Item Identification:
LT: 1.1.2 Would be a Short Term Action proposed under Goal 1 Objective 1.1
Proposed Action Title/Description:
Explore funding opportunities with partners (both internal & external) to implement the actions identified in the plan.
Rationale for Proposed Action Item:
• Linn County currently has limited local funding opportunities available to fund and implement natural hazard mitigation projects. • In a self-completed hazard analysis, Linn County rated itself as having an above average or high risk to the majority of hazards addressed by the NHMP. Exploring funding opportunities could provide the County with resources to implement actions for hazard mitigation. Implementing such actions could assist the County in reducing its overall risk to hazards. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for, and vulnerability to, most hazards addressed by the NHMP as being high. Exploring funding opportunities could provide the County with resources to implement actions for hazard mitigation. Implementing such actions could assist the County in reducing its overall risk to hazards.
Ideas for Implementation:
• Convene a meeting of the Steering Committee annually to discuss potential funding sources. • Maintain communication with external partners in an effort to identify upcoming fundings sources. Report findings at Steering Committee meetings. • Collaborate with other communities to find funding sources on collaborative projects • Identify existing funding sources for hazard mitigation projects

Coordinating Organization:	**Linn County Emergency Management**

Internal Partners:	**External Partners:**
Steering Committee Members	OEM DOGAMI FEMA ONHW

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	Ongoing	

Status:	The Steering Committee evaluated this action item and determined that exploring funding opportunities with all partners will still serve a vital role in implementation of the action items. This action item has been deferred and included in the 2010 Action Items.

Proposed Action Item Identification:
LT: 1.1.3 Would be a Long Term Action proposed under Goal 1 Objective 1.1
Proposed Action Title/Description:
Establish mitigation benchmarks to assist in evaluating and updating the plan
Rationale for Proposed Action Item:
• In a self-completed hazard analysis, Linn County rated itself as having an above average or high risk to the majority of hazards addressed by the NHMP. Establishing mitigation benchmarks can assist the County in more effectively and efficiently updating and evaluating its plan, helping the County reduce its risk to the hazards addressed by the NHMP. • The ways in which natural hazards affect communities cannot be completely predicted and are subject to change. As risk assessment information changes or is updated, the predictions for how natural hazards will affect a community also change. Establishing benchmarks will provide an opportunity to incorporate new and updated risk assessment data into Linn County's NHMP, assisting the County in mitigating the affects of natural hazards addressed by the Plan. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for, and vulnerability to, most hazards addressed by the NHMP as being high. Establishing mitigation benchmarks can assist the County in more effectively and efficiently updating and evaluating its plan, helping the County reduce its risk to the hazards addressed by the NHMP. • The Disaster Mitigation Act of 2000 requires that communities describe how they will monitor, evaluate and update their plans within a five-year cycle [201.6(c)(4)(*i*)]. Establishing benchmarks will assist the County in evaluating and updating its plan, and allow the County to easily identify what has been accomplished and what remains to be completed.
Ideas for Implementation:
• Research existing federal requirements for five-year cycle of plan monitoring, evaluation, and updating. Incorporate any appropriate requirements into Linn County's mitigation benchmarks. • Identify and document potential mitigation benchmarks • The Steering Committee will convene annually to evaluate existing benchamarks and identify any modifications or adjustments that need to be made to existing benchmarks. • Partner with appropriate state agencies for assistance in developing appropriate benchmarks. • Incorporate identified benchmarks into all Plan review and evaluation meetings.

Coordinating Organization:	**Steering Committee**

Internal Partners:	**External Partners:**
Planning and Building Departments Emergency Management	State Agencies OEM FEMA

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	Ongoing	

Status:	Deferred - Linn County has made progress on many of the Action Items in the plan. The Steering Committee determined to defer this item since it is still relevant to the 2010 update.

Proposed Action Item Identification:

ST: 1.2.1 Would be a Short Term Action proposed under Goal 1 Objective 1.2

Proposed Action Title/Description:

Encourage and support the development of local community plan supplements to the County Natural Hazard Mitigation Plan

Rationale for Proposed Action Item:

- In a self-completed hazard analysis, Linn County rated itself as having an above average or high risk to the majority of hazards addressed by the NHMP. Supporting the development of local community plans allows for better risk assessment data collection at the local level. Better local risk assessment data improves the county's risk assessment data. Improved county risk assessment data assists the county in better identifying at-risk areas and methods for mitigating those risks, helping the county reduce its overall risk to hazards.
- The Linn County plan only covers unincorporated Linn County and not incorporated communities. The City of Albany is currently developing a stand-alone mitigation plan. Supporting the development of such local city plans that will supplement the County plan and improve the data and coverage of the County NHMP. Such actions can assist the County in reducing its overall risk to hazards addressed by the NHMP.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for, and vulnerability to, hazards in general is high. Supporting the development of local community plans allows for better risk assessment data collection at the local level. Better local risk assessment data improves the county's risk assessment data. Improved county risk assessment data assists the county in better identifying at-risk areas and methods for mitigating those risks, helping the county reduce its overall risk to hazards.

Ideas for Implementation:

- Hold a forum to inform incorporated communities about the FEMA planning requirements.
- Assist communities with the mitigation planning process. Possible methods include:
  - Develop or acquire exisitng materials with information about the natural hazard mitigation planning process that could be distributed to project directors and emergency managers of city plans.
    - Provide links on the County's website for plan documents, and include an e-mail address and/or phone number that communities can contact for questions or assistance.
  - A County-hosted workshop to provide information and assistnace to project managers and emergency managers involved in city plans.

Coordinating Organization:	**Linn County Board of County Commissioners**

Internal Partners:	**External Partners:**
Steering Committee Members Planning and Building Departments	Local Cities FEMA ONHW OEM

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
1-2 Years		

Status:	Several Cities within Linn County are in the process of developing addendums or updating current addendums. Since there are still cities that could develop addendums the Steering Committee deferred this action.

Proposed Action Item Identification:
ST: 1.2.2 Would be a Short Term Action proposed under Goal 1 Objective 1.2
Proposed Action Title/Description:
Develop County protocols and communication strategies for the dissemination of media messages that focus on individual responsibility for disaster safety and risk reduction (e.g. IBHS homeowner guides, press releases for awareness campaigns, etc.)
Rationale for Proposed Action Item:
• The Steering Committee identified a lack of awareness of hazard risk among County residents. Developing communication strategies to inform the public about hazard mitigation would be a way to increase public awareness about hazards and encourage public participation in the County's efforts to mitigate its risks to the hazards addressed by the NHMP. • In a self-completed hazard analysis, Linn County rated itself as having an above average or high risk to the majority of hazards addressed by the NHMP. Informing the public of their role in the County's risk mitigation efforts, not only increases the public's awareness of the county's hazard risks, but also helps the County reduce its risk to the hazards addressed by the NHMP. • Mitigation is a shared responsibility between local, state, and federal government; citizens; businesses; non-profit organizations; and others. Informing the public of their role in the County's risk mitigation efforts, not only increases the public's awareness of the county's hazard risks, but also helps the County reduce its risk to the hazards addressed by the NHMP. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for, and vulnerability to, most hazards addressed by the NHMP as being high. Informing the public of their role in the County's risk mitigation efforts, not only increases the public's awareness of the county's hazard risks, but also helps the County reduce its risk to the hazards addressed by the NHMP. • The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(*ii*)]. Conducting outreach to educate the public on the shared responsibility of hazard mitigation would be a way to involve the public in the County's continued mitigation efforts.
Ideas for Implementation:
• Implement ONHW's homeowner survey of County residents to gain an understanding of current risk perception levels as well as preferred methods of receiving risk reduction information. • Utilize the prefered methods of communication indicated by the household survey to develop communication strategies. • Determine if materials or communication strategies already exist; utilize any existing materials and communication strategies. • Develop targeted outreach campainges for specific hazards. Develop plans to run the campainges during the times of the year when the county has a greater risk to specific hazards (an example would be running a wildfire campaigne from mid-spring through the summer).

Coordinating Organization:	**Linn County Public Information Officer**

Internal Partners:	**External Partners:**
Planning and Building Departments Emergency Management	State Agencies FEMA IBHS

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
6 Months – 1 Year		

Status:	Deferred - No progress has been made due to lack of resources.

Proposed Action Item Identification:

ST: 1.2.3 Would be a Short Term Action proposed under Goal 1 Objective 1.2

Proposed Action Title/Description:

Distribute information regarding the Natural Hazard Mitigation Plan to public officials and community leaders, and provide updates on hazard vulnerability and County hazard mitigation activities.

Rationale for Proposed Action Item:

- In a self-completed hazard analysis, Linn County rated itself as having an above average or high risk to the majority of hazards addressed by the NHMP. Informing elected officials of their role in the County's risk mitigation efforts, not only increases officials' awareness of the county's hazard risks, but assists elected officials in making more informed decisions regarding hazards. More informed decisions regarding natural hazards assist the County in reducing its overall risk to the hazards addressed in the NHMP.
- Mitigation is a shared responsibility between local, state, and federal government; citizens; businesses; non-profit organizations; and others. Informing elected officials of their role in the County's risk mitigation efforts, not only increases the public's awareness of the county's hazard risks, but also helps the County reduce its risk to the hazards addressed by the NHMP.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for, and vulnerability to, most hazards addressed by the NHMP as being high. Informing elected officials of their role in the County's risk mitigation efforts, not only increases officials' awareness of the county's hazard risks, but assists elected officials in making better informed decisions regarding hazards. More informed decisions regarding natural hazards assist the County in reducing its overall risk to the hazards addressed in the NHMP.
- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(*ii*)]. Providing information to public officials about Linn County's risk to the hazards addressed in the NHMP would assist the elected officials in making more informed decisions regarding natural hazards. More informed decisions regarding natural hazards assist the County in reducing its overall risk to the hazards addressed in the NHMP.

Ideas for Implementation:

- Identify pertinent information to provide to and share with elected officials regarding the hazards addressed in the NHMP.
- Develop strategies for delivering the information to elected officials. Such methods could include:
  - Quick reference brouchers and factsheets.
  - Mailing such materials out to elected officials.
  - Informing elected officials of the existance of hazard related materials.
  - A County-sponsored seminar for elected officals regarding hazards.

Coordinating Organization:	**Linn County Steering Committee**

Internal Partners:	**External Partners:**
Planning and Building Departments County Departments; Linn County Emergency Management	State Agencies

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
6 Months – 1 Year		

Status:	The Steering Committee changed the language of this action item so that it would be more feasible to accomplish**.**

Proposed Action Item Identification:		
LT: 1.2.4 Would be a Long Term Action proposed under Goal 1 Objective 1.2		
Proposed Action Title/Description:		
Develop and maintain a database of current action items		
Rationale for Proposed Action Item:		
• In a self-completed hazard analysis, Linn County rated itself as having an above average or high risk to the majority of hazards addressed by the NHMP. Developing and maintaining a database or action items can allow the County to more quickly identify projects to submit for funding opportunities, making the County more competitive for potential funding opportunities. Being a more competitive candidate for funding opportunities can assist the county in reducing its overall risk to the natural hazards addressed in the NHMP. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for, and vulnerability to, most hazards addressed by the NHMP as being high. Developing and maintaining a database or action items can allow the County to more quickly identify projects to submit for funding opportunities, making the County more competitive for potential funding opportunities. Being a more competitive candidate for funding opportunities can assist the county in reducing its overall risk to the natural hazards addressed in the NHMP. • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(*ii*)]. Developing and maintaining a database or action items can allow the County to more quickly identify projects to submit for funding opportunities, making the County more competitive for potential funding opportunities. Being a more competitive candidate for funding opportunities can assist the county in reducing its overall risk to the natural hazards addressed in the NHMP.		
Ideas for Implementation:		
• Develop a database for storing action items and relevant information regarding action items. • Upon the Steering Committee's final approval, add all approved plan action items into the database. • Develop methods for maintaining the database and keeping it up-to-date. • Identify methods in which actions can be incorporated into other existing plans, programs, and policies.		
Coordinating Organization:	**Linn County Emergency Management**	
Internal Partners:		**External Partners:**
Planning and Building Departments		
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years) Ongoing	
Status:	Deferred - No progress has been made due to lack of resources.	

Proposed Action Item Identification:
ST: 2.1.1 Would be a Short Term Action proposed under Goal 2 Objective 2.1
Proposed Action Title/Description:
Provide mitigation training to county planning and public works staff, including GIS technicians.
Rationale for Proposed Action Item:
• In a self-completed hazard analysis, Linn County rated itself as having an above average or high risk to the majority of natural hazards addressed by the NHMP. Providing mitigation training for county planning, public works, and GIS staff increases their awareness and understanding of natural hazard mitigation planning. More informed staff can incorporate natural hazard mitigation into their daily work activities, make better decisions regarding natural hazard planning, and can assist the Steering Committee in implementing the Plan's identified action items. This can help the county reduce its overall risk to the natural hazards addressed by the NHMP. • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(*ii*)]. Providing mitigation training for county planning, public works, and GIS staff increases their awareness and understanding of natural hazard mitigation planning. More informed staff can incorporate natural hazard mitigation into their daily work activities, make better decisions regarding natural hazard planning, and can assist the Steering Committee in implementing the Plan's identified action items. This can help the county reduce its overall risk to the natural hazards addressed by the NHMP. • Have County staff members who understand the principles of mitigation will create the understanding needed to better incorporate mitigation into existing programs, which is a key requirement of the Disaster Mitigation Act of 2000.
Ideas for Implementation: (Optional)
• Identify desired areas of natural hazard mitigation training for county planning, public works, and GIS staff. • Research existing regional, state, and federal natural hazard mitigation training programs, and contact agencies for information on possible training opportunities. • Allow staff members to attend natural hazard mitigation trainings, or provide incentives for their attendance. Ensure that this is a continued, County-supported effort.

Coordinating Organization:	**Linn County Emergency Management**

Internal Partners:	**External Partners:**
Linn County Roads	FEMA Fire Marshall OEM Insurance Companies DOGAMI ONHW

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
ongoing		

Status:	Deferred - The County has identified specific training opportunities available through the FEMA Independent Study program and announcements will prepare to the Roadmaster and Director of Planning and Building for dissemination to their staff members.

Proposed Action Item Identification:

ST: 2.1.2 Would be a Short Term Action proposed under Goal 2 Objective 2.1

Proposed Action Title/Description:

Develop a continuity of government plan that details how core governmental operations will be maintained in the event of an emergency.

Rationale for Proposed Action Item:
(What critical issues will the action address?)

- **Commonwealth of Pennsylvania Human Resources and Management –** Continuity of government refers to the need to continue core governmental operations in the event of an emergency situation, including natural disasters. These plans detail how essential business functions will be maintained in the event of an emergency that disrupts normal operations.
- In a self-completed hazard analysis, Linn County rated itself as having an above average or high risk to the majority of natural hazards addressed by the NHMP. The County currently does not have a continuity of government plan. Developing a continuity plan will assist the County in planning how it will respond in the event of a natural disaster, helping the County mitigate the effects potential natural hazard events may have on the community.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for, and vulnerability to, most natural hazards addressed by the NHMP as being high. Developing a continuity plan will assist the County in planning how it will respond in the event of a natural disaster, helping the County mitigate the effects that potential natural hazard events may have on the community.

Ideas for Implementation: (Optional)

- Identify existing plans and policies within Linn County that deal with the County's response to natural hazard events and evaluate their methods for responding to a natural hazard event.
- Identify "core governmental opperations" necessary for Linn County and the departments and agencies responsbile for them.
- Develop a method for monitoring, evaluationg, and updating Linn County's continuity of government plan.
- When possible, integrate response, recovery, mitigation, and continuity plans to reflect the disaster cycle.

Coordinating Organization:	**Linn County Administrative Office**

Internal Partners:	**External Partners:**
Emergency Management County Departments	Elected Officials Board of County Commissioners

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
1-2 Years		

Status:	Deferred - In January 2010, Linn County began participating in a six-county grant award initiative to provide COG and Coop planning for each of the participating counties and their cities. An initial COOP Plan training workshop was conducted in February 2010. A mid-term training will be conducted in June 2010.

Proposed Action Item Identification:
LT: 2.1.3 Would be a Long Term Action proposed under Goal 2 Objective 2.1
Proposed Action Title/Description:
Evaluate current zoning codes to incorporate mitigation principles.
Rationale for Proposed Action Item:
• In a self-completed hazard analysis, Linn County rated itself as having an above average or high risk to the majority of natural hazards addressed by the NHMP. Implementing mitigation principles through existing zoning codes allows the County to reduce the duplication of efforts. • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings [201.6(c)(3)(*ii*)]. Evaluating and enhancing zoning codes would address the future built environment and would also help further the objectives of Oregon Statewide Land Use Planning Goal 7 - Areas Subject to Natural Disasters and Hazards
Ideas for Implementation:
• Identify mitigation principles missing from existing zoning codes, or existing codes that mitigation principles could be added to. • Research the possibilty for implementing mitigation principles them through zoning codes, and implement if possible.

Coordinating Organization:	**Linn County Planning & Building Department**

Internal Partners:	**External Partners:**
Emergency Management	Planning Commission Board of County Commissioners

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
1-3 years		

Status:	Deferred - not completed due to lack of resources and funds**.**

Proposed Action Item Identification:

ST: 2.1.4 Would be a Short Term Action proposed under Goal 2 Objective 2.1

Proposed Action Title/Description:

Participate in the National Flood Insurance Program's Community Rating System

Rationale for Proposed Action Item:

- In a self-completed hazard analysis, Linn County rated itself as having a high flood risk rating of 220 out of 240. The County currently does not participate in the National Flood Insurance Program's Community Rating System (CRS). Participating in the CRS can help the County to better identify ways to reduce its flood risk and save money by earning reduced insurance premiums.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for a future flood event is high (that the county would be likely to have a major flooding event in the next 10-35 years) and the county's vulnerability to a future flood event is high. Participating in the CRS can help the County to better identify ways to reduce its flood risk and save money by earning reduced insurance premiums. Linn County was significantly impacted by the flooding events in 1996 and 1997, both of which were Presidentially Declared Disasters.
- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings [201.6(c)(3)(*ii*)]. Participating in the CRS can help the County to better identify ways to reduce its flood risk and save money by earning reduced insurance premiums.

Ideas for Implementation:

- Determine CRS eligibility requirements
- Research and document current activities that Linn County is already conducting.
- Complete and submit CRS participation application
- Possible Ideas:
  - Update Linn County's code to reflect requirements of the CRS
  - Establish outreach projects to provide education flood hazards to Linn County Residents
  - Implement reasonable higher regulatory standards
  - Obtain digital floodplain maps.

Coordinating Organization:	**Linn County Planning & Building Department**

Internal Partners:	**External Partners:**
Building Official Emergency Management	Board of County Commissioners FEMA Insurance Companies Local Cities

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
3-6 Months		

Status:	Deferred - not completed due to lack of resources and funds**.**

Proposed Action Item Identification:

LT: 2.1.5 Would be a Long Term Action proposed under Goal 2 Objective 2.1

Proposed Action Title/Description:

Develop management strategies to preserve the function of the floodplain

Rationale for Proposed Action Item:

- In a self-completed hazard analysis, Linn County rated itself as having a high flood risk rating of 220 out of 240. Developing management strategies to preserve the function of the floodplain would affect the types of development, amount of development, and land use practices in the County's floodplain. Monitoring development and land use practices in the floodplain can assist the County in reducing its overall flood risk.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for a future flood event is high (that the county would be likely to have a major flooding event in the next 10-35 years) and the county's vulnerability to a future flood event is high. Developing management strategies to preserve the function of the floodplain would affect the types of development, amount of development, and land use practices in the County's floodplain. Monitoring development and land use practices in the floodplain can assist the County in reducing its overall flood risk.
- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings [201.6(c)(3)(*ii*)]. Developing management strategies to preserve the function of the floodplain would affect the types of development, amount of development, and land use practices in the County's floodplain. Monitoring development and land use practices in the floodplain can assist the County in reducing its overall flood risk.

Ideas for Implementation:

- Identify the functions of the floodplain that are important to Linn County.
- Identify the departments and agencies responsible for maintaining and preserving those functions.
- Work with those departments and agencies to develop management strategies for preserving those functions.
- Develop methods for monitoring, evaluating, and updating those management strategies.

Coordinating Organization:	**Linn County Planning and Building Department**

Internal Partners:	**External Partners:**
Building Official	Local Cities FEMA DSL ODFW OWRD Watershed Councils

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	2-3 Years	

Status:	This action item has been deferred and was not completed due to lack of resources and funds this item was not completed**.**

Proposed Action Item Identification:		
LT:2.1.6 Would be a Long Term Action Proposed under Goal 2 Objective 2.1		
Proposed Action Title/Description:		
Develop a scour protection plan for Linn County Bridges.		
Rationale for Proposed Action Item:		
• The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that reduce the effects of hazards on existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing a scour protection plan for Linn County bridges will protect existing bridges from erosion caused by flooding events		
Ideas for Implementation:		
• Coordinate efforts with ODOT and the Army Corps of Engineers who have resources to assist communities in developing scour protection plans.		
Coordinating Organization:	Road Department	
Internal Partners:		**External Partners:**
Linn County Surveyor; Linn County GIS		State and Federal agencies
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	ongoing	
Status:	**New Action Item**	

Proposed Action Item Identification:
ST: 2.2.1 Would be a Short Term Action Proposed under Goal 2 Objective 2.2
Proposed Action Title/Description:
Develop an inventory of county assets including replacement costs
Rationale for Proposed Action Item:
• In a self-completed hazard analysis, Linn County rated itself as having an above average or high risk to the majority of natural hazards addressed by the NHMP. Developing an inventory of county assets and replacement costs can assist the County in identifying what community assets are vulnerable to the natural hazards addressed in the NHMP. Assessing its vulnerability to hazards can help the County to better identify ways to reduce its risk to natural hazards. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for, and vulnerability to, most natural hazards addressed by the NHMP as being high. Developing an inventory of county assets and replacement costs can assist the County in identifying what community assets are vulnerable to the natural hazards addressed in the NHMP. Assessing its vulnerability to hazards can help the County to better identify ways to reduce its risk to natural hazards. • The Disaster Mitigation Act of 2000 requires that communities identify their vulnerability to the hazards that affect the community, and how the community will be impacted [201.6(c)(2)(*ii*)(A)] and recommends estimating potential dollar losses [201.6(c)(2)(*ii*)(B)]. Developing an inventory of county assets and replacement costs can assist the County in identifying what community assets are vulnerability to the natural hazards addressed in the NHMP. Assessing its vulnerability to hazards can help the County to better identify ways to reduce its risk to natural hazards.
Ideas for Implementation:
• Identify assets that are important to the County to protect from the affects of natural hazards. • Identify any existing inventories of important assets, including but not limited to: critical facilities and infrastructure, natural and cultural resources, historic sites and buildings, etc. • Create a single server/location database for storing the inventory • Develop methods for updating and maintaining the database and inventory. • Make the outcome of this inventory available through the County's GIS system

Coordinating Organization:	**Linn County General Services**

Internal Partners:	**External Partners:**
GIS	Linn County Property Management Treasurer Assessor

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
1-2 Years		

Status:	Deferred - not completed due to lack of resources and funds**.**

Proposed Action Item Identification:
ST: 2.2.2 Would be a Short Term Action proposed under Goal 2 Objective 2.2
Proposed Action Title/Description:
Re-run DOGAMI HAZUS with local refined data for the earthquake hazard
Rationale for Proposed Action Item:
• HAZUS is a GIS mapping tool that can be used to estimate loss for potential natural hazard events such as earthquakes. HAZUS can assist communities determine in losses, allowing for emergency preparedness, response and recovery planning, and future risk reduction decisions. HAZUS is able to provide more accurate estimates when it has more refined data to work with. Adding better local data can allow Linn County to use the software to obtain more accurate estimates. Better estimates allow the County to better identify mitigation strategies that can assist it in reducing its risk to earthquakes. • In a self-completed hazard analysis, Linn County rated itself as having a high earthquake risk rating of 223 out of 240. Re-running HAZUS with more refined local data can assist Linn County in obtaining better estimates for potential losses from earthquakes. Better estimates allow the County to better identify mitigation strategies that can assist it in reducing its risk to earthquakes. • The Disaster Mitigation Act of 2000 requires that communities identify their vulnerability to the hazards that affect the community, and how the community will be impacted [201.6(c)(2)(*ii*)(A)]. Re-running HAZUS with more refined local data can assist Linn County in obtaining better estimates for potential losses from earthquakes, assisting the County in identifying its vulnerability to earthquakes. Better estimates of its vulnerability allow the County to better identify mitigation strategies that can assist the County in reducing its risk to earthquakes.
Ideas for Implementation:
• Obtain HAZUS training for appropriate County staff (GIS technicians, planners, etc…) • Identify and collect local refined data. • Obtain any new HAZUS updates. • Ensure that any new HAZUS software updates are compatable with the County's existing servers, programs, and software. • Re-run HAZUS with refined local data.

Coordinating Organization:	**Linn County GIS Department**

Internal Partners:	**External Partners:**
Emergency Management Planning and Building Departments	Assessor DOGAMI FEMA

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
1 Year		

Status:	Deferred - Linn Co. Updated the information from the final DOGAMI Hazus information provided. Since HB 3375 (2003)

Proposed Action Item Identification:
LT: 2.2.3 Would be a Long Term Action proposed under Goal 2 Objective 2.2
Proposed Action Title/Description:
Update Flood Insurance Rate Maps (FIRM)
Rationale for Proposed Action Item:
• In a self-completed hazard analysis, Linn County rated itself as having a high flood risk rating of 220 out of 240. Updated Flood Insurance Rate Maps can assist the County in more accurately predicting its risk to a future flooding event. Better predictions can assist the County to better identify mitigation strategies to reduce its flood risk. The existing FIRM is dated September 29, 1986. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for a future flood event is high (that the county would be likely to have a major flooding event in the next 10-35 years) and the county's vulnerability to a future flood event is high. Updated Flood Insurance Rate Maps can assist the County in more accurately predicting its risk to a future flooding event. Better predictions can assist the County to better identify mitigation strategies to reduce its flood risk. • The Disaster Mitigation Act of 2000 requires communities to identify geographic extent of hazards known to impact the community [201.6(c)(2)(*i*)]. Updated Flood Insurance Rate Maps can assist the County better defining the flood hazard within the community given the development that has taken place since the current FIRMS were created.
Ideas for Implementation:
• Contact the State Floodplain Manager at DLCD to get more information on the Flood Map Modernization Program • Determine whether or not the County has the capability to become a Cooperating Technical Partner in order to assist FEMA update the County's FIRMs.

Coordinating Organization:	**Linn County Planning and Building Department**

Internal Partners:	**External Partners:**
Emergency Management Building Official	Insurance Companies Local Cities FEMA OEM

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
September 2010		

Status:	Deferred - In progress during update.

Proposed Action Item Identification:
ST: 2.2.4 Would be a Short Term Action proposed under Goal 2 Objective 2.2
Proposed Action Title/Description:
Develop pre-storm strategies for coordinated debris removal following wind and winter storms.
Rationale for Proposed Action Item:
• In a self-completed hazard analysis, Linn County rated itself as having a high windstorm risk rating of 230 out of 240. Developing pre-storm response strategies for debris removal after wind and winter storms can assist the County in coordinating its response efforts. Coordinating resources assists the County in more efficiently and effectively using resources and responding when a wind or winter storm does happen. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for a future windstorm or winter storm is high (that the county would be likely to have a major windstorm or winter storm event in the next 10-35 years) and the county's vulnerability to a future windstorm or winter storm is high. Pre-planning to coordinate resources assists the County in more efficiently and effectively using resources and responding when a wind or winter storm does happen.
Ideas for Implementation:
• Identify and prioritize areas most likely to have debris to be removed following a wind or witner storm. • Identify departmetns and agencies would could assist with debris removal. • Work with departments, agencies and private organizations that can assist in developing coordinated strategies for removing debris after a wind or winter storm. Elements to include in strategies could include: o Tasks and responsibilities for each department and agency. o Routes to respond to prioritized areas. o Locations for depositing collected debris, or methods for dealing with collected debris. o Methods for responding to reports of debris caused by wind and winter storms.

Coordinating Organization:	**Linn County Roads Department**

Internal Partners:	**External Partners:**
Emergency Management	Sheriff 911 Coordinator Utility Companies Local Cities

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
1 Year		

Status:	Deferred - not completed due to lack of resources and funds**.**

Proposed Action Item Identification:		
LT: 2.2.5. Would be a Long Term Action proposed under Goal 2 Objective 2.2		
Proposed Action Title/Description:		
Action 2.2.5. Inventory buildings, infrastructure and critical facilities that are vulnerable to sever weather.		
Rationale for Proposed Action Item:		
• Power lines, older buildings and trees are susceptible to damage from wind, ice and snow loads from winder storms.		
Ideas for Implementation:		
• Coordinate efforts with local communities, utility companies and Linn County GIS Department to identify areas of high risk.		
Coordinating Organization:	**Linn County Emergency Management**	
Internal Partners:		**External Partners:**
GIS, Planning and Building, Road Department		Utility companies, Oregon State College of Engineering, local communities.
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	3 years	
Status:	Deferred - not completed due to lack of resources and funds. Action Item was modified.	

Proposed Action Item Identification:		
ST: 2.2.6 Would be a Short Term Action Proposed under Goal 2 Objective 2.2		
Proposed Action Title/Description:		
Support local agency programs that promote measures to reduce water use during drought emergencies.		
Rationale for Proposed Action Item:		
• During severe drought situations it may be necessary to require curtailment of water use		
Ideas for Implementation:		
• Develop public awareness and water conservation programs.		
Coordinating Organization:	**Board Of Commissioners**	
Internal Partners:		**External Partners:**
Planning and Building; Emergency Management; Parks and Recreation Department		NRCS; Department of Agriculture; WRD; Local Water Districts
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
ongoing		
Status:	**New Action Item**	

Proposed Action Item Identification:		
LT: 2.2.7 Would be a Short Term Action Proposed under Goal 2 Objective 2.2		
Proposed Action Title/Description:		
Geo-code the location, type, footprint and elevation data for buildings, infrastructure, and critical facilities in natural hazard areas.		
Rationale for Proposed Action Item:		
• .Identifying buildings, infrastructure, and critical facilities in natural hazards areas can help in identifying whether these facilities are vulnerable to natural hazards and to what extent the damage could be during an event. This information can also be used to develop appropriate mitigation action items to reduce future impacts from natural hazard events. • The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that reduce the effects of hazards on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Geo-coding the location, type, footprint, and elevation data for buildings, infrastructure, and critical facilities in natural hazard areas can be used to identify whether facilities are vulnerable to natural hazards and appropriate mitigation actions that the county can implement.		
Ideas for Implementation:		
• Use DOGAMI's 2007 Rapid Visual Survey to identify Linn County buildings that should be geo-coded. • Coordinate geo-coding efforts with DOGAMI's hazard mapping efforts		
Coordinating Organization:	Linn County GIS Department	
Internal Partners:		**External Partners:**
Assessor; Planning & Building Dept.; Emergency Management; Road Dept.		FEMA; OEM; DOGAMI; Cities; Insurance Companies
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	ongoing	
Status:	Deferred - not completed due to lack of resources and funds.	

Proposed Action Item Identification:		
ST: 2.2.8 Would be a Short Term Action Proposed under Goal 2 Objective 2.2		
Proposed Action Title/Description:		
Continue to improve identification of debris flow areas in Linn County by using mapping with current data and technology.		
Rationale for Proposed Action Item:		
• Using improved methods to map debris flow areas would provide more refined local data and assist Linn County in obtaining better estimates for potential losses from landslides. Better estimates allow the County to better identify mitigation strategies that can assist it in reducing its risk to landslides. • The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that reduce the effects of hazards on existing buildings and infrastructure [201.6(c)(3)(ii)]. Identifying debris flow areas in Linn County by using mapping technology can identify areas vulnerable to landslide events and help determine whether new buildings and infrastructure should be located there.		
Ideas for Implementation:		
• Study the feasibility of conducting a LIDAR analysis of Linn County to better understand areas of debris flow. • Coordinate mapping of debris flow areas with the Department of Geology and Mineral Industries (DOGAMI).		
Coordinating Organization:	**GIS Department**	
Internal Partners:		**External Partners:**
Board Of Commissioners		DOGAMI
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	2-4 years	
Status:	New Action Item	

Proposed Action Item Identification:		
LT:2.2.9 Would be a Long Term Action Proposed under Goal 2 Objective 2.2		
Proposed Action Title/Description:		
Implement Linn County existing development standards for proposed structures located within a "mass movement area".		
Rationale for Proposed Action Item:		
• The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that reduce the effects of hazards on future buildings and infrastructure [201.6(c)(3)(ii)]. Implementing Linn County's existing development standards for proposed structures located within a "mass movement area" will reduce the impact of landslides on future buildings and infrastructure.		
Ideas for Implementation:		
• Follow the permitting process for review of properties within the "mass movement area" the Linn County Planning and Building Department. • Provide landslide information to landowners within these areas.		
Coordinating Organization:	**Linn County Planning and Building**	
Internal Partners:		**External Partners:**
GIS Department, Emergency Management		DOGAMI
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	ongoing	
Status:	**New Action Item**	

Proposed Action Item Identification:		
LT:2.2.10 Would be a Long Term Action Proposed under Goal 2 Objective 2.2		
Proposed Action Title/Description:		
Develop a County wide list of and Evaluate for flood; scour; seismic and structural integrity of all bridge crossings leading to private structures on private and public lands.		
Rationale for Proposed Action Item:		
• The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that reduce the effects of hazards on existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing a county-wide list of bridge crossings that lead to private structures on private and public lands, and evaluating these crossings for flood, scour, and seismic activity, can greatly reduce the impact of floods and earthquakes to existing buildings in Linn County.		
Ideas for Implementation:		
• Conduct an inventory of all bridge crossings in Linn County using GIS • Conduct visual surveys of bridge crossings to provide a preliminary evaluation for flood, scour, and seismic issues. FEMA's *Rapid Visual Screening of Buildings for Seismic Risk: A Handbook* can assist in conducting preliminary evaluations		
Coordinating Organization:	**Linn County Emergency Management**	
Internal Partners:		**External Partners:**
Road Department		Private land owners; Public Agencies
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	ongoing	
Status:	**New Action Item**	

Proposed Action Item Identification:		
LT:2.2.11. Would be a Long Term Action Proposed under Goal 2 Objective 2.2		
Proposed Action Title/Description:		
Discuss funding opportunities to conduct a new hydraulic study for Linn County.		
Rationale for Proposed Action Item:		
•		
Ideas for Implementation:		
• Conduct a hydraulic study in coordination with other agencies to minimize damage.		
Coordinating Organization:	Road Department	
Internal Partners:		**External Partners:**
Linn County Surveyor; Linn County GIS		State and Federal agencies
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	ongoing	
Status:	**New Action Item**	

Proposed Action Item Identification:
LT:2.2.12. Would be a Long Term Action Propose under Goal 2 Objective 2.2
Proposed Action Title/Description:
Develop a risk analysis for each section identified in the Linn County Natural Hazard Mitigation Plan
Rationale for Proposed Action Item:
• A risk analysis involves estimating the damage, injuries, and costs likely to be incurred in a geographic area over a period of time. Risk has two measurable components: (1) the magnitude of the harm that may result, defined through the vulnerability assessment, and (2) the likelihood or probability of the harm occurring. Hazards US (HAZUS) is a risk assessment software program for analyzing potential losses from floods, hurricane winds and earthquakes and can assist communities in completing the risk analysis phase. In HAZUS-MH current scientific and engineering knowledge is coupled with the latest geographic information systems (GIS) technology to produce estimates of hazard-related damage before, or after a disaster occurs. Currently there is insufficient data to conduct a detailed risk analysis for the drought, earthquake, landslide, flood, wildfire, and severe weather hazards in Linn County. Completing a risk analysis for each of these hazards can help in prioritizing areas for mitigation, better planning for infrastructure improvements, or prevent events from occurring. • The Disaster Mitigation Act of 2000 recommends that communities estimate the potential dollar losses to vulnerable structures. [201.6(c)(2)(ii)(B)]. Completing a risk analysis for hazards addressed in this plan will provide Linn County with an estimate of the potential effects impacts of a hazard event. Currently there is insufficient data to conduct a detailed risk analysis for hazards in Linn County.
Ideas for Implementation:
• Use LIDAR data to complete this hydraulic modeling to conduct a more accurate and detailed risk analysis for flood events in Linn County. • Order the HAZUS-MH software free of charge from the FEMA Publication Warehouse. Information can be found at http://www.fema.gov/plan/prevent/hazus/index.shtm. Federal, State, and local government agencies and the private sector can order this information. • Coordinate efforts to complete a risk analysis with the Department of Geology and Mineral Industries (DOGAMI) who has used HAZUS-MH software for several counties and cities across Oregon. • Use the results from the HAZUS software to update Linn County's vulnerability assessment and develop appropriate mitigation actions as needed..

Coordinating Organization:	Steering Committee

Internal Partners:	**External Partners:**
Linn County Departments	State and Federal agencies

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	ongoing	

Status:	**New Action Item**

Proposed Action Item Identification:
ST: 2.3.1 Would be a Short Term Action proposed under Goal 2 Objective 2.3
Proposed Action Title/Description:
Update the Emergency Operations Plan.
Rationale for Proposed Action Item:
• In a self-completed hazard analysis, Linn County rated itself as having an above average or high risk to the majority of natural hazards addressed by the NHMP. Updating the Emergency Operations Plan allows the County to update its ability to provide support and maintain the ability of the emergency services system in order to prevent or reduce the impact of injuries. This allows the County to improve its ability to mitigate the potential affects of the natural hazards addressed by the NHMP. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for, and vulnerability to, most natural hazards addressed by the NHMP as being high. Updating the Emergency Operations Plan allows the County to update its ability to provide support and maintain the ability of the emergency services system in order to prevent or reduce the impact of injuries. This allows the County to improve its ability to mitigate the potential affects of the natural hazards addressed by the NHMP. • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(*ii*)]. Updating the Emergency Operations Plan allows the County to update its ability to provide support and maintain the ability of the emergency services system in order to prevent or reduce the impact of injuries. This allows the County to improve its ability to mitigate the potential affects of the natural hazards addressed by the NHMP.
Ideas for Implementation:
• Evaluate the current Emergency Operations Plan and identify areas that need to be updated or altered to reflect the current conditions and situation of the community. • Ensure that links and references between the Emergency Operations Plan and the mitigation, recovery, and continuity of operations plans are made. • Develop a method for scheduling updates and evaluations of the Emergency Operations Plan.

Coordinating Organization:	**Linn County Emergency Management**

Internal Partners:	**External Partners:**
County Administrator Road Department	Sheriff COG Local Cities 911 Coordinator State Police Utility Companies

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
1 Year		

Status:	Deferred - Since the update is not completed. The deadline for the Linn County to complete the update is July 2012. The County is working on a revision of the Basic Plan portion of the EOP.

Proposed Action Item Identification:
ST: 2.3.2 Would be a Short Term Action proposed under Goal 2 Objective 2.3
Proposed Action Title/Description:
Consolidate mitigation plan, Emergency Operations Plan, recovery plans, and continuity of government plans into a Unified Disaster Plan.
Rationale for Proposed Action Item:
• In a self-completed hazard analysis, Linn County rated itself as having an above average or high risk to the majority of natural hazards addressed by the NHMP. Consolidating the County's plans that address natural hazards improves the County's efficiency and effectiveness in mitigating, responding, and recovering from natural hazards. This can assist the County in reducing its overall risk to the natural hazards addressed by the NHMP. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for, and vulnerability to, most natural hazards addressed by the NHMP as being high. Consolidating the County's plans that address natural hazards improves the County's efficiency and effectiveness in mitigating, responding, and recovering from natural hazards. This can assist the County in reducing its overall risk to the natural hazards addressed by the NHMP. • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(*ii*)]. Consolidating the County's plans that address natural hazards improves the County's efficiency and effectiveness in mitigating, responding, and recovering from natural hazards. This can assist the County in reducing its overall risk to the natural hazards addressed by the NHMP.
Ideas for Implementation:
• Research the plans to identify areas of overlap, areas that could be combined, and areas that are specific to only one plan. • Ensure that links and references between the the mitigation, recovery, emergency operations, and continuity of operations plans are made. • Schedule a Steering Committee meeting to address consolidating the mitigation plan, EOP, recovery plans, and continuity of governemnt plans. Develop a method for consolidating the plans.

Coordinating Organization:	**Linn County Emergency Management**

Internal Partners:	**External Partners:**
County Administrator Road Department	COG Utility Companies Local Cities 911 Coordinator State Police

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
June 2112		

Status:	Deferred – The County is in the process of developing the EOP.

Proposed Action Item Identification:		
ST: 2.3.3. would be a short term action proposed under Goal 2 Objective 2.3		
Proposed Action Title/Description:		
Identify and evaluate county-owned emergency transportation routes and determine which roads and bridges are critical to the transportation network		
Rationale for Proposed Action Item:		
• Emergency transportation routes are essential to evacuating residents and visitors from hazardous areas and to responding to a natural hazard event. Identifying and evaluating county-owned emergency transportation routes and determining which roads and bridges are essential for evacuation and response efforts will make Linn County more resilient to natural hazard events. • Identifying and evaluating county-owned emergency transportation routes and bridges can assist in identifying areas that need further mitigation efforts to reduce the impact of natural hazards.		
Ideas for Implementation:		
• Review emergency transportation routes in coordination with Emergency Management Department and Linn County Fire Departments to determine which roads and bridges are critical to the transportation network. • Conduct a preliminary evaluation of bridges to determine whether the bridges are able to withstand a natural hazard event.		
Coordinating Organization:	**Linn County Emergency Mangement**	
Internal Partners:		**External Partners:**
Road Department, GIS Department, Fire Departments		OEM, FEMA, ODOT
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
1-3 years		
Status:	**Deferred -** This is an ongoing process to provide continual improvement to the County wide Transportation network.	

Proposed Action Item Identification:

ST: 2.4.1 Would be a Short Term Action proposed under Goal 2 Objective 2.4

Proposed Action Title/Description:

Develop a program to implement non-structural retrofit of County staff offices and workspaces

Rationale for Proposed Action Item:

- In a self-completed hazard analysis, Linn County rated itself as having a high earthquake risk rating of 223 out of 240. Developing a program to implement non-structural retrofit projects in County staff offices will reduce the vulnerability of staff offices to earthquakes. This cannot only reduce the potential for injuries to staff that might be caused by a future earthquake, but can assist the county in reducing its risk to earthquakes.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for a future earthquake is high (that the county would be likely to have a major earthquake event in the next 10-35 years) and the county's vulnerability to earthquakes is high. Developing and implementing non-structural retrofit projects in County staff offices will reduce the vulnerability of staff offices to earthquakes, reducing the potential for earthquake-caused injuries. This can assist the County in reducing its overall earthquake risk.
- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(*ii*)]. Developing and implementing non-structural retrofit projects in County staff offices will reduce the vulnerability of staff offices to earthquakes, reducing the potential for earthquake-caused injuries. This can assist the County in reducing its overall earthquake risk.

Ideas for Implementation:

- Develop manuals, brochures, or hazard forms to help raise awareness of the need to mitigate non-structural hazards.
- Provide new employees, through new employee orientation, information on the hazards facing the county.
- Inventory County staff officies to determine needed non-structural retrofitting projects.
- Estimate costs of identified non-structural retrofit projects.
- Prioritize identified projects based on cost-benefit analysis.
- Identify resources and funding to complete retrofit projects.
- Develop a plan/schedule for completing retrofit projects.

Coordinating Organization:	**Linn County Safety Committee**
Internal Partners:	**External Partners:**
General Services	County Insurance Carrier OEM OR-OSHA BC

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
1 Year		

Status:	Deferred - Due to lack of resources and funds this item was not completed.

Proposed Action Item Identification:
LT: 2.4.2 Would be a Long Term Action proposed under Goal 2 Objective 2.4
Proposed Action Title/Description:
Complete a seismic vulnerability assessment of all county-owned structures and prioritize vulnerable publicly owned structures
Rationale for Proposed Action Item:
• In a self-completed hazard analysis, Linn County rated itself as having a high earthquake risk rating of 223 out of 240. Completing a seismic vulnerability assessment of all county-owned structures can assist the County in identifying its vulnerability to earthquakes. A better understanding of its vulnerability to earthquakes can assist the County to better identify mitigation strategies to reduce its overall earthquake risk. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for a future earthquake is high (that the county would be likely to have a major earthquake event in the next 10-35 years) and the county's vulnerability to earthquakes is high. Completing a seismic vulnerability assessment of all county-owned structures can assist the County in identifying its vulnerability to earthquakes. A better understanding of its vulnerability to earthquakes can assist the County to better identify mitigation strategies to reduce its overall earthquake risk. • The Disaster Mitigation Act of 2000 requires communities to assess their vulnerability to natural hazards, particularly by identifying the types and number of buildings, infrastructure, and critical facilities that could be affected [201.6(c)(2)(*ii*)(A)]. Completing a seismic vulnerability assessment of all county-owned structures can assist the County in identifying its vulnerability to earthquakes. A better understanding of its vulnerability to earthquakes can assist the County to better identify mitigation strategies to reduce its overall earthquake risk.
Ideas for Implementation:
• Create list of all County-owned structures to assess. • Develop a list of potential publicly owned structures to assess. Prioritize list based on a cost-benefit analysis for completing a structural vulnerability assessment. • Research the possibility of completing *Rapid Visual Assessments* to determine vulnerability; research the possibility of hiring professionals to complete seismic vulnerability assessments. • Determine which facilities have had their seismic vulnerability analyzed. For the facilities that have been assessed, find out when assessment was done to determine if a new assessment should be completed to address new seismic standards. • For facilities that have had no seismic vulnerability analysis completed, work with facility operators to perform analysis. • Prioritize facilities based on vulnerability. • Ensure that data collected for the vulnerability assessment is captured in the County's GIS system • Encourage County staff to attend state-sponsored *Rapid Visual Assessment* trainings.

Coordinating Organization:	**Linn County Engineer**

Internal Partners:	**External Partners:**	
General Services Building Official	Board of County Commissioners OEM Assessor	DOGAMI Safety Committee

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	5 Years	
Status:	Deferred - Due to lack of resources and funds this item was not completed.	

Proposed Action Item Identification:		
LT: 2.4.3 Would be a Long Term Action proposed under Goal 2 Objective 2.4		
Proposed Action Title/Description:		
Implement structural mitigation projects for prioritized, vulnerable publicly owned structures identified in Action 2.4.2.		
Rationale for Proposed Action Item:		
• In a self-completed hazard analysis, Linn County rated itself as having a high earthquake risk rating of 223 out of 240. Implementing projects to reduce public facilities' seismic vulnerability can reduce the impact earthquakes will have on the facilities. Such actions help to reduce the County's overall risk to potential earthquakes. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates that Linn County's probability for a future earthquake is high (that the county would be likely to have a major earthquake event in the next 10-35 years) and the county's vulnerability to earthquakes is high. Implementing projects to reduce public facilities' seismic vulnerability can reduce the impact earthquakes will have on the facilities. Such actions help to reduce the County's overall risk to potential earthquakes. • The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(*ii*)]. Developing and implementing projects to reduce public facilities' seismic vulnerability can reduce the impact earthquakes will have on the facilities. Such actions help to reduce the County's overall risk to potential earthquakes.		
Ideas for Implementation:		
• Use the seismic vulnerability assessments complted for publicly owned structures in Action Item 2.4.2, develop projects to reduce the seismic vulnerability of the highest prioritized structures. • Identify funding sources to implement projects.		
Coordinating Organization:	**General Services**	
Internal Partners:		**External Partners:**
Planning and Building Department		Board of County Commissioners FEMA DOGAMI OEM ODOT U.S. Dot
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	5 Years	
Status:	**New Action Item, 2005 Action Item 2.4.4 included publicly owned structures and County Owned Bridges. Since the Road Department is responsible for Bridges and General Services is responsible for structures, the Steering Committee separated the Action Item.**	

Proposed Action Item Identification:

LT: 2.4.4 Would be a Long Term Action proposed under Goal 2 Objective 2.4

Proposed Action Title/Description:

Complete seismic vulnerability assessment of all County-owned bridges on lifeline routes and prioritize vulnerable bridges.

Rationale for Proposed Action Item:

- In a self-completed hazard analysis, Linn County rated itself as having a high earthquake risk rating of 223 out of 240. Assessing the seismic vulnerability of all County-owned bridges can assist the County in understanding its vulnerability to potential earthquakes. Having an improved understanding of its earthquake vulnerability can assist the County in better identifying mitigation efforts and directing mitigation funding to prioritized projects.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates that Linn County's probability for a future earthquake is high (that the county would be likely to have a major earthquake event in the next 10-35 years) and the county's vulnerability to earthquakes is high. Assessing the seismic vulnerability of all County-owned bridges can assist the County in understanding its vulnerability to potential earthquakes. Having an improved understanding of its earthquake vulnerability can assist the County in better identifying mitigation efforts and directing mitigation funding to prioritized projects.
- The Disaster Mitigation Act of 2000 requires communities to assess their vulnerability to natural hazards, particularly by identifying the types and number of buildings, infrastructure, and critical facilities that could be affected [201.6(c)(2)(*ii*)(A)]. Assessing the seismic vulnerability of all County-owned bridges can assist the County in understanding its vulnerability to potential earthquakes. Having an improved understanding of its earthquake vulnerability can assist the County in better identifying mitigation efforts and directing mitigation funding to prioritized projects.

Ideas for Implementation:

- Create list of all County-owned bridges along lifeline routes to assess.
- Research the possibility of completing *Rapid Visual Assessments* to determine vulnerability; research the possibility of hiring professionals to complete seismic vulnerability assessments.
- Determine which bridges have already had their seismic vulnerability analyzed. For the bridges that have been assessed, find out when assessment was done to determine if a new assessment should be completed to address new seismic standards.
- For bridges that have had no seismic vulnerability analysis completed, perform analysis.
- Prioritize bridges based on the findings of the vulnerability assessments.

Coordinating Organization:	**Linn County Roads Department**

Internal Partners:	**External Partners:**	
County Engineer	Board of County Commissioners FEMA DOGAMI OEM ODOT	Fire Marshall 911 Coordinator Sheriff

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	5 Years	
Status:	Deferred - funding have not been made available to complete new assessment	

Proposed Action Item Identification:

LT: 2.4.5 Would be a Long Term Action proposed under Goal 2 Objective 2.4

Proposed Action Title/Description:

Implement structural mitigation projects for prioritized, vulnerable County Owned Bridges identified in Action 2.4.4.

Rationale for Proposed Action Item:

- In a self-completed hazard analysis, Linn County rated itself as having a high earthquake risk rating of 223 out of 240. Implementing projects to reduce public facilities' seismic vulnerability can reduce the impact earthquakes will have on the facilities. Such actions help to reduce the County's overall risk to potential earthquakes.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates that Linn County's probability for a future earthquake is high (that the county would be likely to have a major earthquake event in the next 10-35 years) and the county's vulnerability to earthquakes is high. Implementing projects to reduce public facilities' seismic vulnerability can reduce the impact earthquakes will have on the facilities. Such actions help to reduce the County's overall risk to potential earthquakes.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(*ii*)]. Developing and implementing projects to reduce public facilities' seismic vulnerability can reduce the impact earthquakes will have on the facilities. Such actions help to reduce the County's overall risk to potential earthquakes.

Ideas for Implementation:

- Use the seismic vulnerability assessments complted for County Ownded Bridges in Action Item 2.4.4, develop projects to reduce the seismic vulnerability of the highest prioritized structures.
- Identify funding sources to implement projects.

Coordinating Organization:	**Linn County Engineer**

Internal Partners:	**External Partners:**
Road Department	Board of County Commissioners FEMA DOGAMI OEM ODOT U.S. Dot

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	5 Years	
Status	Modified to create Action 2.4.3	

Proposed Action Item Identification:
ST: 3.1.1 Would be a Short Term Action proposed under Goal 3 Objective 3.1
Proposed Action Title/Description:
Develop public awareness campaign aimed at homeowners, children, the elderly, and Spanish speaking residents to make them aware of what they can do to prepare for natural hazard events
Rationale for Proposed Action Item:
• In a self-completed hazard analysis, Linn County rated itself as having a high risk to the majority of hazards addressed by the NHMP. Conducting outreach to educate the public and special needs groups on the importance of having emergency kits, supplies, and plans better prepares citizens for natural hazard events, helping reduce the county's overall risk to natural hazards. • To increase natural hazard mitigation and emergency preparedness in Linn County, residents must be aware of the risk and know what they should do before and after the disaster occurs. Outreach and awareness campaigns need to be carefully organized and developed to ensure that residents receive critical information. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for, and vulnerability to, most hazards addressed by the NHMP as being high. Conducting outreach to educate the public on the importance of having emergency kits, supplies, and plans better prepares citizens for natural hazard events, helping reduce the county's overall risk to natural hazards. • The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(*ii*)]. Conducting outreach to educate the public on the importance of emergency kits, supplies, and plans would be a way to keep the public informed of, and involved in, the County's actions to mitigate hazards.
Ideas for Implementation:
• Encourage the development of 72-hour kits. • Encourage elderly and special needs populations to make plans for emergency supplies and care before an event occurs. • Develop education and outreach materials to make residents aware of the flood hazard and the availability of flood insurance. • Develop education and outreach materials to make residents aware of the earthquake hazard and the availability of earthquake insurance. • Develop awareness campaign that encourages residents to implement structural and non-structural mitigation for the earthquake hazard. • Provide information to residents on landslide prevention (e.g. FEMA Homeowners Landslide Guide for Hillside Flooding, Debris Flow, Erosion and Landslide Control and Hillside Drainage). • Partner with utility providers to make homeowners aware of the importance of tree and limb maintenance. • Partner with insurance providers to provide insurance related information to homeowners and renters.

Coordinating Organization:	**Linn County Emergency Management**

Internal Partners:	**External Partners:**
Public Information Officer	Red Cross; COG; Local Cities; Linn Benton ESD; United Way; State Agencies; Hospitals; Insurance Companies; Children and Families Commission

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
1-2 Years		

Status:	**Deferred – Due to Lack of resources and funds this item was not completed.**

Proposed Action Item Identification:		
LT: 3.1.2 Would be a Long Term Action Proposed under Goal 3 Objective 3.1		
Proposed Action Title/Description:		
Support local agency programs for farmers and ranchers that provide education and training on water conservation measures, including drought management practices for crops and livestock.		
Rationale for Proposed Action Item:		
• Farmers and ranchers depend on water to grow crops and raise livestock. However, in years with severe droughts, water is in limited supply, putting the livelihood of ranchers and farmers at risk. Supporting local agency programs for farmers and ranchers that provide education and training on water conservation measures can assist farmers and ranchers in preserving their livelihoods during severe water shortages.		
Ideas for Implementation:		
• Cooperation with OSU extension services and agricultural organizations prominent and respected within the farming and ranching community, build on existing outreach methods with the goal of providing water conservation/drought management training to farmers and ranchers.		
Coordinating Organization:	Linn County Board of Commissioners	
Internal Partners:		**External Partners:**
Planning and Building, Emergency Management		OSU Extension Services; NRCS; Farm Bureau; WRD;ODFW; Watershed Councils; Water Districts
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	2-5 Years	
Status:	**New Action Item**	

Proposed Action Item Identification:		
ST: 3.1.3 Would be a Short Term Action proposed under Goal 3 Objective 3.1		
Proposed Action Title/Description:		
Use and publicize the NOAA debris flow warning system		
Rationale for Proposed Action Item:		
• The NOAA debris flow warning system is intended to alert people when certain areas become unsafe because of the danger of fast moving landslides. Linn County can use NOAA system to alert citizens who travel or live under steep slopes that are vulnerable to landslides. • In a self-completed hazard analysis, Linn County rated itself as having an average risk rating to landslides of 125 out of 240. Utilizing the debris flow warning system can assist Linn Count in protecting citizens from landslides, helping the County reduce its overall risk to landslides. The County was impacted during the 1996 flood and landslide events • The *State of Oregon's Natural Hazard Mitigation Plan* indicates that Linn County's probability for a future landslide is high (that the county would be likely to have a major earthquake event in the next 10-35 years) and the county's vulnerability to earthquakes is low. Utilizing the warning system to alert citizens of a potential threatening landslide can assist the County in reducing its overall risk to landslides. • The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(*ii*)]. Utilizing the warning system to alert citizens of a potential threatening landslide can assist the county in reducing its overall risk to landslides.		
Ideas for Implementation:		
• Determine steps necessary to use the debris warning system in Linn County. • Identify areas in Linn County vulnerable to landslide that might need to be notified of potential threatening landslides; maintain a list of vulnerable areas. • Develop partnerships with local media outlets to notify citizens of the warning system's existence. • Develop partnerships with local media outlets (particularly television and radio) and develop methods for alerting systems when a landslide occurs.		
Coordinating Organization:	**Emergency Management**	
Internal Partners:		**External Partners:**
Road Department		ODF OEM NOAA DOGAMI ODOT
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	Ongoing	
Status:	**Deferred and Modified –** The debris flow warning system information is now included in National Weather Service issued flood warnings. Refer to the Portland NWS web site for current information. Since the operating agency has changed the action item LS-ST #1 has been changed to reflect the NOAA debris flow warning system instead of DOF debris flow warning system.	

Proposed Action Item Identification:		
ST: 3.1.4 Would be a Short Term Action proposed under Goal 3 Objective 3.1		
Proposed Action Title/Description:		
Increase public education related to landslide hazards by distributing DOGAMI landslide informational brochure.		
Rationale for Proposed Action Item:		
• The Department of Geology and Mineral Industries (DOGAMI) has several informational brochures on the landslide hazard at its website. Using this information in a public education campaign in Linn County can greatly increase public awareness of landslide events in Linn County.		
Ideas for Implementation:		
• Distribute the DOGAMI landslide informational brochure through the Linn County website, at the Linn County Courthouse, and in local cities.		
Coordinating Organization:	**Emergency Management**	
Internal Partners:		**External Partners:**
Planning and Building Department; Road Department		DOGAMI; OEM;
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
Ongoing		
Status:	**New Action Item**	

Proposed Action Item Identification:
LT: 3.2.1 Would be a Long Term Action proposed under Goal 3 Objective 3.2
Proposed Action Title/Description:
Encourage small businesses to develop recovery plans and to implement non-structural mitigation.
Rationale for Proposed Action Item:
• Local economies can be severely impacted by disasters when local businesses have to close for extended periods of time due to physical and/or infrastructure damage. In a self-completed hazard analysis, Linn County rated itself as having a high risk to the majority of hazards addressed by the NHMP. Encouraging small businesses to develop recovery plans and implement non-structural mitigation can assist their recovery in the event of a natural hazard, mitigating the impact of natural hazards on the County's economic assets. Such mitigation efforts can assist the County in recovering more effectively and efficiently after the occurrence of a natural hazard. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates Linn County's probability for, and vulnerability to, most hazards addressed by the NHMP as being high. Encouraging businesses to develop recovery plans and implement non-structural mitigation activities can assist their recovery in the event of a natural hazard, mitigating the impact of natural hazards on the County's economic assets. Such mitigation efforts can assist the County in recovering more effectively and efficiently after the occurrence of a natural hazard. • The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(*ii*)]. Encouraging businesses to develop recovery plans and implement non-structural mitigation activities can assist their recovery in the event of a natural hazard, mitigating the impact of natural hazards on the County's economic assets. Such mitigation efforts can assist the County in recovering more effectively and efficiently after the occurrence of a natural hazard.
Ideas for Implementation:
• Contact the Institute for Buisness and Home Saftey for information on their traning and software that can assist businesses in developing business continuity plans. • Determine what materials and resources already exist to assist businesses in developing recovery plans and identify non-strucural mitigation techniques and activities. • Develop methods to disseminate information and resources to small businesses. Possible methods could include: o Generating a list of small businesses and mailing information packets to those busienesses. o Staffing a booth with informaiton at County events. o Keeping packets of information at certain County agency offices and notifying small businesses of the existence of the packets. o Identify funding sources, if necessary, for any communication methods. • Hold a County-sponsored small business symposium regarding the development of recovery plans and identifying non-strucutural mitigation activities.

Coordinating Organization:	**Linn County Chamber of Commerce**

Internal Partners:	**External Partners:**
Emergency Management Public Information Officer	Business Development Coordinator; COG; LBCC Business Development; Local Cities

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	Ongoing	

Status:	Deferred – lack of funding or resources

Proposed Action Item Identification:
ST: 3.3.1 Would be a Short Term Action proposed under Goal 3 Objective 3.3
Proposed Action Title/Description:
Assist K-12 schools, childcare facilities and schools to develop vulnerability assessments and mitigation projects to improve safety
Rationale for Proposed Action Item:
• In a self-completed hazard analysis, Linn County rated itself as having a high earthquake risk rating of 223 out of 240. Assisting schools and childcare facilities to develop vulnerability assessments and mitigation projects can improve the safety of citizens in Linn County and mitigate the affect that natural hazards have on the County's assets and critical infrastructure. Such activities can assist in reducing the County's overall earthquake risk. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates that Linn County's probability for a future earthquake is high (that the county would be likely to have a major earthquake event in the next 10-35 years) and the county's vulnerability to earthquakes is high. Assisting schools and childcare facilities to develop vulnerability assessments and mitigation projects can improve the safety of citizens in Linn County and mitigate the affect that natural hazards have on the County's assets and critical infrastructure. Such activities can assist in reducing the County's overall earthquake risk. • The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(*ii*)]. Assisting schools and childcare facilities to develop vulnerability assessments and mitigation projects can improve the safety of citizens in Linn County and mitigate the affect that natural hazards have on the County's assets and critical infrastructure. Such activities can assist in reducing the County's overall earthquake risk.
Ideas for Implementation:
• Develop a list of all K-12 schools, childcare facilities, and other schools within Linn County. • Determine if any schools have already had their seismic vulnerability analyzed. For the facilities that have been assessed, find out when assessment was done to determine if a new assessment should be completed to address new seismic standards. • For facilities that have had no seismic vulnerability analysis completed, work with each facility to perform analysis. • Use vulnerability assessments to identify mitigation projects. • Create programs to cover the costs of the projects, or to cost-share the costs of the projects with facilities (for example, the County pays for 75% and the facility pays for 25% of identified projects).

Coordinating Organization:	**Linn-Benton Educational Service District**

Internal Partners:	**External Partners:**
Emergency Management	School Districts Private Schools American Red Cross DOGAMI OEM Commission on Children and Families

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
1-2 Years		

Status:	Deferred - The Linn-Benton Educational Service District lost the position duet o cut backs and has not completed or made progress on this action item.

Proposed Action Item Identification:

LT: 3.3.2 Would be a Long Term Action proposed under Goal 3 Objective 3.3

Proposed Action Title/Description:

Encourage multi-objective stream and river enhancement projects that maximize flood mitigation

Rationale for Proposed Action Item:

- In a self-completed hazard analysis, Linn County rated itself as having a high flood risk rating of 230 out of 240. Multi-objective stream and river enhancement projects can not only assist flood mitigation efforts, but can also reduce the duplication of efforts. Minimizing duplication allows the County to maximize its resources for natural hazard mitigation efforts, assisting the County in reducing its overall flood risk.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates that Linn County's probability for a future flood is high (that the county would be likely to have a major flooding event in the next 10-35 years) and the county's vulnerability to a future flood is high. Multi-objective stream and river enhancement projects can not only assist flood mitigation efforts, but can also reduce the duplication of efforts. Minimizing duplication allows the County to maximize its resources for natural hazard mitigation efforts, assisting the County in reducing its overall flood risk.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(*ii*)]. Implementing multi-objective stream and river enhancement projects that maximize flood mitigation efforts assist the County in reducing its overall flood risk.

Ideas for Implementation:

- Identify stream and river enhancement projects, and locations of projects, that mitigate Linn County's flood risk.
- Identify any existing projects that are already scheduled for the same or close-by areas identified for mitigaiton projects.
- Contact the departments and/or agencies responsible for the already scheduled projects; discuss the potential for adding flood mitigation components to existing projects.
- Identify sources of funding for any potential cost of compensating or funding projects.
- Develop methods for external partners to submit proposals for multi-objective projects to the Board of County Commissioners or Steering Committee.
- Partner with community service organizations, such as Northwest Youth Corp to complete stream enhancement projects.

Coordinating Organization:	**Linn County Board of County Commissioners**

Internal Partners:	**External Partners:**	
Emergency Management	Watershed Councils	DEQ
	Water Control Districts	FEMA
	DSL	USCE
	ODFW	Local Cities
	DOF	

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	Ongoing	

Status:	**Deferred -** Linn County works in a cooperative partnership with the North Santiam Watershed Council, South Santiam Watershed Council, and the Calapooia Watershed Council. Linn County Road Department has supported the efforts of these councils by providing technical support, and match funds for certain projects and programs.

Proposed Action Item Identification:		
LT: 3.3.3 Would be a Long Term Action proposed under Goal 3 Objective 3.3		
Proposed Action Title/Description:		
Conduct community based fuel reduction demonstration projects in the wildland-urban interface.		
Rationale for Proposed Action Item:		
• In a self-completed hazard analysis, Linn County reported itself as having an above average wildland-urban interface fire (WUI) risk of 183 out of 240. Demonstrating fuel reduction projects to communities in the WUI can assist in showing residents how easy and aesthetically pleasing fuels reduction projects can be. Community residents may be more likely to share responsibility for mitigating the fire risk on their own properties and implement fuel reduction measures after viewing a demonstration. Such actions can assist the County in reducing its overall WUI fire risk. • The *State of Oregon's Natural Hazard Mitigation Plan* indicates that Linn County's probability for a future WUI fire is high (that the county would be likely to have a major WUI fire event in the next 10-35 years) and the county's vulnerability to a future WUI fire is medium. Demonstrating fuel reduction projects to communities in the WUI can assist in showing residents how easy and aesthetically pleasing fuels reduction projects can be. Community residents may be more likely to share responsibility for mitigating the fire risk on their own properties and implement fuel reduction measures after viewing a demonstration. Such actions can assist the County in reducing its overall WUI fire risk. • The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(*ii*)]. Conducting demonstrations of fuel reduction projects in WUI communities is a way to involve residents in sharing the responsibility of mitigating the WUI fire risk, and demonstrate the ease of implementing fuel reduction projects. Such actions can not only continue to involve the public in the County's mitigation efforts, but can also assist the County in reducing its overall WUI fire risk.		
Ideas for Implementation:		
• Conduct public outreach to try to determine which fuels reduction methods Linn County WUI residents would be supportive of and likely to implement on their own properties. • Identify target communities within the WUI where the County wants to conduct fuels reduction project demonstrations. • Develop demonstration presentations and identify demonstration facilitators. • Develop informational materials to disseminate to residents at the demonstrations. • Identify funding sources to fund demonstrations and the production of informational materials. • Develop methods for advertising the demonstrations to community residents, and methods for encouraging attendance. • Encourage demonstration projects that highlight that fuel reduction projects can be aesthetically pleasing		
Coordinating Organization:	**Emergency Management**	
Internal Partners:		**External Partners:**
		State Fire Marshall ODF Fire Districts Local Cities OEM
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	Ongoing	
Status:	Deferred and Modified - This program should continue to be listed on the Long Term Action Item list. Fuels reduction projects will continue based on future available funding. The Steering Committee has decided to deferred this action item and include it in the 2010 update.	

Proposed Action Item Identification:

ST: 3.3.4 Would be a Short Term Action proposed under Goal 3 Objective 3.3

Proposed Action Title/Description:

Partner with the Oregon Department of Forestry and Rural Fire Districts to promote home site assessment programs for the wildfire hazard

Rationale for Proposed Action Item:

- In a self-completed hazard analysis, Linn County reported itself as having an above average wildland-urban interface fire (WUI) risk of 183 out of 240. Promoting home site assessments for locations within Linn County's WUI can assist property owners in identifying their vulnerability to WUI fire and identifying mitigation activities. Assisting property owners with this may increase the likelihood that property owners would share responsibility for WUI fire mitigation on their properties and implement mitigation activities. Such actions can assist the County in reducing its overall WUI fire risk.
- The *State of Oregon's Natural Hazard Mitigation Plan* indicates that Linn County's probability for a future WUI fire is high (that the county would be likely to have a major WUI fire event in the next 10-35 years) and the county's vulnerability to a future WUI fire is medium. Promoting home site assessments for locations within Linn County's WUI can assist property owners in identifying their vulnerability to WUI fire and identifying mitigation activities. Assisting property owners with this may increase the likelihood that property owners would share responsibility for WUI fire mitigation on their properties and implement mitigation activities. Such actions can assist the County in reducing its overall WUI fire risk.
- The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(*ii*)]. Promoting home site assessment programs would be a way to conduct outreach to inform homeowners of the county's risk to WUI fire and keep them involved in the County's efforts to mitigate that risk.

Ideas for Implementation:

- Determine if the home site asessments would be free for homeowners; free if they participate in a County survey, attend a community forum, etc.; or offered at a reduced cost to homeowners.
- Work with partners to identify at-risk communities to target for the program.
- Work with partners to develop home site assessment programs. Components of the program could include:
    - Determining what the assessments of home sites would include, and who would be responsible for conducting them.
    - Determining if there is a need to prioritize at-risk communities based on vulnerability, and begin the program in the most vulnerable, highest priority communities first.
    - Identifying and developing the most appropriate methods of communication to reach at-risk homeowners.
- Identify funding sources to fund the program.

Coordinating Organization:	**Linn County Emergency Management**

Internal Partners:	**External Partners:**	
Land Management	ODF Rural Fire Districts State Fire Marshall	Local Cities OEM

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
1-2 Years		

Status:	**Deferred -** Home site assessments were completed during 2007 and 2008. The entire portion of Linn County lying within Oregon Department of Forestry boundaries were assessed and documented. Since this action item is ongoing, the Steering Committee decided to defer it from the 2010 update.

Proposed Action Item Identification:		
LT:3.3.5 Would be a Long Term Action Proposed under Goal 2 Objective 2.4		
Proposed Action Title/Description:		
Implement a routine bridge inspection program for bridges identified in Action 2.2.10 to ensure the bridges continues to be structurally sound.		
Rationale for Proposed Action Item:		
• The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that reduce the effects of hazards on a new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Implementing a routine bridge inspection program would ensure that Linn County bridges continue to be structurally sound. • Bridges are essential to any road network, and they can be easily damaged by floods, landslides, and earthquakes. Routine bridge inspections are important in ensuring that bridges remain structurally sound.		
Ideas for Implementation:		
• Model a bridge inspection program after the federal highway administration's National Bridge Inspection Standards available at: http://www.fhwa.dot.gov/bridge/nbis.htm. • Conduct bridge inspections on an annual basis, focusing on the bridges identified under action item 2.2.10.		
Coordinating Organization:	**Road Department**	
Internal Partners:		**External Partners:**
Road Department; Planning and Building; Emergency Management		Private land owners; Public Agencies; Linn County Fire Defense Board
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	ongoing	
Status:	**Deferred -** The Linn County Road Department has been working in cooperation with the Oregon Department of Transportation to identify county wide emergency transportation routes and bypass routes in the event of an emergency whether it be associated with an accident or a natural disaster. Ongoing action item.	

Proposed Action Item Identification:		
LT:3.3.6 Would be a Long Term Action Proposed under Goal 3 Objective 3.3		
Proposed Action Title/Description:		
Develop a partnership to identify areas where required visual buffers along designated scenic highways have potential blow down issues endangering life and infrastructure.		
Rationale for Proposed Action Item:		
• State forest practices rules require visual buffers of trees along scenic highways to maintain the aesthetic qualities provided by forests. • Only ODOT can determine whether there may be an undue risk in certain areas that would require removal of the trees.		
Ideas for Implementation:		
• Develop a partnership between ODOT, ODF, private timber companies and private landowners that would inventory and summarize areas of high hazard for blow down after removal of adjacent standing timber. • Develop a timeline with scheduled harvest to minimize visual impacts but to maintain safety. • Identify ownership of potential hazard trees. • Identify party responsible for harvest activity. • Develop educational material for County residents and neighbors		
Coordinating Organization:	**Emergency Management**	
Internal Partners:		**External Partners:**
Road Department		ODOT; ODF; Private land owners; Private timber owners
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	ongoing	
Status:	**New Action Item**	

Proposed Action Item Identification:		
LT:3.3.7 Would be a Long Term Action Proposed under Goal 3 Objective 3.3		
Proposed Action Title/Description:		
Create database of private resources including equipment, labor, special expertise and operating area as well as contact information that could be mobilized rapidly in event of fire, earthquake, flood or severe weather impacts.		
Rationale for Proposed Action Item:		
• Linn County has experienced impacts from each of the above mentioned events. • The county and public agencies may not have appropriate equipment or an adequate labor force during emergency situations. • Many private organizations already have resources located closer to impact areas and may be providing these services to their own, neighbors or clients property.		
Ideas for Implementation:		
• Consider an incident command structure and provide training that would coordinate resources included in the database. • Allow updating by private organizations through use of online technology accessable following registration of the organization. • Develop educational resources for private organizations wishing to participate in the database that will identify goals, implementation and updating requirements. • Develop inspection and evaluation procedures of the potential resources. • Determine database fields that would provide adequate information to make product useful. • Develop training exercises to test capabilities and prepare for actual events.		
Coordinating Organization:	**Emergency Management**	
Internal Partners:		**External Partners:**
Road Department; Linn County Information Technology Dept.; Sheriffs Office; Planning and Building Department		Rural and City Fire Departments; Private road builders, contractors, logging companies, timber companies, aggregate companies and fire fighting companies
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term(2-4 or more years)	
	ongoing	
Status:	**New Action Item**	

Appendix C: Economic Analysis of Natural Hazard Mitigation Projects

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

The appendix outlines three approaches for conducting economic analyses of natural hazard mitigation projects. It describes the importance of implementing mitigation activities, different approaches to economic analysis of mitigation strategies, and methods to calculate costs and benefits associated with mitigation strategies. Information in this section is derived in part from: The Interagency Hazards Mitigation Team, *State Hazard Mitigation Plan*, (Oregon State Police – Office of Emergency Management, 2000), and Federal Emergency Management Agency Publication 331, *Report on Costs and Benefits of Natural Hazard Mitigation*. This section is not intended to provide a comprehensive description of benefit/cost analysis, nor is it intended to evaluate local projects. It is intended to (1) raise benefit/cost analysis as an important issue, and (2) provide some background on how economic analysis can be used to evaluate mitigation projects.

Why Evaluate Mitigation Strategies?

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

Evaluating mitigation projects is a complex and difficult undertaking, which is influenced by many variables. First, natural disasters affect all segments of the communities they strike, including individuals, businesses, and public services such as fire, police, utilities, and schools. Second, while some of the direct and indirect costs of disaster damages are measurable, some of the costs are non-financial and difficult to quantify in dollars. Third, many of the impacts of such events produce "ripple-effects" throughout the community, greatly increasing the disaster's social and economic consequences.

While not easily accomplished, there is value, from a public policy perspective, in assessing the positive and negative impacts from mitigation activities, and obtaining an instructive benefit/cost comparison. Otherwise, the decision to pursue or not pursue various mitigation options would not be based on an objective understanding of the net benefit or loss associated with these actions.

What are some Economic Analysis Approaches for Evaluating Mitigation Strategies?

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

Benefit/Cost Analysis

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

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

Cost-Effectiveness Analysis

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

Investing in Public Sector Mitigation Activities

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

Investing in Private Sector Mitigation Activities

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

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

STAPLE/E Approach

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

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

Social: Community development staff, local non-profit organizations, or a local planning board can help answer these questions.

- Is the proposed action socially acceptable to the community?
- Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- Will the action cause social disruption?

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

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

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

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

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

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

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

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

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

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

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

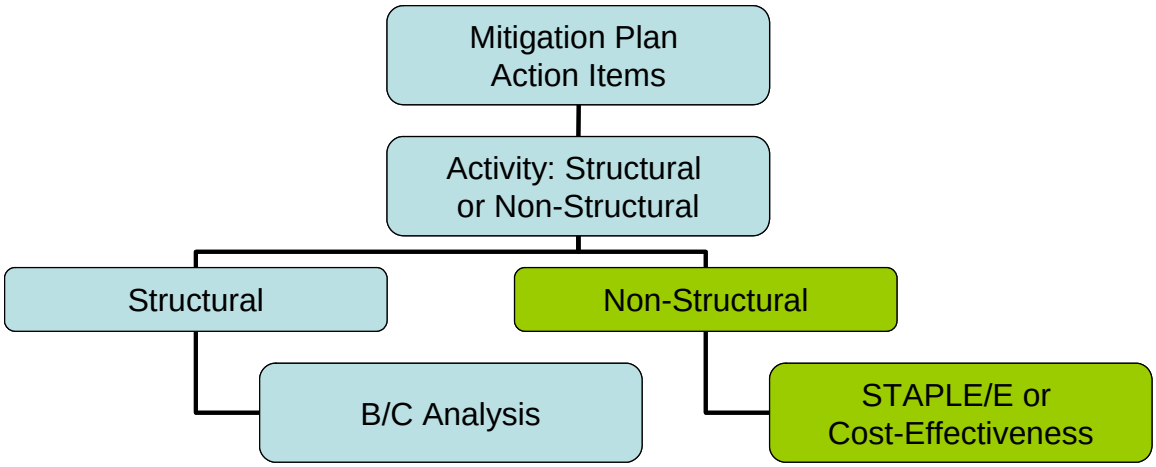
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

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

When to use the Various Approaches

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

Figure A.1: Economic Analysis Flowchart



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o
urce: Oregon Partnership for Disaster Resilience at the University of Oregon's Community Service Center, 2005

Implementing the Approaches

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

1. Identify the Activities

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

2. Calculate the Costs and Benefits

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

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

- ***Consider costs and benefits to society and the environment***. These are not easily measured, but can be assessed through a variety of economic tools including existence value or contingent value theories. These theories provide quantitative data on the value people attribute to physical or social environments. Even without hard data, however, impacts of structural projects to the physical environment or to society should be considered when implementing mitigation projects.
- ***Determine the correct discount rate***. Determination of the discount rate can just be the risk-free cost of capital, but it may include the decision maker's time preference and also a risk premium. Including inflation should also be considered.

3. Analyze and Rank the Activities

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

- ***Net present value***. Net present value is the value of the expected future returns of an investment minus the value of the expected future cost expressed in today's dollars. If the net present value is greater than the projected costs, the project may be determined feasible for implementation. Selecting the discount rate, and identifying the present and future costs and benefits of the project calculates the net present value of projects.
- ***Internal rate of return***. Using the internal rate of return method to evaluate mitigation projects provides the interest rate equivalent to the dollar returns expected from the project. Once the rate has been calculated, it can be compared to rates earned by investing in alternative projects. Projects may be feasible to implement when the internal rate of return is greater than the total costs of the project. Once the mitigation projects are ranked on the basis of economic criteria, decision-makers can consider other factors, such as risk, project effectiveness, and economic, environmental, and social returns in choosing the appropriate project for implementation.

Economic Returns of Natural Hazard Mitigation

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

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

These parameters can be estimated using observed prices, costs, and engineering data. The difficult part is to correctly determine the effectiveness of the hazard mitigation project and the resulting reduction in damages and losses. Equally as difficult is

assessing the probability that an event will occur. The damages and losses should only include those that will be borne by the owner. The salvage value of the investment can be important in determining economic feasibility. Salvage value becomes more important as the time horizon of the owner declines. This is important because most businesses depreciate assets over a period of time.

Additional Costs from Natural Hazards

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

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

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

Additional Considerations

Conducting an economic analysis for potential mitigation activities can assist decision-makers in choosing the most appropriate strategy for their community to reduce risk and prevent loss from natural hazards. Economic analysis can also save time and resources from being spent on inappropriate or unfeasible projects. Several resources and models are listed on the following page that can assist in conducting an economic analysis for natural hazard mitigation activities.

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

business development, among others. Incorporating natural hazard mitigation with other community projects can increase the viability of project implementation.

Resources

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 the 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, Ocbober 25, 1995.

Horner, Gerald, *Benefit/Cost Methodologies for Use in Evaluating the Cost Effectiveness of Proposed Hazard Mitigation Measures*, Robert Olsen 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 D

DOGAMI Earthquake HAZUS Models

Earthquake Scenarios and

Ground Motion Maps

CRUSTAL EARTHQUAKE SCENARIO DETAILS FOR LINN COUNTY

Crustal Earthquake Scenario: A magnitude 6.7 earthquake on the Mill Creek Fault.

For the magnitude 6.7 earthquake on the Mill Creek Fault scenario, we defined the fault source using the "deterministic seismic source" option within HAZUS-MH (Figure D1) (FEMA, 2003b). The fault and earthquake event were chosen by examination of USGS (2004) data and data in the Geomatrix Consultants, Inc. (1995) *Seismic Design Mapping, State of Oregon* report prepared for the Oregon Department of Transportation. In general, a likely worst-case scenario was selected. Figure D1 has the location of the fault, shown as the dark line, and the census tracts within Linn County. Figure D2 displays the peak ground acceleration (PGA) for the crustal scenario.

Scenario Name	Mill Creek M6.7
Type of Earthquake	Source
Fault Name	Mill Creek Fault
Historical Epicenter ID #	70
Probabilistic Return Period	NA
Longitude of Epicenter	−123.015
Latitude of Epicenter	44.7428
Earthquake Magnitude	6.7
Depth (km)	0.00
Rupture Length (km)	27.11
Rupture Orientation (degrees)	0.00
Attenuation Function	Reverse-Slip

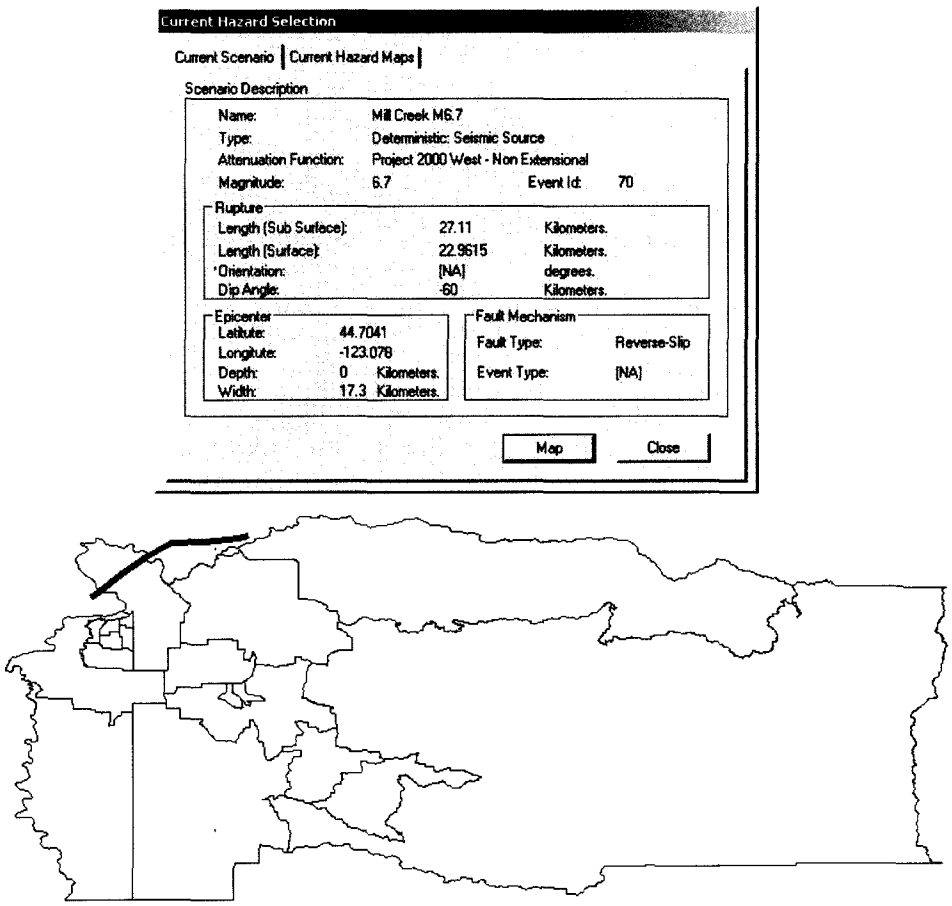

Figure D1. Mill Creek Fault details from HAZUS-MH (FEMA, 2003b). The location of the fault is shown as the dark line.

Crustal Earthquake Scenario Ground Motion Map

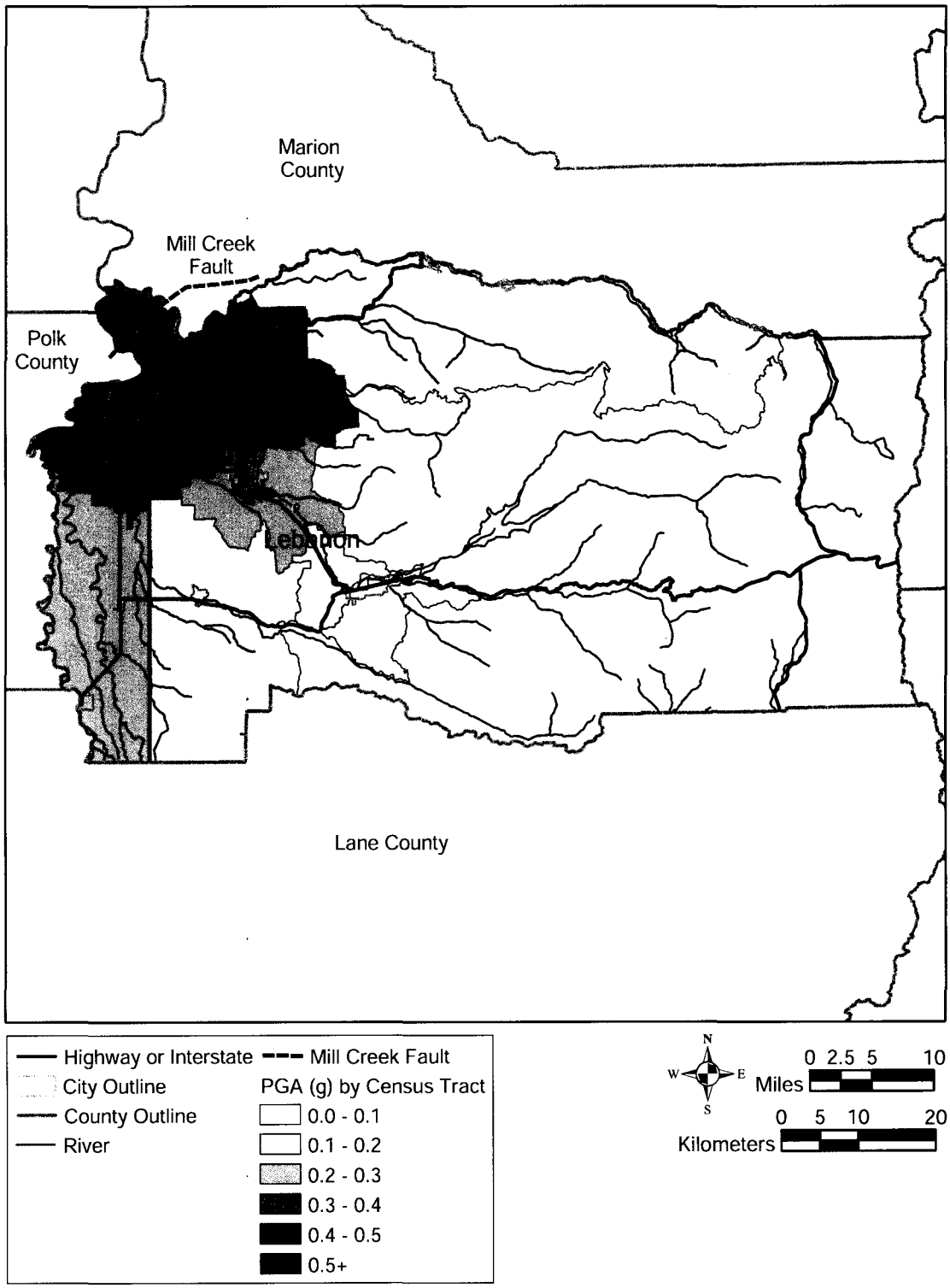

Figure D2. Peak ground acceleration (PGA) by census tracts map for the crustal earthquake scenario, Linn County, Oregon (FEMA, 2003b).

SUBDUCTION ZONE EARTHQUAKE SCENARIO DETAILS FOR LINN COUNTY

Subduction Zone Scenario: A magnitude 9.0 earthquake on the Cascadia Subduction Zone was selected for the subduction zone earthquake scenario.

For the Cascadia Subduction Zone earthquake scenario, we used the "user-defined event" option within HAZUS-MH to incorporate ground motion maps developed by the Cascadia Region Earthquake Workgroup (CREW, 2003) to model damage and loss from a magnitude 9.0 earthquake (Figure D3). The CREW maps were developed from ground motion data provided by the U.S. Geological Survey. The CREW earthquake scenario required the input of four sets of GIS files that are included within the HAZUS-MH study region: regional peak ground acceleration (PGA), peak ground velocity (PGV), and the spectral velocity at 0.3 s and 1.0 s (CREW, 2003). Figure D4 displays the PGA for the subduction zone scenario.

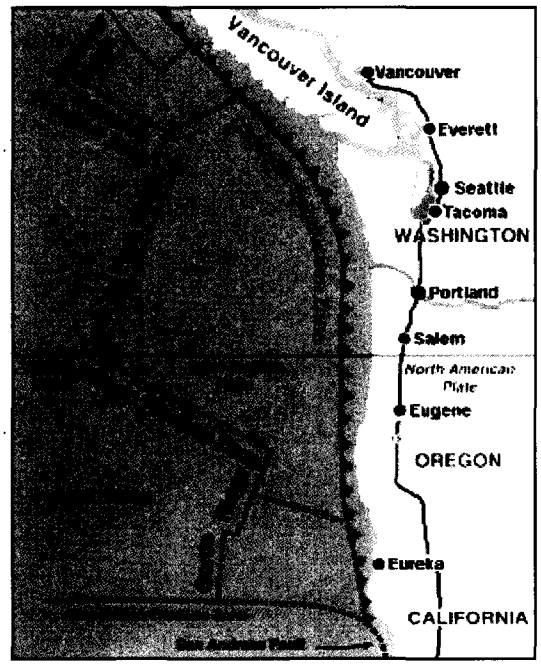

Figure D3. Location of the Cascadia Subduction Zone (CREW, 2003).

Subduction Zone Earthquake Scenario Ground Motion Map

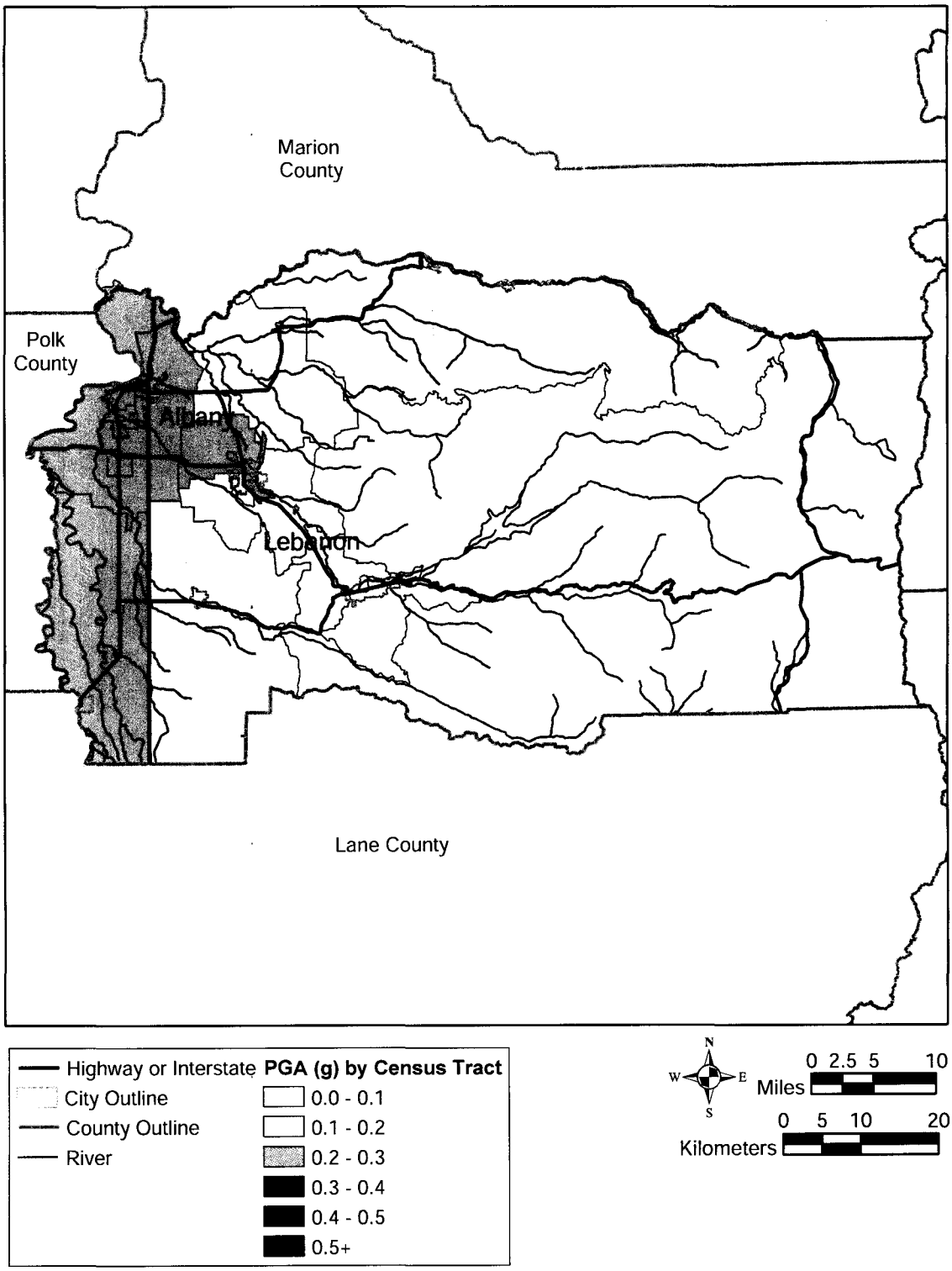

Figure D4. Peak ground acceleration (PGA) by census tracts map for the Cascadia Subduction Zone earthquake scenario, Linn County, Oregon (FEMA, 2003b).

GEOLOGIC HAZARD MAPS

Relative Ground-Shaking Amplification Susceptibility Map

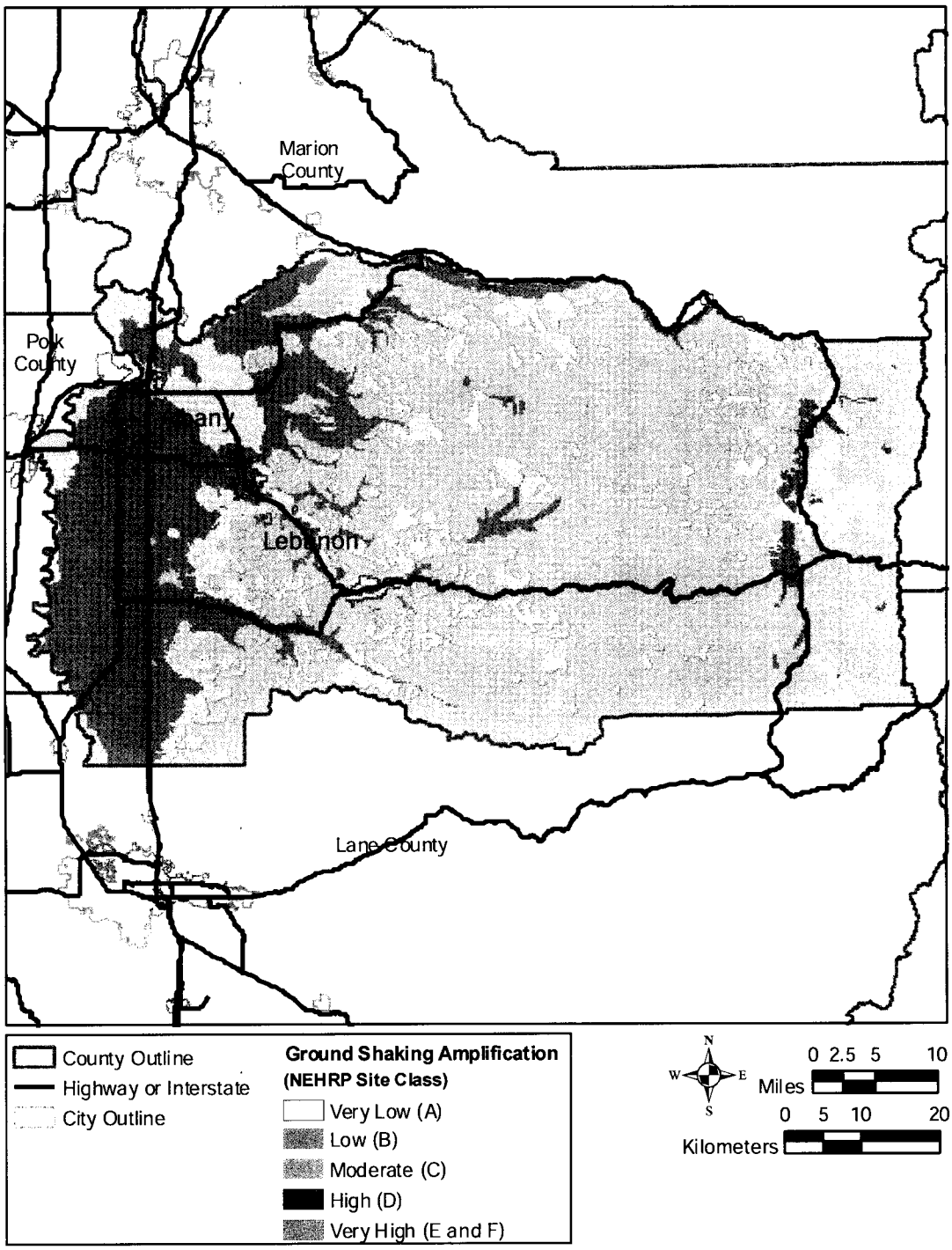

Figure D5. Relative ground-shaking amplification susceptibility map for Linn County, Oregon.

Relative Liquefaction Hazard Susceptibility Map

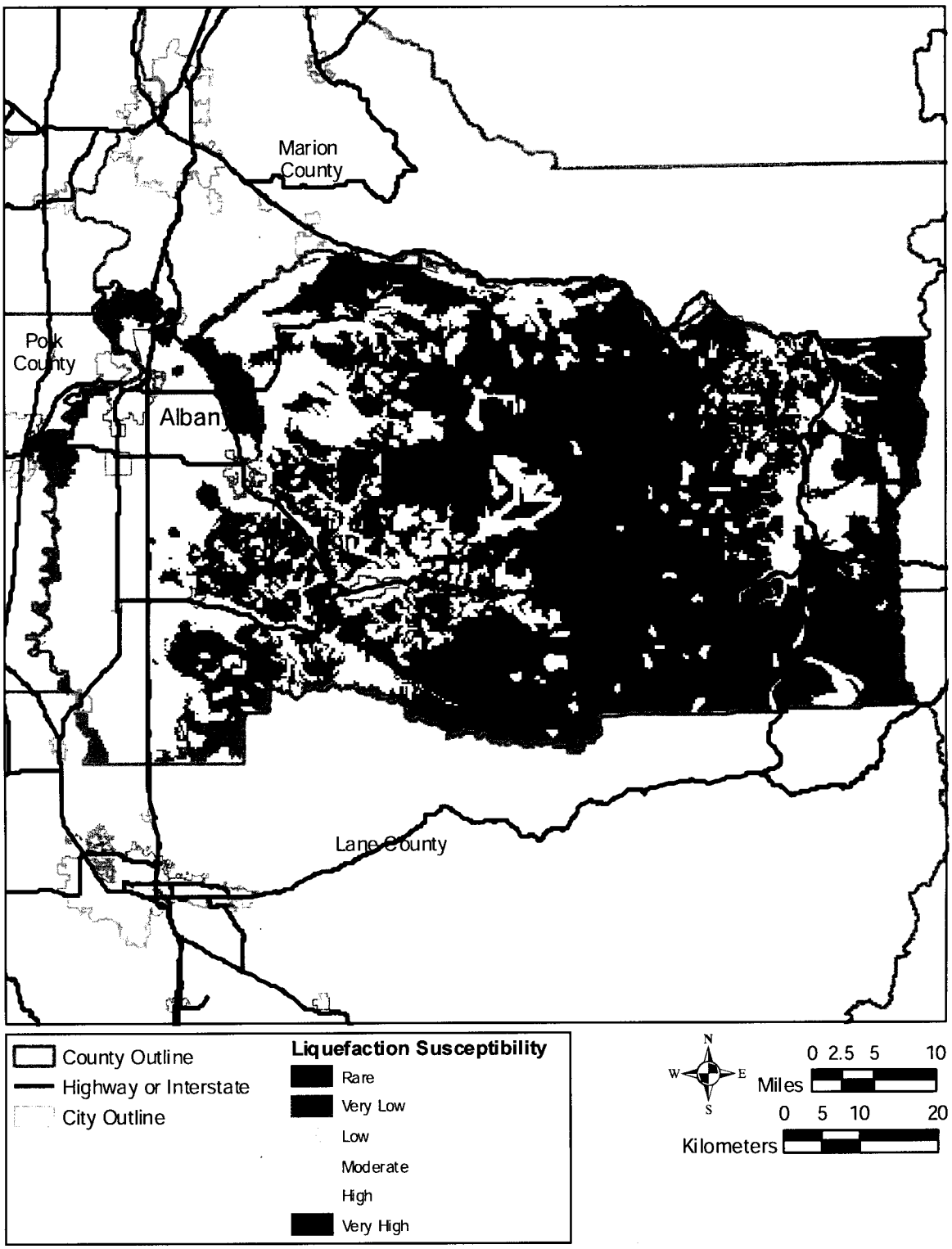

Figure D6. Relative liquefaction susceptibility map for Linn County, Oregon.

Relative Earthquake-Induced Landslide Susceptibility Map

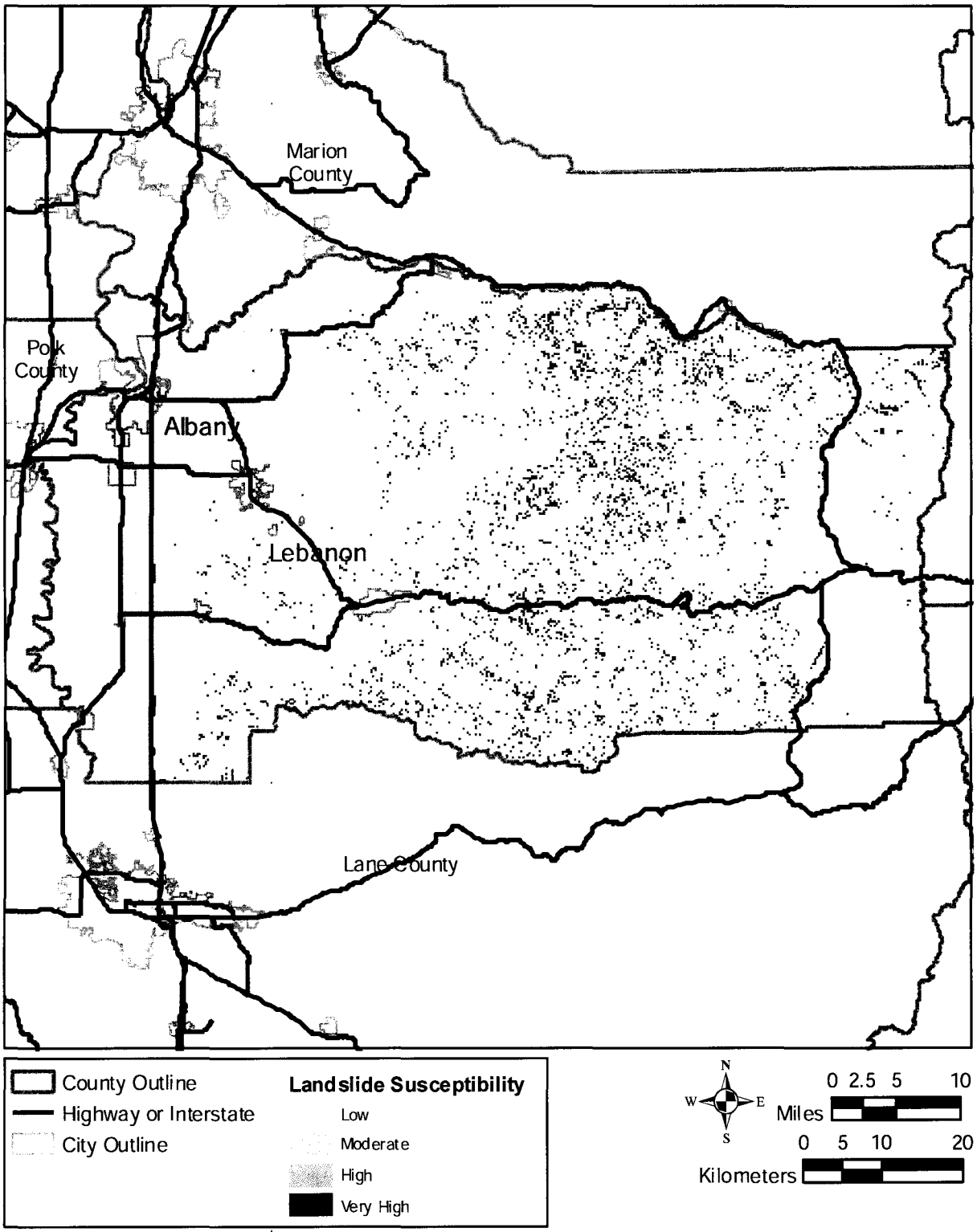

Figure D7. Relative earthquake-induced landslide susceptibility map for Linn County, Oregon.

Identified Landslide Areas Map

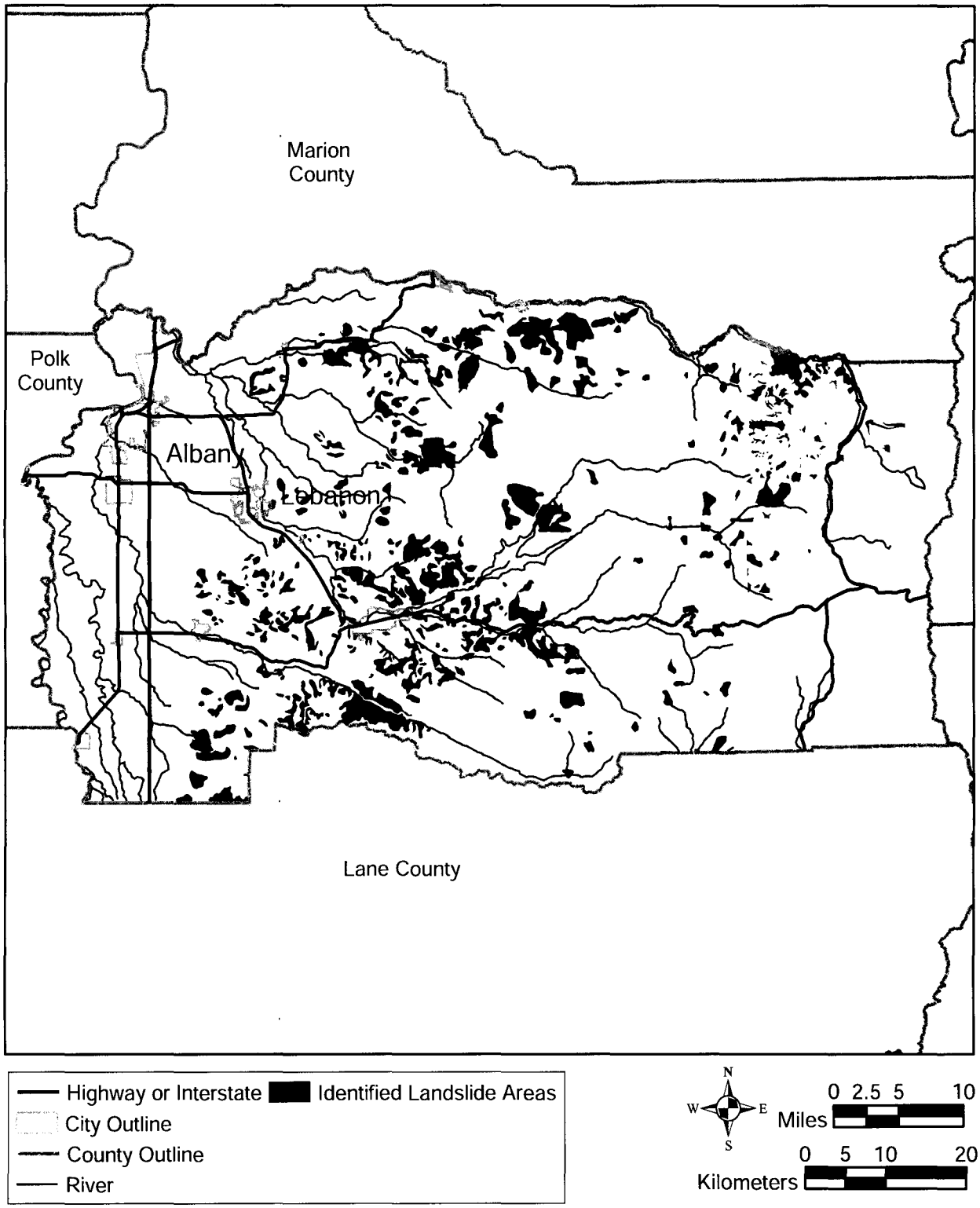

Figure D8. Identified landslide map for Linn County, Oregon.

HAZUS-MH: Earthquake Event Report

Region Name: ***Linn Crustal***

Earthquake Scenario: ***Mill Creek M6.7***

Print Date: ***March 18, 2005***

Disclaimer:
The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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Appendix A: County Listing for the Region

Appendix B: Regional Population and Building Value Data

General Description of the Region

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Oregon

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 2,304.63 square miles and contains 20 census tracts. There are over 39 thousand households in the region and has a total population of 103,069 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 36 thousand buildings in the region with a total building replacement value (excluding contents) of 5,669 (millions of dollars). Approximately 99.00 % of the buildings (and 85.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 4,440 and 1,278 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

HAZUS estimates that there are 36 thousand buildings in the region which have an aggregate total replacement value of 5,669 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 80% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 71 beds. There are 64 schools, 13 fire stations, 5 police stations and 0 emergency operation facilities. With respect to HPL facilities, there are 11 dams identified within the region. Of these, 6 of the dams are classified as 'high hazard'. The inventory also includes 69 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 2 and 3.

The total value of the lifeline inventory is over 5,718.00 (millions of dollars). This inventory includes over 400 kilometers of highways, 122 bridges, 19,117 kilometers of pipes.

Table 2: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	122	1,732.10
	Segments	71	1,421.20
	Tunnels	0	0.00
		Subtotal	**3,153.30**
Railways	Bridges	0	0.00
	Facilities	1	2.50
	Segments	110	209.90
	Tunnels	0	0.00
		Subtotal	**212.40**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	1	1.20
		Subtotal	**1.20**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	26	160.10
	Runways	26	913.10
		Subtotal	**1,073.30**
		Total	**4,440.10**

Table 3: Utility System Lifeline inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	191.20
	Facilities	4	150.50
	Pipelines	0	0.00
		Subtotal	**341.70**
Waste Water	Distribution Lines	NA	114.70
	Facilities	10	752.60
	Pipelines	0	0.00
		Subtotal	**867.30**
Natural Gas	Distribution Lines	NA	76.50
	Facilities	1	1.20
	Pipelines	0	0.00
		Subtotal	**77.70**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	3	372.90
		Subtotal	**372.90**
Communication	Facilities	7	0.80
		Subtotal	**0.80**
		Total	**1,660.40**

Earthquake Scenario

HAZUS uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Mill Creek M6.7
Type of Earthquake	Source
Fault Name	Mill Creek Fault
Historical Epicenter ID #	70
Probabilistic Return Period	NA
Longitude of Epicenter	-123.08
Latitude of Epicenter	44.70
Earthquake Magnitude	6.70
Depth (Km)	0.00
Rupture Length (Km)	22.96
Rupture Orientation (degrees)	0.00
Attenuation Function	Project 2000 West - Non Extensional

Building Damage

Building Damage

HAZUS estimates that about 12,431 thousand buildings will be at least moderately damaged. This is over 34.00 % of the total number of buildings in the region. There are an estimated 2,671 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS technical manual. Table 4 below summaries the expected damage by general occupancy for the buildings in the region. Table 5 summaries the expected damage by general building type.

Table 4: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	1	0.00	0	0.01	0	0.01	0	0.01	0	0.01
Commercial	46	0.28	27	0.39	52	0.77	52	1.72	63	2.35
Education	1	0.00	1	0.01	2	0.04	3	0.09	3	0.12
Government	4	0.02	1	0.01	1	0.02	1	0.03	1	0.04
Industrial	6	0.04	4	0.05	8	0.11	9	0.30	11	0.39
Other Residential	2,583	15.40	1,122	16.05	1,648	24.46	1,241	41.07	962	35.99
Religion	2	0.01	1	0.01	1	0.02	1	0.04	1	0.05
Single Family	14,124	84.24	5,832	83.46	5,026	74.58	1,714	56.74	1,631	61.04
Total	**16,767**		**6,988**		**6,739**		**3,021**		**2,672**	

Table 5: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	20	0.01	1	0.01	1	0.02	2	0.06	3	0.09
MH*	2,390	14.26	924	13.22	1,404	20.84	1,111	36.79	817	30.58
Precast	7	0.03	3	0.04	7	0.10	9	0.30	11	0.40
RM*	3	0.02	1	0.02	3	0.05	4	0.14	5	0.17
Steel	22	0.01	1	0.02	3	0.05	6	0.19	12	0.44
UM*	124	0.74	58	0.83	84	1.25	77	2.55	115	4.29
Wood	14,201	84.65	5973	85.48	5,177	76.82	1,747	57.85	1,638	61.32
Total	**16,767**		**6,988**		**6,739**		**3,021**		**2,672**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 71 hospital beds available for use. On the day of the earthquake, the model estimates that only 3 hospital beds (4.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 20.00% of the beds will be back in service. By 30 days, 62.00% will be operational.

Table 6: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Least Moderate Damage > 50%**	**Complete Damage > 50%**	**# likely Functional on day 1**
Hospitals	1	1	0	0
Schools	64	22	0	42
EOCs	0	0	0	0
PoliceStations	5	3	0	2
FireStations	13	3	0	10

Transportation and Utility Lifeline Damage

Table 7 provides damage estimates for the transportation system.

Table 7: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	71	0	0	71	71
	Bridges	122	12	0	111	119
	Tunnels	0	0	0	0	0
Railways	Segments	110	0	0	110	110
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	1	0	0	1
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	1	0	0	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	26	6	0	23	26
	Runways	26	0	0	26	26

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 8-10 provide information on the damage to the utility lifeline systems. Table 8 provides damage to the utility system facilities. Table 9 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, HAZUS performs a simplified system performance analysis. Table 10 provides a summary of the system performance information.

Table 8 : Expected Utility System Facility Damage

System	Total #	# of Locations With at Least Moderate Damage	With Complete Damage	with Functionality > 50 % After Day 1	After Day 7
Potable Water	4	2	0	2	4
Waste Water	10	4	0	5	10
Natural Gas	1	0	0	1	1
Oil Systems	0	0	0	0	0
Electrical Power	3	1	0	2	3
Communication	7	2	0	6	7

Table 9 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	9,559	308	266
Waste Water	5,735	243	211
Natural Gas	3,824	260	225
Oil	0	0	0

Table 10: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	39,541	2,084	1,157	117	0	0
Electric Power		11,371	7,251	3,254	776	15

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 6 ignitions that will burn about 0.06 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 142 people and burn about 8 (millions of dollars) of building value.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 42.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates (3,683 households to be displaced due to the earthquake. Of these, 927 people (out of a total population of 103,069 will seek temporary shelter in public shelters.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 11 provides a summary of the casualties estimated for this earthquake

Table 11: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	8	2	0	1
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	3	1	0	0
	Industrial	12	4	1	1
	Other-Residential	281	72	8	14
	Single Family	344	77	5	8
	Total	**650**	**156**	**14**	**25**
2 PM	Commercial	518	159	26	52
	Commuting	1	1	1	0
	Educational	83	25	4	8
	Hotels	1	0	0	0
	Industrial	92	28	4	9
	Other-Residential	64	17	2	3
	Single Family	79	18	1	2
	Total	**838**	**248**	**39**	**74**
5 PM	Commercial	406	125	21	40
	Commuting	9	11	20	4
	Educational	10	3	1	1
	Hotels	1	0	0	0
	Industrial	58	17	3	5
	Other-Residential	107	28	3	6
	Single Family	138	31	2	3
	Total	**729**	**215**	**49**	**59**

Economic Loss

The total economic loss estimated for the earthquake is 1,700.28 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 1,315.72 (millions of dollars); 10 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 66 % of the total loss. Table 12 below provides a summary of the losses associated with the building damage.

Table 12: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses							
	Wage	0.00	3.04	32.06	1.43	2.72	39.25
	Capital-Related	0.00	1.29	28.26	1.10	1.06	31.71
	Rental	19.36	22.41	15.53	0.59	1.33	59.22
	Relocation	2.12	0.60	0.84	0.06	0.46	4.08
	Subtotal	**21.47**	**27.34**	**76.69**	**3.18**	**5.57**	**134.25**
Capital Stock Loses							
	Structural	101.77	34.82	43.94	10.49	7.52	198.54
	Non_Structural	382.11	164.12	123.22	40.72	32.04	742.22
	Content	96.57	34.58	57.77	26.76	17.12	232.79
	Inventory	0.00	0.00	2.64	5.08	0.20	7.92
	Subtotal	**580.45**	**233.52**	**227.57**	**83.06**	**56.88**	**1,181.47**
	Total	**601.92**	**260.86**	**304.26**	**86.24**	**62.44**	**1,315.72**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages. Tables 13 & 14 provide a detailed breakdown in the expected lifeline losses.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 15 presents the results of the region for the given earthquake.

Table 13: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	1,421.20	$12.85	0.90
	Bridges	1,732.06	$116.85	6.75
	Tunnels	0.00	$0.00	0.00
	Subtotal	**3153.30**	**129.70**	
Railways	Segments	209.93	$2.21	1.05
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	2.46	$1.15	46.70
	Subtotal	**212.40**	**3.40**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Bus	Facilities	1.23	$0.63	51.16
	Subtotal	**1.20**	**0.60**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Airport	Facilities	160.12	$36.02	22.49
	Runways	913.13	$2.25	0.25
	Subtotal	**1073.30**	**38.30**	
	Total	**4440.10**	**172.00**	

Table 14: Utility System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	150.50	$27.50	18.27
	Distribution Line	191.20	$6.55	3.43
	Subtotal	**341.69**	**$34.05**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	752.60	$112.79	14.99
	Distribution Line	114.70	$5.18	4.52
	Subtotal	**867.29**	**$117.98**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	1.20	$0.07	5.79
	Distribution Line	76.50	$5.54	7.25
	Subtotal	**77.70**	**$5.61**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	372.90	$54.84	14.71
	Subtotal	**372.90**	**$54.84**	
Communication	Facilities	0.80	$0.11	13.44
	Subtotal	**0.79**	**$0.11**	
	Total	**1,660.38**	**$212.59**	

Table 15. Indirect Economic Impact with outside aid
(Employment as # of people and Income in millions of $)

	LOSS	Total	%
First Year			
	Employment Impact	0	0.00
	Income Impact	(67)	-7.10
Second Year			
	Employment Impact	0	0.00
	Income Impact	(91)	-9.63
Third Year			
	Employment Impact	0	0.00
	Income Impact	(100)	-10.69
Fourth Year			
	Employment Impact	0	0.00
	Income Impact	(100)	-10.69
Fifth Year			
	Employment Impact	0	0.00
	Income Impact	(100)	-10.69
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	(100)	-10.69

Appendix A: County Listing for the Region

Linn, OR

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Oregon					
	Linn	103,069	4,821	847	5,669
Total State		**103,069**	**4,821**	**847**	**5,669**
Total Region		**103,069**	**4,821**	**847**	**5,669**

HAZUS-MH: Earthquake Event Report

Region Name: ***Linn Cascadia***

Earthquake Scenario: ***Cascadia M9.0***

Print Date: ***March 18, 2005***

Disclaimer:
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General Description of the Region

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Oregon

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 2,304.63 square miles and contains 20 census tracts. There are over 39 thousand households in the region and has a total population of 103,069 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 36 thousand buildings in the region with a total building replacement value (excluding contents) of 5,669 (millions of dollars). Approximately 99.00 % of the buildings (and 85.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 4,440 and 1,278 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

HAZUS estimates that there are 36 thousand buildings in the region which have an aggregate total replacement value of 5,669 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 80% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 71 beds. There are 64 schools, 13 fire stations, 5 police stations and 0 emergency operation facilities. With respect to HPL facilities, there are 11 dams identified within the region. Of these, 6 of the dams are classified as 'high hazard'. The inventory also includes 69 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 2 and 3.

The total value of the lifeline inventory is over 5,718.00 (millions of dollars). This inventory includes over 400 kilometers of highways, 122 bridges, 19,117 kilometers of pipes.

Table 2: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	122	1,732.10
	Segments	71	1,421.20
	Tunnels	0	0.00
		Subtotal	**3,153.30**
Railways	Bridges	0	0.00
	Facilities	1	2.50
	Segments	110	209.90
	Tunnels	0	0.00
		Subtotal	**212.40**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	1	1.20
		Subtotal	**1.20**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	26	160.10
	Runways	26	913.10
		Subtotal	**1,073.30**
		Total	**4,440.10**

Table 3: Utility System Lifeline inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	191.20
	Facilities	4	150.50
	Pipelines	0	0.00
		Subtotal	**341.70**
Waste Water	Distribution Lines	NA	114.70
	Facilities	10	752.60
	Pipelines	0	0.00
		Subtotal	**867.30**
Natural Gas	Distribution Lines	NA	76.50
	Facilities	1	1.20
	Pipelines	0	0.00
		Subtotal	**77.70**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	3	372.90
		Subtotal	**372.90**
Communication	Facilities	7	0.80
		Subtotal	**0.80**
		Total	**1,660.40**

Earthquake Scenario

HAZUS uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Cascadia M9.0
Type of Earthquake	User-defined
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	8.50
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

HAZUS estimates that about 10,372 thousand buildings will be at least moderately damaged. This is over 29.00 % of the total number of buildings in the region. There are an estimated 2,470 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS technical manual. Table 4 below summaries the expected damage by general occupancy for the buildings in the region. Table 5 summaries the expected damage by general building type.

Table 4: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0.00	0	0.00	0	0.01	0	0.01	0	0.02
Commercial	18	0.10	21	0.26	53	1.00	62	2.40	86	3.47
Education	1	0.00	1	0.01	2	0.04	3	0.11	3	0.13
Government	1	0.01	1	0.01	2	0.03	2	0.07	2	0.09
Industrial	2	0.01	2	0.03	7	0.13	10	0.40	16	0.64
Other Residential	1,161	6.66	1,039	12.41	1,942	36.65	1,950	74.89	1,463	59.20
Religion	1	0.01	1	0.01	1	0.02	1	0.05	2	0.08
Single Family	16,259	93.21	7,304	87.26	3,291	62.12	575	22.07	899	36.37
Total	**17,444**		**8,370**		**5,298**		**2,604**		**2,471**	

Table 5: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	7	0.00	0	0.00	1	0.02	2	0.09	4	0.16
MH*	860	4.93	813	9.71	1,779	33.59	1,870	71.80	1,324	53.60
Precast	2	0.01	1	0.02	6	0.11	10	0.38	16	0.64
RM*	1	0.01	1	0.01	3	0.06	5	0.19	6	0.26
Steel	5	0.00	0	0.00	2	0.04	5	0.19	17	0.67
UM*	83	0.47	66	0.78	103	1.95	90	3.45	116	4.71
Wood	16,486	94.50	7471	89.26	3,348	63.20	546	20.97	880	35.63
Total	**17,444**		**8,370**		**5,298**		**2,604**		**2,471**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 71 hospital beds available for use. On the day of the earthquake, the model estimates that only 63 hospital beds (90.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 90.00% of the beds will be back in service. By 30 days, 90.00% will be operational.

Table 6: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Least Moderate Damage > 50%**	**Complete Damage > 50%**	**# likely Functional on day 1**
Hospitals	1	0	0	1
Schools	64	0	0	64
EOCs	0	0	0	0
PoliceStations	5	0	0	5
FireStations	13	0	0	13

Transportation and Utility Lifeline Damage

Table 7 provides damage estimates for the transportation system.

Table 7: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	71	0	0	71	71
	Bridges	122	0	0	122	122
	Tunnels	0	0	0	0	0
Railways	Segments	110	0	0	110	110
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	1	1
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	26	0	0	26	26
	Runways	26	0	0	26	26

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 8-10 provide information on the damage to the utility lifeline systems. Table 8 provides damage to the utility system facilities. Table 9 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, HAZUS performs a simplified system performance analysis. Table 10 provides a summary of the system performance information.

Table 8 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 % After Day 1	After Day 7
Potable Water	4	1	0	3	4
Waste Water	10	2	0	2	10
Natural Gas	1	0	0	1	1
Oil Systems	0	0	0	0	0
Electrical Power	3	0	0	2	3
Communication	7	0	0	7	7

Table 9 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	9,559	451	191
Waste Water	5,735	357	151
Natural Gas	3,824	382	161
Oil	0	0	0

Table 10: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	39,541	777	259	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 36.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates (2,563 households to be displaced due to the earthquake. Of these, 653 people (out of a total population of 103,069 will seek temporary shelter in public shelters.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 11 provides a summary of the casualties estimated for this earthquake

Table 11: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	9	3	0	1
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	4	1	0	0
	Industrial	16	5	1	2
	Other-Residential	340	87	9	17
	Single Family	194	43	3	5
	Total	**563**	**139**	**14**	**25**
2 PM	Commercial	619	193	32	63
	Commuting	0	0	0	0
	Educational	96	30	5	10
	Hotels	1	0	0	0
	Industrial	121	37	6	12
	Other-Residential	77	20	2	4
	Single Family	45	10	1	1
	Total	**960**	**290**	**46**	**90**
5 PM	Commercial	494	152	26	49
	Commuting	0	0	0	0
	Educational	10	3	1	1
	Hotels	1	0	0	0
	Industrial	76	23	4	7
	Other-Residential	127	33	4	7
	Single Family	77	17	1	2
	Total	**785**	**229**	**35**	**67**

Economic Loss

The total economic loss estimated for the earthquake is 1,310.63 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 1,150.68 (millions of dollars); 13 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 51 % of the total loss. Table 12 below provides a summary of the losses associated with the building damage.

Table 12: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses							
	Wage	0.00	2.45	43.02	2.09	3.16	50.72
	Capital-Related	0.00	1.04	37.44	1.53	1.16	41.17
	Rental	10.27	20.13	19.59	0.80	1.51	52.29
	Relocation	1.18	0.62	1.09	0.07	0.51	3.47
	Subtotal	**11.45**	**24.23**	**101.14**	**4.49**	**6.34**	**147.65**
Capital Stock Loses							
	Structural	54.39	39.13	57.54	14.03	9.68	174.77
	Non_Structural	209.37	160.93	155.67	51.51	35.46	612.94
	Content	55.41	31.54	68.41	32.40	17.48	205.23
	Inventory	0.00	0.00	3.15	6.65	0.29	10.09
	Subtotal	**319.16**	**231.60**	**284.77**	**104.59**	**62.91**	**1,003.03**
	Total	**330.61**	**255.83**	**385.92**	**109.07**	**69.25**	**1,150.68**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages. Tables 13 & 14 provide a detailed breakdown in the expected lifeline losses.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 15 presents the results of the region for the given earthquake.

Table 13: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	1,421.20	$4.44	0.31
	Bridges	1,732.06	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Subtotal	**3153.30**	**4.40**	
Railways	Segments	209.93	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	2.46	$0.65	26.32
	Subtotal	**212.40**	**0.60**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Bus	Facilities	1.23	$0.34	27.99
	Subtotal	**1.20**	**0.30**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Airport	Facilities	160.12	$22.00	13.74
	Runways	913.13	$1.09	0.12
	Subtotal	**1073.30**	**23.10**	
	Total	**4440.10**	**28.50**	

Table 14: Utility System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	150.50	$12.57	8.35
	Distribution Line	191.20	$5.62	2.94
	Subtotal	**341.69**	**$18.19**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	752.60	$83.55	11.10
	Distribution Line	114.70	$4.44	3.87
	Subtotal	**867.29**	**$88.00**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	1.20	$0.10	8.25
	Distribution Line	76.50	$4.75	6.21
	Subtotal	**77.70**	**$4.85**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	372.90	$20.33	5.45
	Subtotal	**372.90**	**$20.33**	
Communication	Facilities	0.80	$0.07	8.32
	Subtotal	**0.79**	**$0.07**	
	Total	**1,660.38**	**$131.43**	

Table 15. Indirect Economic Impact with outside aid
(Employment as # of people and Income in millions of $)

	LOSS	Total	%
First Year			
	Employment Impact	0	0.00
	Income Impact	(65)	-6.90
Second Year			
	Employment Impact	0	0.00
	Income Impact	(85)	-9.04
Third Year			
	Employment Impact	0	0.00
	Income Impact	(93)	-9.92
Fourth Year			
	Employment Impact	0	0.00
	Income Impact	(93)	-9.92
Fifth Year			
	Employment Impact	0	0.00
	Income Impact	(93)	-9.92
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	(93)	-9.92

Appendix A: County Listing for the Region

Linn, OR

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Oregon					
	Linn	103,069	4,821	847	5,669
Total State		**103,069**	**4,821**	**847**	**5,669**
Total Region		**103,069**	**4,821**	**847**	**5,669**

Appendix E
Grant Programs

Hazard Mitigation Programs

Post-Disaster Federal Programs

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

Pre-Disaster Federal Programs

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

- http://www.fema.gov/government/grant/fma/index.shtm

Detailed program and application information for federal post-disaster and pre-disaster programs can be found in the FY10 Hazard Mitigation Assistance Unified Guidance, available at http://www.fema.gov/library/viewRecord.do?id=3649

For Oregon Emergency Management grant guidance on Federal Hazard Mitigation Assistance, visit: http://www.oregon.gov/OMD/OEM/plans_train/grant_info/hma.pdf

OEM contact: Dennis Sigrist, dsigrist@oem.state.or.us

State Programs

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

Federal Mitigation Programs, Activities & Initiatives

Basic & Applied Research/Development

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

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

Hazard ID and Mapping

- National Flood Insurance Program: Flood Mapping; FEMA. Flood insurance rate maps and flood plain management maps for all NFIP communities. http://www.fema.gov/plan/prevent/fhm/index.shtm
- National Digital Orthophoto Program, DOI – USGS. Develops topographic quadrangles for use in mapping of flood and other hazards. http://www.ndop.gov/
- Mapping Standards Support, DOI-USGS. Expertise in mapping and digital data standards to support the National Flood Insurance Program. http://ncgmp.usgs.gov/ncgmpstandards/
- Soil Survey, USDA-NRCS. Maintains soil surveys of counties or other areas to assist with farming, conservation, mitigation or related purposes. http://soils.usda.gov/survey/

Project Support

- Coastal Zone Management Program, NOAA. Provides grants for planning and implementation of non-structural coastal flood and hurricane hazard mitigation projects and coastal wetlands restoration. http://coastalmanagement.noaa.gov/
- Community Development Block Grant Entitlement Communities Program, HUD. Provides grants to entitled cities and urban counties to develop viable communities (e.g., decent housing, a suitable living environment, expanded economic opportunities), principally for low- and moderate- in come persons. http://www.hud.gov/offices/cpd/communitydevelopment/programs/entitlement/
- National Fire Plan (DOI – USDA) Provides technical, financial, and resource guidance and support for wildland fire management across the United States. Addresses five key points: firefighting, rehabilitation, hazardous fuels reduction, community assistance, and accountability. http://www.forestsandrangelands.gov/NFP/index.shtml
- Assistance to Firefighters Grant Program, FEMA. Grants are awarded to fire departments to enhance their ability to protect the public and fire service personnel from fire and related hazards. Three types of grants are available: Assistance to Firefighters Grant (AFG), Fire Prevention and Safety (FP&S), and Staffing for Adequate Fire and Emergency Response (SAFER). http://www.firegrantsupport.com/
- Emergency Watershed Protection Program, USDA-NRCS. Provides technical and financial assistance for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas damaged by severe natural hazard events. http://www.nrcs.usda.gov/programs/EWP/

- Rural Development Assistance – Utilities, USDA. Direct and guaranteed rural economic loans and business enterprise grants to address utility issues and development needs. http://www.usda.gov/rus/
- Rural Development Assistance – Housing, USDA. Grants, loans, and technical assistance in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster necessary. http://www.rurdev.usda.gov/rhs/
- Public Assistance Grant Program, FEMA. The objective of the Federal Emergency Management Agency's (FEMA) Public Assistance (PA) Grant Program is to provide assistance to State, Tribal and local governments, and certain types of Private Nonprofit organizations so that communities can quickly respond to and recover from major disasters or emergencies declared by the President. http://www.fema.gov/government/grant/pa/index.shtm
- National Flood Insurance Program, FEMA. Makes available flood insurance to residents of communities that adopt and enforce minimum floodplain management requirements. http://www.fema.gov/business/nfip/
- HOME Investments Partnerships Program, HUD. Grants to states, local government and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons. http://www.hud.gov/offices/cpd/affordablehousing/programs/home/
- Disaster Recovery Initiative, HUD. Grants to fund gaps in available recovery assistance after disasters (including mitigation). http://www.hud.gov/offices/cpd/communitydevelopment/programs/dri/driquickfacts.cfm
- Emergency Management Performance Grants, FEMA. Helps state and local governments to sustain and enhance their all-hazards emergency management programs. http://www.fema.gov/government/grant/empg/index.shtm#0
- Partners for Fish and Wildlife, DOI – FWS. Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats. http://www.fws.gov/partners/
- North American Wetland Conservation Fund, DOI-FWS. Cost-share grants to stimulate public/private partnerships for the protection, restoration, and management of wetland habitats. http://www.doi.gov/partnerships/wetlands.html
- Federal Land Transfer / Federal Land to Parks Program, DOI-NPS. Identifies, assesses, and transfers available Federal real property for acquisition for State and local parks and recreation, such as open space. http://www.nps.gov/ncrc/programs/flp/flp_questions.html
- Wetlands Reserve program, USDA-NCRS. Financial and technical assistance to protect and restore wetlands through easements and restoration agreements. http://www.nrcs.usda.gov/Programs/WRP/
- Secure Rural Schools and Community Self-Determination Act of 2000, US Forest Service. Reauthorized for FY2008-2011, it was originally enacted in 2000 to provide five years of transitional assistance to rural counties affected by the decline in revenue from timber harvests on federal lands. Funds have been used for improvements to public

schools, roads, and stewardship projects. Money is also available for maintaining infrastructure, improving the health of watersheds and ecosystems, protecting communities, and strengthening local economies. http://www.fs.fed.us/srs/