

Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan

Polk County and the Cities of:
Dallas, Falls City, Independence, and Monmouth



Photo: Gary Halvorson (Oregon State Archives)

October 2017

Volume I: Basic Plan

Prepared for:

Polk County
Dallas, Falls City, Independence, and Monmouth

Prepared by:

University of Oregon
Community Service Center
Oregon Partnership for Disaster Resilience



UNIVERSITY OF OREGON



This Natural Hazard Mitigation Plan was prepared by:



With support from:



UNIVERSITY OF OREGON



Department of Planning, Public Policy and Management
School of Architecture and Allied Arts

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FEMA

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SPECIAL THANKS & ACKNOWLEDGEMENTS

Polk County developed this Multi-Jurisdictional Natural Hazards Mitigation Plan (NHMP) through a regional partnership funded by the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation (PDM) Competitive Grant Program: EMS-2014-PC-0011, Sub-grant Application Reference: PDMC-PL-10-OR-2014-002. This updated Natural Hazard Mitigation Plan is a collaboration between Polk County and the Cities of Dallas, Falls City, Independence, and Monmouth. The county utilized a four-phased planning process, plan templates and plan development support provided by the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center.

Special thanks to Sidney Mulder, Associate Planner, Polk County Community Development for her leadership in convening the committee.

Polk County NHMP Update Steering Committee

Polk County

- Convener, Sidney Mulder, Associate Planner
- Dean Bender, Emergency Manager
- Autumn Hillebrand, Office Manager
- Todd Whitaker, Public Works Director
- Austin McGuigan, Community Development Director

City of Dallas

- Convener, Jason Locke, Community Development/Operations Director
- Ron Foggin, City Manager
- Tom Simpson, Police Chief
- Fred Hertel, Fire Chief
- Fred Braun, City Engineer

City of Falls City

- Convener, City Manager
- Domenica Protheroe, City Clerk
- Terry Ungricht, Mayor and City Manager
- Don Poe, Lead Public Works Worker
- Members of the City Council

City of Independence

- Convener, Shawn Irvine, Economic Development Director
- Robert Mason, Police Chief
- Michael Danko, Community Development Director
- Jason Kistler, Information Services Manager
- Matthew Carpenter, Public Works Lead Worker

City of Monmouth

- Convener, Mark Fancey, Community Development Director
- Russ Cooper, Monmouth Public Works Director
- Scott McClure, Monmouth City Manager
- Allen Risen, Western Oregon University Public Safety
- Michael Smith – Director Western Oregon University Facilities
- Ben Stange, Fire Chief, Polk County Fire District No. 1
- Darrell Tallen, Monmouth Chief of Police
- Chuck Thurman, Monmouth Power & Light Superintendent

Community Service Center Team

- Michael Howard, OPDR Assistant Program Manager
- Julie Foster, Grant's Administrator
- Megan Knox, Project Assistant
- Tarik Rawlings, Project Assistant

Additional Thanks:

To the Department of Geology and Mineral Industries for assistance with hazard data; the Department of Land Conservation and Development staff in the hazards for flood data, mapping and process support; to the Oregon Military Department Office of Emergency Management for grant administration and process support.

About the Community Service Center

The Community Service Center (CSC), a research center affiliated with the Department of Planning, Public Policy, and Management at the University of Oregon, is an interdisciplinary organization that assists Oregon communities by providing planning and technical assistance to help solve local issues and improve the quality of life for Oregon residents. The role of the CSC is to link the skills, expertise, and innovation of higher education with the transportation, economic development, and environmental needs of communities and regions in the State of Oregon, thereby providing service to Oregon and learning opportunities to the students involved.

About the Oregon Partnership for Disaster Resilience

The Oregon Partnership for Disaster Resilience (OPDR) 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 at the University of Oregon, the OPDR employs a service-learning model to increase community capacity and enhance disaster safety and resilience statewide.

Plan Template Disclaimer

This Natural Hazards Mitigation Plan is based in part on a plan template developed by the Oregon Partnership for Disaster Resilience. The template is structured to address the requirements contained in 44 CFR 201.6; where language is applicable to communities throughout Oregon, OPDR encourages the use of standardized language. As part of this regional planning initiative, OPDR provided copies of the plan templates to communities for use in developing or updating their natural hazards mitigation plans. OPDR hereby authorizes the use of all content and language provided to Polk County in the plan template.

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PLAN SUMMARY

Polk County updated this Multi-Jurisdictional Natural Hazards Mitigation Plan (NHMP, MNHMP, or Plan) in an effort to prepare for the long-term effects resulting from natural hazards. It is impossible to predict exactly when these hazards will occur, or the extent to which they will affect the community. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to create a resilient community that will benefit from long-term recovery planning efforts.

The Federal Emergency Management Agency (FEMA) defines mitigation as “. . . the effort to reduce loss of life and property by lessening the impact of disasters . . . through risk analysis, which results in information that provides a foundation for mitigation activities that reduce risk.” Said another way, natural hazard mitigation is a method of permanently reducing or alleviating the losses of life, property, and injuries resulting from natural hazards through long and short-term strategies. Example strategies include policy changes, such as updated ordinances, projects, such as seismic retrofits to critical facilities; and education and outreach to targeted audiences, such as Spanish speaking residents or the elderly. Natural hazard mitigation is the responsibility of the “Whole Community” - individuals, private businesses and industries, state and local governments, and the federal government.

44 CFR 201.6 – The local mitigation plan is the representation of the jurisdiction’s commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards. . . .

Why Develop this Mitigation Plan?

In addition to establishing a comprehensive community-level mitigation strategy, the Disaster Mitigation Act of 2000 (DMA2K) and the regulations contained in 44 CFR 201 require that jurisdictions maintain an approved Natural Hazard Mitigation Plan (NHMP) in order to receive federal funds for mitigation projects. Local and federal approval of this Plan ensures that the county and listed jurisdictions will remain eligible for pre- and post-disaster mitigation project grants.

44 CFR 201.6(a)(1) – A local government must have a mitigation plan approved pursuant to this section in order to receive HMGP project grants . . .

What is Mitigation?

“Any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event.”

- U.S. Federal Emergency Management Agency

Who Participated in Developing the Plan?

The Polk County NHMP is the result of a collaborative effort between the county, cities, special districts, citizens, public agencies, non-profit organizations, the private sector and regional organizations. County and City steering committees guided the plan development process.

The County Steering Committee included representatives from the following jurisdictions:

- Polk County
- City of Dallas
- City of Falls City
- City of Independence
- City of Monmouth

44 CFR 201.6(c)(1) – Documentation of 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.

The Polk County Planning Department convened the planning process and will take the lead in implementing, maintaining and updating the plan. Polk County is dedicated to directly involving the public in the continual review and update of the natural hazards mitigation plan. The public will have the opportunity to continue to provide feedback about the plan throughout the implementation and maintenance period.

How Does this Mitigation Plan Reduce Risk?

The NHMP is intended to assist Polk County reduce the risk from natural hazards by identifying resources, information, and strategies for risk reduction. It is also intended to guide and coordinate mitigation activities throughout the county. A risk assessment consists of three phases: hazard identification, vulnerability assessment, and risk analysis, as illustrated in the following graphic.

*44 CFR 201.6(c)(2) – A Risk Assessment that provides the factual basis for activities proposed in the strategy
...*

Figure PS-I Understanding Risk



Source: Oregon Partnership for Disaster Resilience.

By identifying and understanding the relationship between natural hazards, vulnerable systems, and existing capacity, Polk County is better equipped to identify and implement actions aimed at reducing the overall risk to natural hazards.

What is Polk County’s Overall Risk to Hazards?

Polk County reviewed and updated their risk assessment to evaluate the probability of each hazard as well as the vulnerability of the community to that hazard. Scores are based on the Polk County Hazard Analysis submitted to the Oregon Office of Emergency Management (January 2016) and updated by the steering committee in 2016. Table PS-1 below summarizes hazard probability and vulnerability as determined by the county steering committee (for more information see Section 2, Risk Assessment).

Table PS-I Risk Assessment Summary

Hazard	Probability	Vulnerability	Total Threat Score	Hazard Rank
Windstorm	High	High	230	# 1
Winter Storm	High	High	230	# 1
Flood - Riverine	High	Moderate	165	# 3
Earthquake (Cascadia)	Moderate	Moderate	162	# 4
Earthquake (Crustal)	Moderate	Moderate	162	# 4
Drought	Moderate	Moderate	160	# 6
Wildfire (WUI)	Moderate	Moderate	120	# 7
Landslide	High	Low	93	# 8
Volcano	Low	Moderate	84	# 9

Source: Polk County NHMP Steering Committee (2016)

At the end of this executive summary, hazard briefs provide summary information for priority hazards in Polk County.

What is the Plan's Mission?

The mission of the Polk County NHMP is to:

Mission: *To assist in reducing risk, preventing loss, and protecting life, property, and the environment from future natural hazard events. The plan fosters collaboration and coordinated partnerships among public and private partners. This can be achieved by increasing public awareness and education and identifying activities to guide the county towards building a safer community.*

44 CFR 201.6(c)(3)(i) – A description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

What are the Plan Goals?

The plan goals describe the overall direction that the participating jurisdiction's agencies, organizations, and citizens can take toward mitigating risk from natural hazards. Below is a list of the plan goals (Note: although numbered the goals are not prioritized):

GOAL 1: PUBLIC EDUCATION AND AWARENESS

Provide public information and education/awareness to all residents of the county concerning natural hazard areas and mitigation efforts.

GOAL 2: PREVENTIVE AND IMPLEMENTATION

Develop and implement activities to protect human life, commerce, property and natural systems.

GOAL 3: COLLABORATION AND COORDINATION

Strengthen hazard mitigation by increasing collaboration and coordination among citizens, public agencies, non-profit organizations, businesses, and industry.

GOAL 4: FUNDING AND PARTNERSHIPS

Seek partnerships in funding and resources for future mitigation efforts.

GOAL 5: EMERGENCY OPERATIONS

Coordinate and integrate natural hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL 6: NATURAL RESOURCES UTILIZATION

Link land use planning, development criteria, codes, and natural resources and watershed planning with natural hazard mitigation.

How are the Action Items Organized?

The action items are organized within an action matrix included within Section 3, Mitigation Strategy.

44 CFR 201.6(c)(3)(ii) – A section that identifies and analyzes a comprehensive range of specific mitigation actions . . .

Data collection, research and the public participation process resulted in the development of the action items. The Action Item Matrix portrays the overall Plan framework and identifies linkages between the plan goals and actions. The matrix documents the title of each action along with, the coordinating organization, timeline, and the plan goals addressed. Action items particular to each of the participating cities are included at the end of the action item matrix in Section 3, Mitigation Strategy and in the jurisdictional addenda.

Comprehensive Action Plan

The following table summarizes specific **priority** NHMP actions. Refer to the Mitigation Strategy section for a complete list of actions.

Action ID Key: MH = Multi-Hazard, DR = Drought, EQ = Earthquake, FL = Flood, LS = Landslide, WF = Wildfire, WT = Winter Storm

Table PS-2 Polk County High Priority NHMP Actions

Action Item #	Description	Managing Department / Agency	Timeframe	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility
Priority Actions					
Multi-Hazard Actions (MH)					
MH #1	Identify primary and secondary transportation routes to interconnect critical facilities. Create a map with these emergency routes to be used in the event of a natural hazard.	Emergency Management - HMT	Ongoing	General Fund	BC: TBD TF: Yes
MH #2	Reduce potential isolation of critical facilities in the event of a natural hazard by creating redundancy. Create a map with alternatives transportation routes. Create a plan for multiple communication alternatives.	Public Works/Emergency Management	1-5 years	General Fund	BC: TBD TF: Yes
MH #3	Utilize social media as a communication outlet in the event of a natural hazard.	Emergency Management	Ongoing	General Fund	BC: TBD TF: Yes
Windstorm Actions (WS)					
WS #1	Develop and implement programs to keep trees from threatening lives, property, and public infrastructure during windstorm events. Identify hazard trees, encourage harvesting of hazard trees within utility and road corridors, and those blown down during storm events.	Emergency Management- HMT, Public Works, Community Development	Ongoing	General Fund, HMGP	BC: TBD TF: Yes

Source: Polk County NHMP Steering Committee (2017)

Table PS-3 Dallas High Priority NHMP Actions

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility
Priority Actions					
Multi-Hazard Actions (MH)					
MH #1	Perform hydrologic and hydraulic engineering, and drainage studies and analyses. Use information obtained for feasibility determination and project design. This information should be a key component, directly related to a proposed project.	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
MH #2	Harden utility headers located along river embankments to mitigate potential flood, debris, and erosion damages.	Public Works	Ongoing	General Fund	BC: TBD TF: Yes
Earthquake Actions (EQ)					
EQ #1	Evaluate critical public facility seismic performance for fire stations, public works buildings, potable water systems, wastewater systems, electric power systems, and bridges within the jurisdiction.	Community Development, Police, Fire, Public Work	Short Term (0-2 Years)	General Fund, HMGP, HMA	BC: TBD TF: Yes
Flood Action (FL) - including erosion					
FL #1	Install bank protection such as rock, concrete, asphalt, vegetation, or other armoring or protective materials to provide river bank protection.	Public Works	Ongoing	General Fund, HMGP, HMA, NRCS	BC: TBD TF: Yes
FL #2	Establish flood mitigation priorities for critical facilities and residential and commercial buildings located within the 100-year floodplain using survey elevation data.	Community Development, Public Works	Short Term (0-2 Years)	General Fund, HMA	BC: TBD TF: Yes
Wildfire Actions (WF)					
WF #1	Participate in the maintenance, implementation, and update of the Polk County Community Wildfire Protection Plan (2009).	PC SW Rural Fire District Polk County & City Manager	Ongoing	General Fund	BC: TBD TF: Yes

Source: Dallas NHMP Steering Committee (2017)

Table PS-4 Falls City High Priority NHMP Actions

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility
Priority Actions					
Multi-Hazard Actions (MH)					
MH #1	Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities (particularly schools) susceptible to short term power disruption.	Falls City School District	Mid-Term (2-5 Years)	HMGP, School District Bond	BC: TBD TF: Yes
Earthquake Actions (EQ)					
EQ #1	Disseminate FEMA pamphlets to educate and encourage homeowners concerning seismic structural and non-structural retrofit benefits.	City Manager	Ongoing	General Fund, NEHRP, HMGP	BC: TBD TF: Yes
EQ #2	Repair Dayton Street Bridge	City Manager, Public Works	Mid-Term (2-5 Years)	OR-IFA, USDA, OPRD	BC: \$116,000 TF: Yes
Flood Action (FL) - including erosion					
FL #1	Develop an outreach program to educate public concerning NFIP participation benefits, floodplain development, land use regulation, and NFIP flood insurance availability to facilitate continued compliance with the NFIP.	MWVCOG Planning, City Manager, & Public Works	Short Term (0-2 Years)	General Fund	BC: TBD TF: Yes

Source: Falls City NHMP Steering Committee (2017)

Table PS-5 Independence High Priority NHMP Actions

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Priority Actions					
Multi-Hazard Actions (MH)					
MH #1	Develop a secondary or backup communication link to the County EOC for assured communication during natural or manmade hazards.	Police Dept.	Short Term (0-2 Years)	Homeland Security Grants/ Partnerships	BC: TBD TF: Yes
Earthquake Actions (EQ)					
EQ #1	Inspect, prioritize, and retrofit any critical facility or public infrastructure that does not meet current Building Codes.	Community Development	Short Term (0-2 Years)	General Fund, HMGP, HMA, SRGP	BC: TBD TF: Yes
EQ #2	Structurally retrofit the historic buildings in the downtown core for earthquake survivability.	Historic Preservation Commission	Long Term (5+ Years)	URD/Property Owners	BC: TBD TF: Yes
Flood Action (FL) - including erosion					
FL #1	Build a new Gun Club Road bridge to mitigate the flood and the resultant transportation hazard.	Community Development	Short Term (0-2 Years)	Transportation Fund/ General Fund/ Storm Fund	BC: TBD TF: Yes
FL #2	Identify and resolve areas of persistent stormwater flooding due to undersized, underperforming, stormwater infrastructure.	Public Works	Mid-Term (2-5 Years)	OWEB, General Fund, Grants, SDCs	BC: TBD TF: Yes
FL #3	Create access along Ash Creek to allow for early discovery of debris dams which causes backflow flooding and allow emergency removal of flood causing debris blockages.	Community Development	Short Term (0-2 Years)	State Parks/ Transportation Fund/ Watershed Enhancement grant	BC: TBD TF: Yes

Source: Independence NHMP Steering Committee (2017)

Table PS-6 Monmouth High Priority NHMP Actions

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Priority Actions					
Multi-Hazard Actions (MH)					
MH #1	Develop and incorporate city ordinances commensurate with building and fire codes to reflect survivability from wind, seismic, fire, and other hazards to ensure life safety.	Community Development Department, Building Department, Fire District	Ongoing	General Fund	BC: TBD TF: Yes
MH #2	Review ordinances and develop outreach programs to assure propane tanks are properly anchored and hazardous materials are properly stored and protected from known natural hazards such as seismic or flooding events.	Building Department, Fire District	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes
Earthquake Actions (EQ)					
EQ #1	Update the City Code to adopt, implement, and enforce current State of Oregon Building Codes.	Building Department	Ongoing	General Fund	BC: TBD TF: Yes
EQ #2	Retrofit important public facilities with significant seismic vulnerabilities (City Hall, etc.), such as unreinforced masonry construction. Consider structural and non-structural options.	City Manager, Central School District	Long Term (5+ Years)	General Fund, NEHRP, HMGP, SRGP	BC: TBD TF: Yes
Flood Action (FL) - including erosion					
FL #1	Develop, or revise, adopt, and enforce storm water ordinances and regulations to manage run-off from new development, including buffers and retention basins.	Community Development Department, Public Works Department	Ongoing	General Fund, HMA	BC: TBD TF: Yes
FL #2	Identify and resolve areas of persistent stormwater flooding due to undersized, underperforming, stormwater infrastructure.	Public Works	Mid-Term (2-5 Years)	OWEB, General Fund, Grants, SDCs	BC: TBD TF: Yes
Winter Storm Actions (WT)					
WT #1	Implement and enforce the most current Uniform International, and State, Building Codes to ensure structures can withstand winter storm hazards such as high winds, rain, water, and snow.	Building Department	Short Term (0-2 Years)	General Fund	BC: TBD TF: Yes
WT #2	Develop and implement tree clearing mitigation programs to keep trees from threatening lives, property, and public infrastructure from severe weather events.	Public Works Department, Monmouth Power & Light	Short Term (0-2 Years)	General Fund, HMGP, HMA	BC: TBD TF: Yes

Source: Monmouth NHMP Steering Committee (2017)

How will the plan be implemented?

The plan maintenance section of this Plan details the formal process that will ensure that the Polk County NHMP remains an active and relevant document. The plan will be implemented, maintained, and updated by a designated convener. The Polk County Planning Department is the designated convener (Plan Convener) and is responsible for overseeing the review and implementation processes (see jurisdictional addenda for city conveners). The plan maintenance process includes a schedule for monitoring and evaluating the plan semi-annually and producing a plan revision every five years. This section also describes how the communities will integrate public participation throughout the plan maintenance process.

44 CFR 201.6(c)(3)(iii) – An action plan describing how the actions . . . will be prioritized, implemented and administered . . .

44 CFR 201.6(c)(4) – A plan maintenance process . . .

Plan Adoption

Once the plan is locally reviewed and deemed complete the plan Convener submits it to the State Hazard Mitigation Officer at the Oregon Military Department – Office of Emergency Management (OEM). OEM reviews the plan and submits it to the Federal Emergency Management Agency (FEMA – Region X) for review. This review will address the federal criteria outlined in FEMA Interim Final Rule 44 CFR Part 201.6. Once the plan is pre-approved by FEMA, the county and cities formally adopt the plan via resolution. The Polk County Plan Convener will be responsible for ensuring local adoption of the Polk County NHMP and providing the support necessary to ensure plan implementation. Once the resolution is executed at the local level and documentation is provided to FEMA, the plan is formally acknowledged by FEMA and the county (and participating cities) will re-establish eligibility for the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program funds, and the Flood Mitigation Assistance program funds.

44 CFR 201.6(c)(5) – Documentation that the plan has been formally adopted by the governing body of the jurisdiction . . .

44 CFR 201.6(d) – Plan review [process] . . .

The accomplishment of the NHMP goals and actions depends upon regular Steering Committee participation and adequate support from county and city leadership. Thorough familiarity with this Plan will result in the efficient and effective implementation of appropriate mitigation activities and a reduction in the risk and the potential for loss from future natural hazard events.

The Steering Committees for Polk County and participating cities each met to review the plan update process and their governing bodies adopted the NHMP as shown below:

Polk County adopted the plan on **January 10, 2018**

The City of Dallas adopted the plan on **January 16, 2018**

The City of Falls City adopted the plan on **December 14, 2017**

The City of Independence adopted the plan on **February 27, 2018**

The City of Monmouth adopted the plan on **January 16, 2018**

FEMA Region X approved the Polk County NHMP on **February 6, 2018**. With approval of this Plan, the entities listed above are now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **February 5, 2023**.

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FEMA

April 2, 2018

The Honorable Mike Ainsworth
Chair, Polk County Commissioners
850 Main Street
Dallas, Oregon 97338

Dear Chair Ainsworth:

On February 6, 2018, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the Polk County Hazard Mitigation Plan as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance (HMA) grants through February 5, 2023 through your state.

Polk County

City of Dallas

City of Monmouth

Falls City

City of Independence

The updated list of approved jurisdictions includes the City of Independence that recently adopted the Plan. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Joseph Murray, Planner with Oregon Office of Emergency Management, at (503) 378-2911, who coordinates and administers these efforts for local entities.

Sincerely,

A handwritten signature in blue ink that reads "Mark Carey".

Mark Carey, Director
Mitigation Division

cc: Angie Lane, Oregon Office of Emergency Management

BH:vl

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**BEFORE THE BOARD OF COMMISSIONERS FOR
POLK COUNTY, OREGON**

In the Matter of Adopting)
Updates to the Polk County)
Multi-jurisdictional Hazard)
Mitigation Plan)

RESOLUTION NO. 18-02

WHEREAS, Polk County recognizes the threat that natural hazards pose to people, property, and infrastructure within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people, property, and infrastructure from future hazard occurrences; and

WHEREAS, an adopted Natural Hazard Mitigation Plan (NHMP) is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

WHEREAS, Polk County fully participated in the FEMA prescribed mitigation planning process to prepare this Natural Hazard Mitigation Plan; and

WHEREAS, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *Polk County Multi-Jurisdictional Natural Hazard Mitigation Plan* and pre-approved it (dated, November 27, 2017) contingent upon this official adoption of the participating governments and entities; and

WHEREAS, the NHMP is comprised of three volumes: Volume I – Basic Plan, Volume II – City Addenda, and Volume III – Appendices, collectively referred to herein as the NHMP; and

WHEREAS, the NHMP is in an on-going cycle of development and revisions to improve its effectiveness.

NOW, THEREFORE, IT IS HEREBY RESOLVED by the Polk County Board of Commissioners:

- 1. Polk County hereby adopts the *Polk County Multi-Jurisdictional Natural Hazard Mitigation Plan* as an official plan included as Exhibit A; and
- 2. Polk County will submit this Adoption Resolution to the Oregon Office of Emergency Management and Federal Emergency Management Agency,


Regions X officials to enable final approval of the *Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan*.

- 3. Polk County determines that an emergency related to the economic welfare of the citizens of Polk County is declared and this ordinance is effective immediately upon passage.

Dated: January 10, 2018, at Dallas, Oregon.

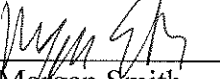
POLK COUNTY BOARD OF COMMISSIONERS


Mike Ainsworth, Chair


Jennifer Wheeler, Commissioner


Craig Pope, Commissioner

Approved as to Form:


Morgan Smith
County Counsel

RESOLUTION NO. 3387

A Resolution adopting the Polk County Multi-Jurisdictional Hazard Mitigation Plan.

WHEREAS, the City of Dallas recognizes the threat that natural hazards pose to people, property and infrastructure within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people, property and infrastructure from future hazard occurrences; and

WHEREAS, an adopted Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

WHEREAS, the City of Dallas has fully participated in the FEMA prescribed mitigation planning process to prepare the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan*, which has established a comprehensive, coordinated planning process to eliminate or minimize these vulnerabilities; and

WHEREAS, the City of Dallas has identified natural hazard risks and prioritized a number of proposed actions and programs needed to mitigate the vulnerabilities of the City of Dallas to the impacts of future disasters within the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan*; and

WHEREAS, these proposed projects and programs have been incorporated into the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan* that has been prepared and promulgated for consideration and implementation by the cities of Polk County; and

WHEREAS, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan* and pre-approved it (dated, November 27, 2017) contingent upon this official adoption of the participating governments and entities; and

WHEREAS, the NHMP is comprised of comprised of three volumes: Volume I -Basic Plan, Volume II - City Addenda, and Volume III - Appendices, collectively referred to herein as the NHMP; and

WHEREAS, the NHMP is in an on-going cycle of development and revision to improve it's effectiveness; and

WHEREAS, City of Dallas adopts the NHMP and directs the City Manager to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP;

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF DALLAS, OREGON, AS FOLLOWS:

Section 1. That the City of Dallas adopts *the Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan* as an official plan; and

Section 2. That the City of Dallas will submit this Adoption Resolution to the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the *Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan*.

Adopted: January 16, 2018

Approved: January 16, 2018



BRIAN W. DALTON, MAYOR

ATTEST:



GREG ELLIS,
CITY MANAGER PRO-TEM

APPROVED AS TO FORM:



LANE P. SHETTERLY,
CITY ATTORNEY

Resolution 27-2017

A Resolution Adopting the City of Falls City Representation in the Updates to the Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan

Whereas, the City of Falls City recognizes the threat that natural hazards pose to people, property and infrastructure within our community; and

Whereas, undertaking hazard mitigation actions will reduce the potential for harm to people, property and infrastructure from future hazard occurrences; and

Whereas, an adopted Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

Whereas, the City of Falls City has fully participated in the FEMA prescribed mitigation planning process to prepare the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan*, which has established a comprehensive, coordinated planning process to eliminate or minimize these vulnerabilities; and

Whereas, the City of Falls City has identified natural hazard risks and prioritized a number of proposed actions and programs needed to mitigate the vulnerabilities of the City of Falls City to the impacts of future disasters within the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan*; and

Whereas, these proposed projects and programs have been incorporated into the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan* that has been prepared and promulgated for consideration and implementation by the cities of Polk County; and

Whereas, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan* and pre-approved it (dated, November 27, 2017) contingent upon this official adoption of the participating governments and entities;

Whereas, the NHMP is comprised of comprised of three volumes: Volume I -Basic Plan, Volume II – City Addenda, and Volume III - Appendices, collectively referred to herein as the NHMP; and

Whereas, the NHMP is in an on-going cycle of development and revision to improve it's effectiveness; and

Whereas, City of Falls City adopts the NHMP and directs the City Manager to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.

NOW THEREFORE, THE CITY OF FALLS CITY RESOLVES AS FOLLOWS:

Section 1: The City of Falls City adopts *the Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan* as an official plan; and

Section 2: The City of Falls City will submit this Adoption Resolution to the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the *Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan*.

Section 3: This Resolution was duly passed and adopted by the Falls City Council and takes effect upon signature of the Mayor.

Adopted this 14th day of December, 2017

Vote: AYE 5 NAY 1 ABSTAIN 0 ABSENT 0

Approved:

12/15/17
Date


Jeremy Gordon, Mayor

Attest:

12/15/2017
Date


Terry Ungricht, City Manager

BEFORE THE CITY COUNCIL OF THE CITY OF INDEPENDENCE

STATE OF OREGON, COUNTY OF POLK

A Resolution Adopting the City of Independence]
Representation in the Updates to the Polk County]
Multi-Jurisdictional Natural Hazards Mitigation Plan]

RESOLUTION #18-1473

Whereas, the City of Independence recognizes the threat that natural hazards pose to people, property and infrastructure within our community; and

Whereas, undertaking hazard mitigation actions will reduce the potential for harm to people, property and infrastructure from future hazard occurrences; and

Whereas, an adopted Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

Whereas, the City of Independence has fully participated in the FEMA prescribed mitigation planning process to prepare the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan*, which has established a comprehensive, coordinated planning process to eliminate or minimize these vulnerabilities; and

Whereas, the City of Independence has identified natural hazard risks and prioritized a number of proposed actions and programs needed to mitigate the vulnerabilities of the City of Independence to the impacts of future disasters within the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan*; and

Whereas, these proposed projects and programs have been incorporated into the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan* that has been prepared and promulgated for consideration and implementation by the cities of Polk County; and

Whereas, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan* and pre-approved it (dated, November 27, 2017) contingent upon this official adoption of the participating governments and entities;

Whereas, the NHMP is comprised of comprised of three volumes: Volume I -Basic Plan, Volume II – City Addenda, and Volume III - Appendices, collectively referred to herein as the NHMP; and

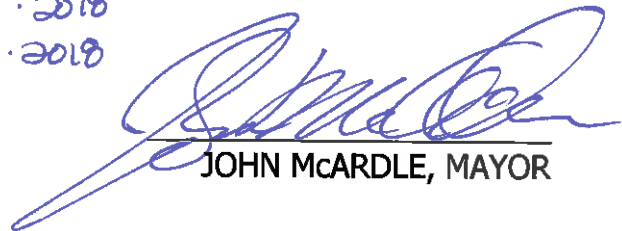
Whereas, the NHMP is in an on-going cycle of development and revision to improve it's effectiveness; and

Whereas, City of Independence adopts the NHMP and directs the City Manager to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.

Now, therefore, be it resolved, that the City of Independence adopts *the Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan* as an official plan; and


Be it further resolved, that the City of Independence will submit this Adoption Resolution to the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the *Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan*.

PASSED by the City Council: 02.27.2018
SIGNED by the Mayor: 02.27.2018
Effective Date: 02.27.2018



JOHN McARDLE, MAYOR

ATTEST:



Karin Johnson, MMC, City Recorder

CITY OF MONMOUTH, COUNTY OF POLK

STATE OF OREGON

A Resolution Adopting the City of)
Monmouth Representation in the)
Updates to the Polk County)
Multi-Jurisdictional Natural Hazards)
Mitigation Plan)

RESOLUTION NO. 1858

WHEREAS, the City of Monmouth recognizes the threat that natural hazards pose to people, property and infrastructure within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people, property and infrastructure from future hazard occurrences; and

WHEREAS, an adopted Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

WHEREAS, the City of Monmouth has fully participated in the FEMA prescribed mitigation planning process to prepare the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan*, which has established a comprehensive, coordinated planning process to eliminate or minimize these vulnerabilities; and

WHEREAS, the City of Monmouth has identified natural hazard risks and prioritized a number of proposed actions and programs needed to mitigate the vulnerabilities of the City of Monmouth to the impacts of future disasters within the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan*; and

WHEREAS, these proposed projects and programs have been incorporated into the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan* that has been prepared and promulgated for consideration and implementation by the cities of Polk County; and

WHEREAS, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *Polk County, Multi-Jurisdictional Natural Hazard Mitigation Plan* and pre-approved it

(dated, November 27, 2017) contingent upon this official adoption of the participating governments and entities; and

WHEREAS, the NHMP is comprised of comprised of three volumes: Volume I -Basic Plan, Volume II - City Addenda, and Volume III - Appendices, collectively referred to herein as the NHMP; and

WHEREAS, the NHMP is in an on-going cycle of development and revision to improve it's effectiveness; and


WHEREAS, City of Monmouth adopts the NHMP and directs the City Manager to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP; NOW, THEREFORE,

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF MONMOUTH:

Section 1. That the City of Monmouth adopts *the Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan* as an official plan; and


Section 2. That the City of Monmouth will submit this Adoption Resolution to the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the *Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan*.

Adopted by the City Council and
approved by and signed by
the Mayor: January 16, 2018.



Steven V. Milligan, Mayor

ATTEST:



Phyllis L. Bolman, City Recorder

Volume I: Basic Plan

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SECTION I: INTRODUCTION

Section I: Introduction provides a general introduction to natural hazard mitigation planning in Polk County. In addition, it addresses the planning process requirements contained in 44 CFR 201.6(b) thereby meeting the planning process documentation requirement contained in 44 CFR 201.6(c)(1). The section concludes with a general description of how the plan is organized.

What is Natural Hazard Mitigation?

The Federal Emergency Management Agency (FEMA) defines mitigation as “. . . the effort to reduce loss of life and property by lessening the impact of disasters . . . through risk analysis, which results in information that provides a foundation for mitigation activities that reduce risk.”¹ Said another way, natural hazard mitigation is a method of permanently reducing or alleviating the losses of life, property, and injuries resulting from natural hazards through long and short-term strategies. Example strategies include policy changes, such as updated ordinances, projects, seismic retrofits to critical facilities, and education and outreach to targeted audiences, such as Spanish speaking residents or the elderly. Natural hazard mitigation is the responsibility of the “Whole Community”; individuals, private businesses and industries, state and local governments, and the federal government.

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

Why Develop a Mitigation Plan?

Polk County developed this Natural Hazards Mitigation Plan (NHMP or Plan) in an effort to reduce future loss of life and damage to property resulting from natural hazards. It is impossible to predict exactly when natural hazard events will occur, or the extent to which they will affect community assets. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from natural hazards.

In addition to establishing a comprehensive community-level mitigation strategy, the Disaster Mitigation Act of 2000 (DMA2K) and the regulations contained in 44 CFR 201, require that jurisdictions maintain an approved NHMP in order to receive federal funds for mitigation projects. Local and federal approval of this plan ensures that the county and listed cities will remain eligible for pre- and post-disaster mitigation project grants.

¹ FEMA, *What is Mitigation?* <http://www.fema.gov/what-mitigation>

What Federal Requirements Does This Plan Address?

DMA2K is the latest federal legislation addressing mitigation planning. It reinforces the importance of mitigation planning and emphasizes planning for natural hazards before they occur. As such, this Act established the Pre-Disaster Mitigation (PDM) grant program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP). Section 322 of the Act specifically addresses mitigation planning at the state and local levels. State and local jurisdictions must have approved mitigation plans in place in order to qualify to receive post-disaster HMGP funds. Mitigation plans must demonstrate that State and local jurisdictions' proposed mitigation measures are based on a sound planning process that accounts for the risk to the individual and State and local jurisdictions' capabilities.

Chapter 44 Code of Federal Regulations (CFR), section 201.6, also requires a local government to have an approved mitigation plan in order to receive HMGP project grants.² Pursuant of Chapter 44 CFR, the Natural Hazard Mitigation Plan planning processes shall include opportunity for the public to comment on the plan during review, and the updated Natural Hazard Mitigation Plan shall include documentation of the public planning process used to develop the plan.³ The Natural Hazard Mitigation Plan update must also contain a risk assessment, mitigation strategy and a plan maintenance process that has been formally adopted by the governing body of the jurisdiction.⁴ Lastly, the Natural Hazard Mitigation Plan must be submitted to Oregon Military Department – Office of Emergency Management (OEM) for initial plan review, and then federal approval.⁵ Additionally, a recent change in the way OEM administers the Emergency Management Performance Grant (EMPG), which helps fund local emergency management programs, also requires a FEMA-approved NHMP.

What is the Policy Framework for Natural Hazards Planning in Oregon?

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

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

² Code of Federal Regulations, Chapter 44. Section 201.6, subsection (a), 2015

³ *ibid*, subsection (b). 2015

⁴ *ibid*, subsection (c). 2015

⁵ *ibid*, subsection (d). 2015

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

How was the Plan Developed?

The plan was developed by the Polk County Natural Hazard Mitigation Plan Steering Committee and the Steering Committees for the cities of Dallas, Falls City, Monmouth, and Independence. The Polk County Steering Committee formally convened on three occasions to discuss and revise the plan. Each of the participating city Steering Committees met at least once formally. Steering Committee members contributed data and maps, and reviewed and updated the community profile, risk assessment, action items, and implementation and maintenance plan.

An open public involvement process is essential to the development of an effective plan. In order to develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunity for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the plan during review.⁶ OPDR provided a publicly accessible project website for the general public to provide feedback on the draft NHMP via a web form. In addition, Polk County provided a press release on their website and in the Itemizer Observer to encourage the public to offer feedback on the plan update. The County and city websites continue to be a focal point for distribution natural hazard information through the use of hazard viewers, emergency alerts, hazard preparation, and annual natural hazard progress reports.

How is the Plan Organized?

Each volume of the plan provides specific information and resources to assist readers in understanding the hazard-specific issues facing county and city residents, businesses, and the environment. Combined, the sections work in synergy to create a mitigation plan that furthers the community's mission to reduce or eliminate long-term risk to people and their property from hazards and their effects. This plan structure enables stakeholders to use the section(s) of interest to them.

Volume I: Basic Plan

Plan Summary

The plan summary provides an overview of the FEMA requirements, planning process, and highlights the key elements of the risk assessment, mitigation strategy, and implementation and maintenance strategy.

⁶ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

Section 1: Introduction

The Introduction briefly describes the countywide mitigation planning efforts and the methodology used to develop the plan.

Section 2: Risk Assessment

Section 2 provides the factual basis for the mitigation strategies contained in Section 3. (Additional information is included within Appendix B, which contains an overall description of Polk County and the cities of Dallas, Falls City, Monmouth, and Independence.) This section includes a brief description of community sensitivities and vulnerabilities. The Risk Assessment allows readers to gain an understanding of each jurisdiction's vulnerability and resilience to natural hazards.

A hazard summary is provided for each of the hazards addressed in the plan. The summary includes hazard history, location, extent, vulnerability, impacts, and probability. This NHMP addresses the following hazards:

- Drought
- Earthquake
- Flood
- Landslide
- Volcano
- Wildfire
- Windstorm
- Winter Storm

Additionally, this section provides information on the jurisdictions' participation in the National Flood Insurance Program (NFIP).

Section 3: Mitigation Strategy

This section documents the plan vision, mission, goals, and actions (mitigation strategy) and also describes the components that guide implementation of the identified actions. Actions are based on community sensitivity and resilience factors, and the risk assessments in Section 2 and Volume II (City Addenda).

Section 4: Plan Implementation and Maintenance

This section provides information on the implementation and maintenance of the plan. It describes the process for prioritizing projects, and includes a suggested list of tasks for updating the plan, to be completed at the semi-annual and five-year review meetings.

Volume II: Jurisdictional Addenda

Volume II of the plan is reserved for any city or special district addenda developed through this multi-jurisdictional planning process. Each of the cities within the county participated in the NHMP process and created an addendum. As such, the five-year update cycle will be the same for all of the cities and the county. The cities of Salem (Marion) and Willamina (Yamhill) are the only incorporated city partially within Polk County that are not included within this MNHMP; the majority of Salem is within Marion County and the majority of Willamina is within Yamhill County. Salem has a stand-alone NHMP.

As such this plan includes addenda for the following jurisdictions: Dallas, Falls City, Independence, and Monmouth.

Volume III: Appendices

The resource appendices are designed to provide the users of the Polk County NHMP with additional information to assist them in understanding the contents of the mitigation plan, and provide them with potential resources to assist with plan implementation.

Appendix A: Planning and Public Process

This appendix includes documentation of all the countywide public processes utilized to develop the plan. It includes invitation lists, agendas, sign-in sheets, and summaries of Steering Committee meetings as well as any other public involvement methods.

Appendix B: Community Profile

The community profile describes the county and participating cities from a number of perspectives in order to help define and understand the region's sensitivity and resilience to natural hazards. The information in this section represents a snapshot in time of the current sensitivity and resilience factors in the region when the plan was updated.

Appendix C: Economic Analysis of Natural Hazard Mitigation Projects

This appendix describes the Federal Emergency Management Agency's (FEMA) requirements for benefit cost analysis in natural hazards mitigation, as well as various approaches for conducting economic analysis of proposed mitigation activities.

Appendix D: Grant Programs and Resources

This appendix lists state and federal resources and programs by hazard.

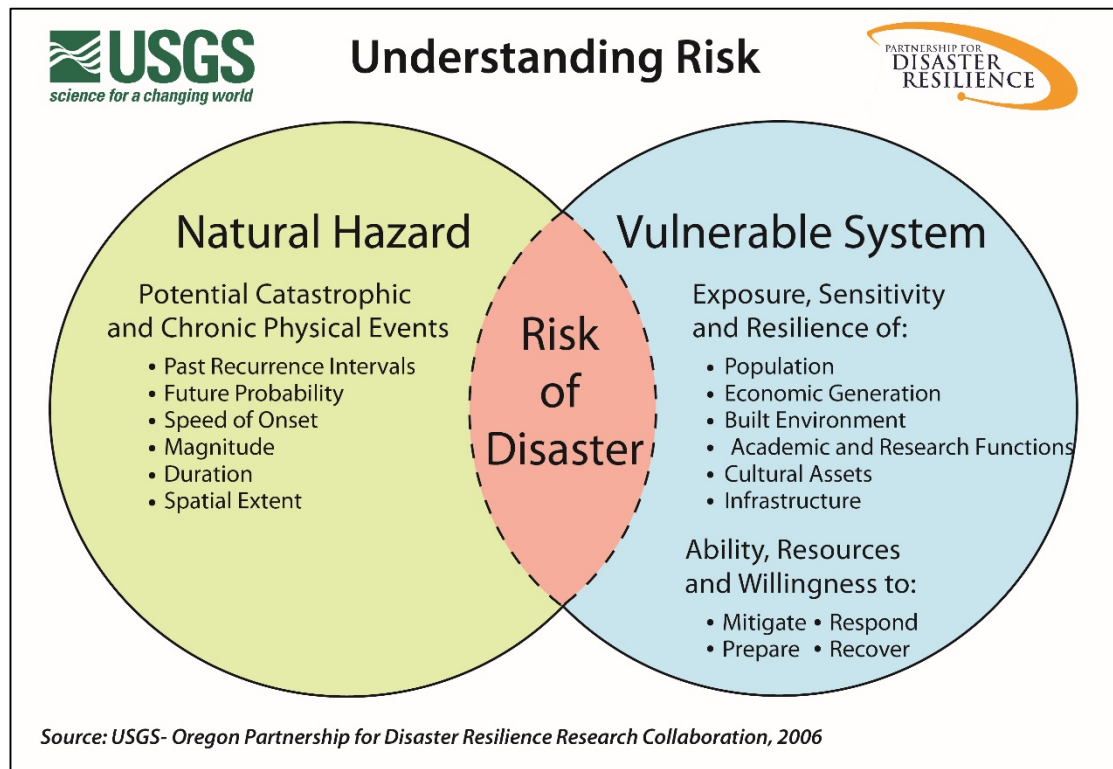
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SECTION 2: RISK ASSESSMENT

This section of the NHMP addresses 44 CFR 201.6(b)(2) - Risk Assessment. The Risk Assessment applies to Polk County and the Cities of Dallas, Falls City, Independence, and Monmouth. City specific information is called out where relevant. In addition, this chapter can assist with addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards.

The information presented below, along with hazard specific information presented in the Hazard Annexes and community characteristics presented in the Community Profile Appendix, is used to inform the risk reduction actions identified in Section 3 – Mitigation Strategy. The risk assessment process is graphically depicted in Figure 2-1 below. Ultimately, the goal of hazard mitigation is to reduce the area where hazards and vulnerable systems overlap.

Figure 2-1 Understanding Risk



Source: Oregon Partnership for Disaster Resilience.

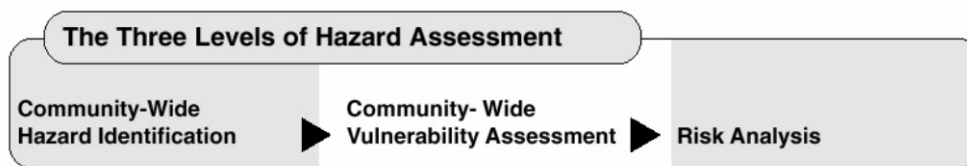
What is a Risk Assessment?

A risk assessment consists of three phases: hazard identification, vulnerability assessment, and risk analysis.

- **Phase 1:** Identify hazards that can impact the jurisdiction. This includes an evaluation of potential hazard impacts – type, location, extent, etc.
- **Phase 2:** Identify important community assets and system vulnerabilities. Example vulnerabilities include people, businesses, homes, roads, historic places and drinking water sources.
- **Phase 3:** Evaluate the extent to which the identified hazards overlap with, or have an impact on, the important assets identified by the community.

The following figure illustrates the three-phase risk assessment process:

Figure 2-2 Three Phases of a Risk Assessment



Source: Planning for Natural Hazards: Oregon Technical Resource Guide, 1998

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

Hazard Identification

Polk County identifies eight natural hazards that could have an impact on the county and each of the participating jurisdictions. Summary information for each hazard is presented below; additional information pertaining to the types and characteristics of each hazard is available in the State of Oregon Natural Hazards Mitigation Plan Region 3 (Mid/ Southern Willamette Valley), Risk Assessment. Table 2-1 lists the hazards identified in the county in comparison to the hazards identified in the State of Oregon NHMP for Region 3, which includes Polk County.

The previous Polk County NHMP profiled riverine erosion and expansive soils as unique hazards. This update of the NHMP aligns each jurisdiction's hazard profiles with the hazards profiled in the State NHMP. Therefore, the riverine erosion hazard is profiled as a characteristic of the flood hazard and the expansive soils hazard is profiled as a characteristic of the flood and drought hazards. Additionally, the drought hazard was profiled as a characteristic of winter storm hazard in the previous NHMP, with this update the drought hazard receives a unique hazard profile.

Table 2-1 Polk County Hazard Identification

Polk County	State of Oregon NHMP Region 3: Mid/ Southern Willamette Valley
Drought	Drought
Earthquake	Earthquake
Flood	Flood
Landslide	Landslide
Volcano	Volcano
Wildfire	Wildfire
Windstorm	Windstorm
Winter Storm	Winter Storm

Source: Polk County NHMP Steering Committee (2016) and State of Oregon NHMP, Region 3: Mid/ Southern Willamette Valley (2015)

The following subsections briefly describe relevant information for each hazard. For additional background on the hazards, vulnerabilities and general risk assessment information for hazards in the Mid/ Southern Willamette Valley (Region 3) refer to the [State of Oregon NHMP, Region 3: Mid/ Southern Willamette Valley Risk Assessment \(2015\)](#).

Drought

Significant Changes Since Previous Plan:

The Drought hazard was not profiled in the 2009 Plan as a unique hazard (it was previously incorporated within the Winter Storm hazard profile), therefore, this section provides a reorganization and new content. A description of expansive soils is included in this profile.

Characteristics

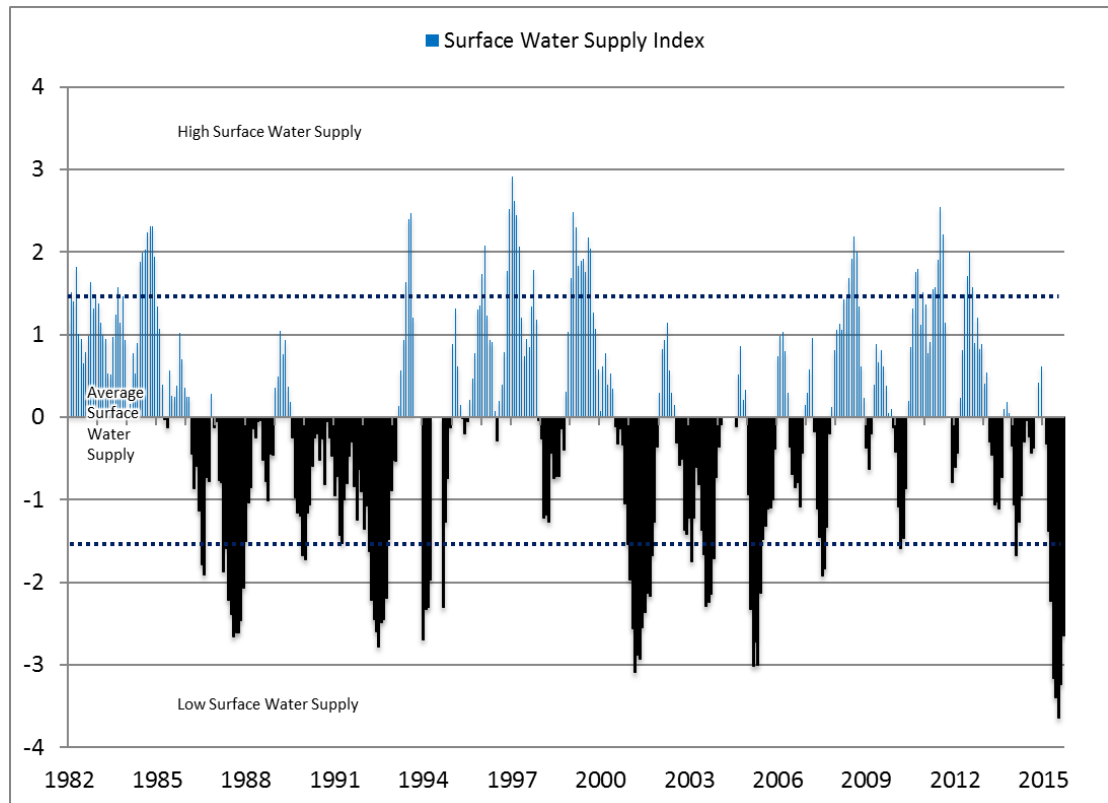
A drought is a period of drier than normal conditions. Drought occurs in virtually every climatic zone, but its characteristics vary significantly from one region to another. Drought is a temporary condition; it differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate. The extent of drought events depends upon the degree of moisture deficiency, and the duration and size of the affected area. Typically, droughts occur as regional events and often affect more than one city and county.

Location and Extent

Droughts occur in every climate zone, and can vary from region to region. Drought may occur throughout Polk County and may have profound effects on the economy, particularly the agricultural and hydro-power sectors. 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. Most federal agencies use the Palmer Method which incorporates precipitation, runoff, evaporation and soil moisture. However, the Palmer Method does not incorporate snowpack as a variable. Therefore, it is not believed to provide a very accurate indication of drought conditions in Oregon and the Pacific Northwest.

The Surface Water Supply Index (SWSI) from the Natural Resources Conservation Service is an index of current water conditions throughout the state. The index utilizes parameters derived from snow, precipitation, reservoir and stream flow data. The data is gathered each month from key stations in each basin. The lowest SWSI value, -4.2, indicates extreme drought conditions (Low Surface Water Supply ranges from -1.6 to -4.2). The highest SWSI value, +4.2, indicates extreme wet conditions (High Surface Water Supply ranges from +1.6 to +4.2). The mid-point is 0.0, which indicates an average water supply (Average Water Supply ranges from +1.5 to -1.5). Figure 2-3 below shows the monthly history of SWSI values from February 1982 to October 2015 for the Willamette Basin which includes Polk County. Research shows that the periods of drought have fluctuated; recent drought periods occurred in 1987, 1992, 1994, 2001, 2003, 2005, and 2015.

Figure 2-3 SWSI Values for the Willamette Basin (1982-2015)



Source: Department of Agriculture-Natural Resources Conservation Service, "Surface Water Supply Index, Upper Deschutes Basin" www.or.nrcs.usda.gov. Accessed February 2016.

History

Drought conditions are not uncommon in Polk County. One recent drought event, and one previously omitted drought event, have been added to the hazard history since the previous plan (as shown in *italics* below):

- 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
- 1928-1941: Statewide prolonged drought caused major agricultural problems.
- 1939-1941: A three-year intense drought in Oregon
- 1976-1981: Intense drought in western Oregon; 1976-1977 single driest year of century (eclipsed only by 2015 water-year). During this period Polk County used dry ice seeding to enhance winter precipitation for agriculture use.
- 1985- 1994: Ten consecutive years of drought cause problems statewide; fires were common and insects attacked trees; a drought emergency was declared in 1992. As a result, Polk County adopted a water curtailment plan. Crop damage was documented and water systems were affected. However, no Polk County residents submitted claims for losses. Governor declared drought.
- 2000-2001: Severe drought conditions; October 2000 to February 2001 was the second driest period of record in Washington and Oregon.

- 2005: February 2005 was the driest since 1977.
- *August 2015: Federal Drought Declaration due low snow pack levels, and low water conditions. Governor and federal declarations of drought.*

El Niño

El Niño Southern Oscillation (ENSO) weather patterns can increase the frequency and severity of drought. During El Niño periods, alterations in atmospheric pressure in equatorial regions yield an increase in the surface temperature off the west coast of North America. This gradual warming sets off a chain reaction affecting major air and water currents throughout the Pacific Ocean; La Niña periods are the reverse with sustained cooling of these same areas. In the North Pacific, the Jet Stream is pushed north, carrying moisture laden air up and away from its normal landfall along the Pacific Northwest coast. In Oregon, this shift results in reduced precipitation and warmer temperatures, normally experienced several months after the initial onset of the El Niño. These periods tend to last nine to twelve months, after which surface temperatures begin to trend back towards the long-term average. El Niño periods tend to develop between March and June, and peak from December to April. ENSO generally follows a two to seven-year cycle, with El Niño or La Niña periods occurring every three to five years. However, the cycle is highly irregular, and no set pattern exists. The last major El Niño was during 1997-1998, and in 2015-2016 Oregon experience a “super” El Niño (the strongest in 15 years, the two previous events occurred in 1982-1983 and 1997-1998) that included record rainfall and snowpack in areas of the state.¹

Future Climate Variability²

Climate models for Oregon suggest, future regional climate changes include increases in temperature around 0.2-1°F per decade in the 21st Century, along with warmer and drier summers, and some evidence that extreme precipitation will increase in the future. Increased droughts may occur in the Willamette Valley under various climate change scenarios as a result of various factors, including reduced snowpack, rising temperatures, and likely reductions in summer precipitation. Climate models suggest that as the region warms, winter snow precipitation will likely shift to higher elevations and snowpack will be diminished as more precipitation falls as rain altering surface flows.

Expansive Soils

The addition of moisture to any type of soil will cause a change in volume, which is referred to as a shrink-swell characteristic.³ Expansive soils are typically comprised of clay minerals that under some conditions are capable of significantly increasing in volume when moisture is added. Clay soils consist of mineral particles that are less than 0.002 millimeters in diameter.

¹ Cho, Renne. “El Nino and global warming – what’s the connection.” Phys.org, February 3, 2016. <https://phys.org/news/2016-02-el-nino-global-warmingwhat.html>

² Oregon Climate Change Research Institute (OCCRI), Oregon Climate Assessment Report (2010) and Northwest Climate Assessment Report (2013). <http://occri.net/reports>

³ US Department of Agriculture, Natural Resources Conservation Service (USDA NRCS). 2008. National Cooperative Soil Survey, Physical Soil Properties–Polk County, Oregon.

Linear extensibility is used to determine the shrink-swell potential of soils. Linear extensibility refers to the change in soil volume as the moisture content is decreased from a moist to a dry state. The amount and type of clay minerals in the soil influence volume change. The volume change is described as a percentage value change for the soil being tested. A low shrink-swell potential is considered less than a 3% change in soil volume; whereas a high shrink-swell potential is greater than 6% change in soil volume.⁴

Soil expansion may be caused by changes in soil moisture, variations in thickness and composition of the expansive foundation soil, non-uniform structural loads, and the geometry of the structure. Potential sources of moisture changes are variation in precipitation, poor gutter or water drainage, vegetation changes over time (such as root growth of nearby trees), and plumbing leaks. By affecting the relative moisture of soils underlying foundations, uneven movement such as localized heave can occur, causing shifting and non-uniform foundation movements, thus impacting the structures above.

Many sources of soil moisture change can be avoided, minimized, or mitigated through planning and structure maintenance. Some signs of possible soil expansion include: separation of joints and trim; cracks in walls, floors, or concrete; and bowed or non-vertical walls. Some possible mitigation measures are maintaining separation between structures and runoff, using compact fill to shed water, not absorb it, and planting trees a distance equal to their mature height away from buildings to reduce root interference.

Several different types of soil expansion related to structures and infrastructure exist, which can include but are not limited to:

- Doming heave - upward, long-term, dome-shaped foundation movement that develops over many years
- Cyclic heave - shrink and swell associated with seasonal or water leak events
- Edge heave - damaging edge or dish-shaped heaving
- Lateral movement – lateral thrust of expansive soils

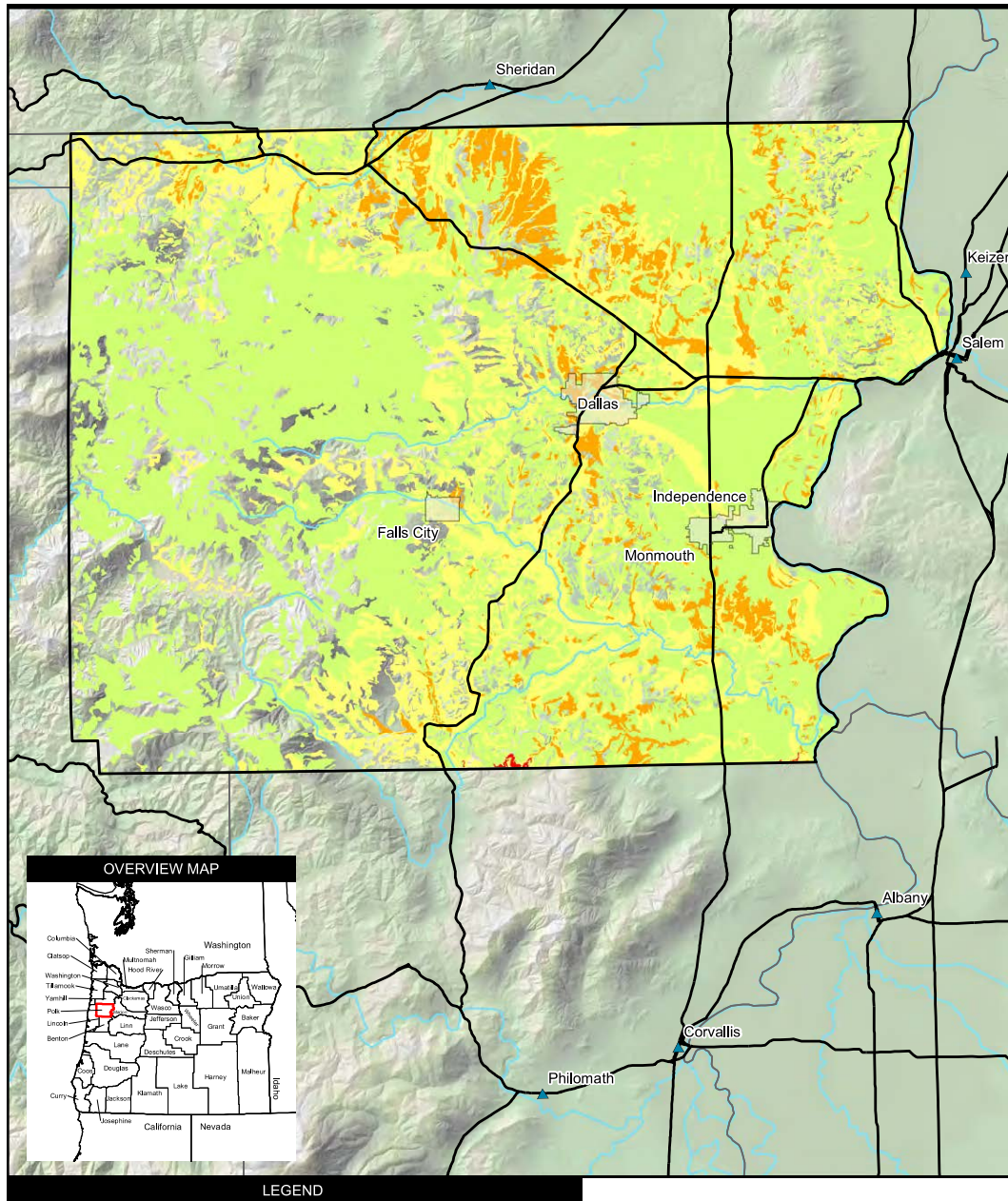
More than 162,000 acres in Polk County contain soils with “moderate” to “severe” shrink-swell potential. These areas are primarily located in the northern and eastern parts of the county. The City of Dallas has large areas of moderate to severe shrink-swell potential.

The geographic extent of expansive soil events are directly dependent on the extent of clay-based expansive soil types and the size and type of moisture event that triggers the soil expansion.

Another dependent factor contributing to risk is the amount and type of infrastructure that exists at the expansive soil location and near proximity, as well as the percentage volume change of the swelling or shrinking soil. The vulnerability of critical infrastructure could be assessed by the location of expansive soil types. The extent of expansive soil effects could be very local and limited to a single structure (i.e. resulting from a plumbing leak), or more landscape in nature due to a large area of soil moisture change (i.e. resulting from a large flood or storm event).

⁴ Ibid.

Map 2-1 Expansive Soils Hazard Area



Source: Polk County NHMP (2009).

Probability Assessment

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. Based on the available data and research for Polk County the NHMP Steering Committee assessed the **probability of experiencing a locally severe drought as “moderate,”** meaning one incident is likely within the next 75-year period.

Expansive soil events are difficult to predict since the location and time when water is available to the soil varies throughout the lifespan of a structure. Most soil expansion and associated structural damage has been shown to occur within five to eight years following construction. However, the effects of heave may also not be observed for many years until some change occurs in the foundation conditions to disrupt the moisture regime. The probability of damages increases for structures on expansive soils when the climate (increased rain), structure construction (type of foundation used), or occupancy habits (e.g., gardening, water diversion, etc.), increases the amount of moisture in the soil.

Vulnerability Assessment

Drought is commonly referenced in terms of its effects on agriculture, with crop damage or failure used to measure its effects. Other direct environmental effects of drought include livestock death or decreased production, wildland fire, impaired productivity of forest land, damage to fish habitat, loss of wetlands, and decreased air quality. Drought is also associated with insect infestation, disease, and wind erosion. Indirect effects to society are measured by the economic and physical hardships brought on by drought and by the increased stress on residents of a drought-stricken area. The economic impact of drought is estimated between \$6 and \$8 billion annually in the United States. These costs primarily affect agricultural, forestry, fisheries, recreation and tourism, transportation and energy sectors.

Drought can affect all segments of Polk County’s population, particularly those employed in water-dependent activities (e.g., agriculture, hydroelectric generation, recreation, etc.). Also, domestic water-users may be subject to stringent conservation measures (e.g., rationing) as per the county’s water management plan and could be faced with significant increases in electricity rates.

All parts of Polk County are susceptible to drought, however, the following areas and issues are of particular concern:

- Agriculture
- Drinking water system
- Power and water enterprises
- Residential and community wells in rural areas
- Fire response capabilities
- Fish and wildlife

Potential impacts to community water supplies and farming are the greatest threats. Additionally, long-term drought periods of more than a year can impact forest conditions

and set the stage for potentially destructive wildfires. The NHMP Steering Committee rated the county as having a **“moderate” vulnerability to drought hazards**, meaning that between 1-10% of the region’s population or assets would be affected by a major drought emergency or disaster.

Potential damages to structures from expansive soils in Polk County include: cracks in grade beams, walls, and drilled shafts; distortion and cracking of pavements and on-grade floor slabs; failure of steel or concrete blocks supporting grade beams; jammed or misaligned doors and windows; and buckling of basement and retaining walls due to lateral forces. Extensive damage can potentially result in the condemnation of structures.

Per the previous version of this plan the County has critical facilities and infrastructure located within areas of low, moderate and high risk; see Map 2-1.

Low risk areas contain 19,057 residential structures (value \$2.7B) and 67 non-residential structures (value unknown).

Moderate risk areas contain 15,578 residential structures (value \$2.2B), 73 non-residential structures (value unknown), 11 government facilities (value \$3.1M), four emergency response facilities (value \$6.3M), nine educational facilities (value \$9.1M), six care facilities (value unknown), and five utilities (value unknown).

High risk areas contain 8,774 residential structures (value 1.3B), 32 non-residential structures (value unknown), five government facilities (value unknown), four educational facilities (value \$18.3M), one utility facility (value unknown) and one dam (value \$25M).

Very high expansive soils areas contain 37 residential structures (worth \$5.3M).⁵

A comprehensive risk and vulnerability assessment is not available for the drought hazard. Statewide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks are present to humans and resources. Agriculture, fishing, and timber have historically been impacted, as well as local and regional economies.

In Polk County, there are several roads that show signs of pavement heaving due to underlying expansive soils: James Howe Road, Crowley Road, Perrydale Road, and Grand Ronde Road appear to be underlain with expansive soils. At the north end of Perrydale road, there are obvious horizontal cracks indicative of pavement heaving.

More information on this hazard can be found in the [Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP \(2015\)](#).

⁵ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

Earthquake

Significant Changes Since Previous Plan:

The Earthquake Hazard section was reformatted since the 2009 Plan. There has not been any new history. However, the Oregon Resilience Plan (2013) has been cited and incorporated where applicable. The probability and vulnerability ratings were updated to distinguish between a Cascadia Subduction Zone event and a crustal event. Large areas of Polk County fall within two of the zones identified in the Oregon Resilience Plan as having significantly different probabilities and vulnerabilities in a Cascadia Subduction Zone event (Coastal and Valley regions). These differences have been incorporated throughout this section.

Characteristics

The Pacific Northwest in general is susceptible to earthquakes from four sources: 1) the offshore Cascadia Subduction Zone; 2) deep intraplate events within the subducting Juan de Fuca Plate; 3) shallow crustal events within the North American Plate, and 4) earthquakes associated with volcanic activity.

All types of earthquakes in the region have some tie to the subducting, or diving, of the dense, oceanic Juan de Fuca Plate under the lighter continental North American Plate. There is also a link between the subducting plate and the formation of volcanoes some distance inland from the offshore subduction zone.

Location and Extent

Polk County is located within the geographical area bordering the Cascadia Subduction Zone. This zone is comprised of an 800-mile sloping fault and several smaller inland and offshore faults extending from British Columbia to the north and Northern California to the south. The fault system separates the Juan de Fuca and North American plates.

The USGS Quaternary Fault and Fold Databases contain two inland fault databases covering Polk County; the Salem and Vancouver 1° x 2° Sheets. The Salem Sheet (44°- 45° by 124° - 122°) delineates nine (9) faults and the Vancouver Sheet (45°-46° by 124°-122°) delineates 15 faults. Those closest to Polk County are the Mount Angel Fault, the Canby-Molalla, and Newberg faults.

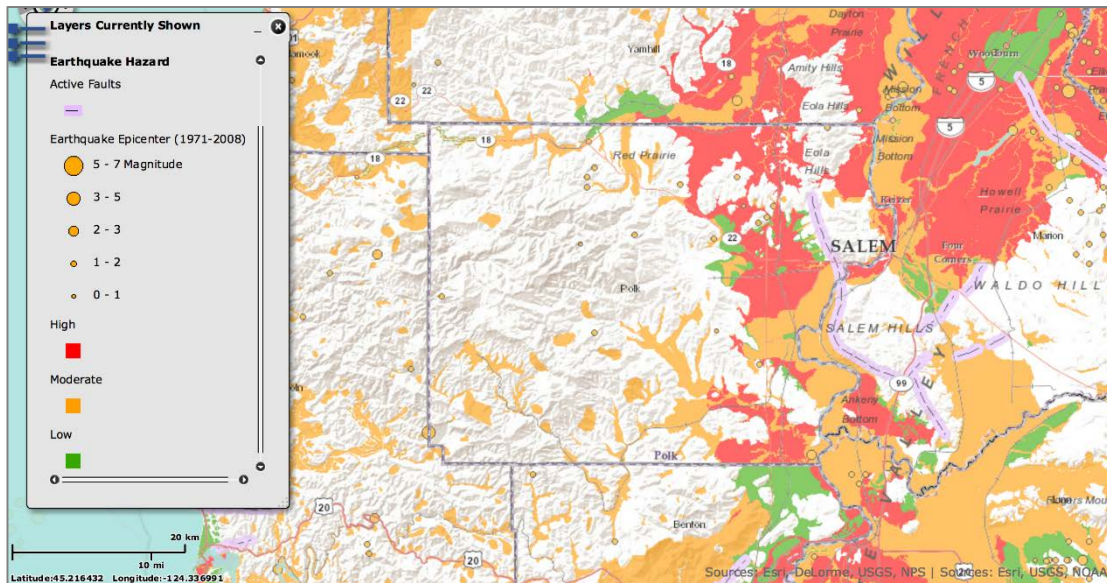
There have been several significant recent earthquakes in the region; however, all significant events have been located in Klamath and Lake Counties in southern Oregon. The region has also been shaken historically by crustal and intraplate earthquakes and prehistorically by subduction zone earthquakes centered outside Central Oregon. All considered, there is good reason to believe that the most devastating future earthquakes would probably originate along shallow crustal faults in the region, or along the offshore Cascadia Subduction Zone (see publications listed below for more information).

Hazard Shake Maps produced by the United States Geological Survey (USGS) consider two alternative scenarios for damaging earthquakes (M 8.3 or M 9.0) along the subduction zone.

The shake maps show the ground motion level that has 1 chance in 475 of being exceeded each year, which is equal to a 10 percent probability of being exceeded in 50 years. Polk County falls within the strong to very strong shaking range (15-25 percent of acceleration of gravity). All of Polk County is subject to earthquakes. However, the western portion of Polk County is more likely to be affected by a major quake, because of its closer proximity to the Cascadia Subduction Zone.

Figure 2-4 shows earthquake epicenters, active faults, and soft soils of Polk County. The earthquakes shown in the figure below are relatively insignificant events below M 2.0. The larger events may have been felt slightly, but little to no structural/property damage resulted. Thus, the seismic hazard for Polk County arises predominantly from major earthquakes on the Cascadia Subduction Zone. Smaller, crustal earthquakes in or near Polk County could be locally damaging, but would not be expected to produce widespread or major damage.

Figure 2-4 Earthquake Epicenters (1971-2008), Active Faults, and Soft Soils



Source: [Oregon HazVu: Statewide Geohazards Viewer \(HazVu\)](#)

The Oregon Department of Geology and Mineral Industries (DOGAMI), in partnership with other state and federal agencies, has undertaken a rigorous program in Oregon to identify seismic hazards, including active fault identification, bedrock shaking, tsunami inundation zones, ground motion amplification, liquefaction, and earthquake induced landslides. DOGAMI has published a number of seismic hazard maps that are available for communities to use. The maps show liquefaction, ground motion amplification, landslide susceptibility, and relative earthquake hazards. OPDR used the DOGAMI Statewide Geohazards Viewer to present a visual map of recent earthquake activity, active faults, and liquefaction; ground shaking is generally expected to be higher in the areas marked by soft soils in the map above. The severity of an earthquake is dependent upon a number of factors including: 1) the distance from the earthquake’s source (or epicenter); 2) the ability of the soil and rock to conduct the earthquake’s seismic energy; 3) the degree (i.e., angle) of slope materials; 4) the composition of slope materials; 5) the magnitude of the earthquake; and 6) the type of earthquake.

For more information, see the following reports:

[Open-File-Report: O-2003-02 – Map of Selected earthquakes for Oregon \(1841-2002\), 2003](#)

[Open-File-Report: O-2007-02 - Statewide seismic needs assessment: Implementation of Oregon 2005 Senate Bill 2 relating to public safety, earthquakes, and seismic rehabilitation of public buildings, 2007](#)

[Interpretive Map Series: IMS-024 - Geologic hazards, earthquake and landslide hazard maps, and future earthquake damage estimates for six counties in the Mid/Southern Willamette Valley including Yamhill, Marion, Polk, Benton, Linn, and Lane Counties, and the City of Albany, Oregon, 2008](#)

[Open-File-Report: O-2013-22 - Cascadia Subduction Zone earthquakes: A magnitude 9.0 earthquake scenario, 2013](#)

[Special Papers: SP-29, Earthquake damage in Oregon Preliminary estimates of future earthquake losses \(1999\)](#)

Additional reports are available via DOGAMI's Publications Search website:

<http://www.oregongeology.org/pubs/search.php>

[Oregon Seismic Safety Policy Advisory Commission Reports:](#)

[Oregon Resilience Plan \(2013\)](#)

History

Polk County has not experienced any major earthquake events in recent history. Seismic events do, however, pose a significant threat. In particular, a Cascadia Subduction Zone (CSZ) event could produce catastrophic damage and loss of life in Polk County. For more information see Figure 2-4 and Map 2-4.

While Polk County has not experienced any significant earthquakes in recent history, earthquakes in Oregon that have affected the county are listed below⁶ (there have not been any significant earthquake events since the previous plan):

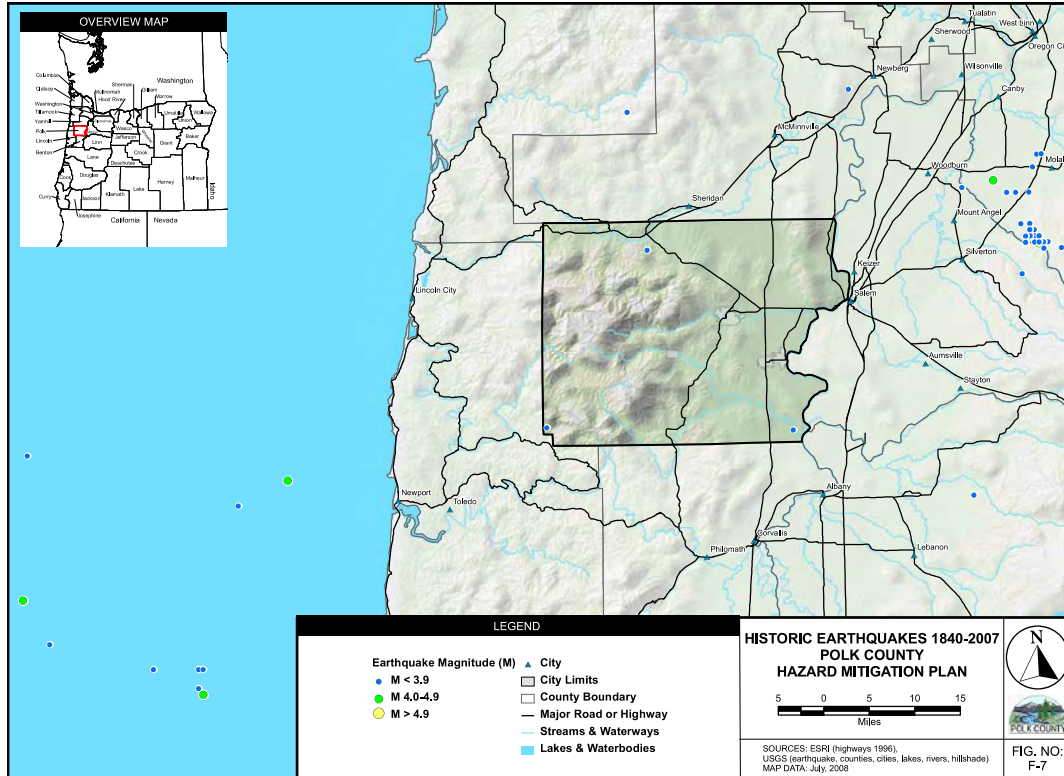
- January 1700: Offshore, Cascadia Subduction Zone (CSZ)- Approximate 9.0 magnitude earthquake generated a tsunami that struck Oregon, Washington, and Japan; destroyed Native American villages along the coast (additional CSZ events occurred approximately in 1400 BCE, 1050 BCE, 600 BCE, 400, 750, and 900)
- April 1949: Olympia, 7.1 magnitude, felt in Polk County.
- April 1961: Albany, 4.5 magnitude, minor damage in Albany
- November 1962: Portland- A 5.2-5.5 magnitude earthquake caused damage to many homes (chimneys, windows, etc); the earthquake was a crustal event
- March 1963: Salem, 4.6 magnitude, minor damage in Salem

⁶ Ivan Wong and Jacqueline D.J. Bolt, 1995, "A Look Back at Oregon's Earthquake History, 1841-1994", Oregon Geology, pp. 125-139.

The Pacific Northwest Seismic Network: Notable Pacific Northwest Earthquakes since 1993

- March 1993: Scotts Mills- A 5.6 magnitude earthquake caused \$27-\$30 million in damages to homes, schools, businesses, state buildings (Salem). Crustal Event (FEMA-985-DR-OR)

Map 2-2 Earthquake History



Source: Polk County NHMP (2009).

Probability Assessment

Polk County is susceptible to deep intraplate events within the Cascadia Subduction Zone (CSZ), where the Juan de Fuca Plate is converging beneath the North American Plate, and shallow crustal events within the North American Plate.

Based on the available data and research (see below) for Polk County the NHMP Steering Committee determined the **probability of experiencing a Cascadia Subduction Zone (CSZ) or a crustal earthquake is “moderate”**, meaning one incident could be expected within the next 75-year period.

Cascadia Subduction Zone

According to the Oregon NHMP, the return period for the largest of the CSZ earthquakes (Magnitude 9.0+) is 530 years with the last CSZ event occurring 314 years ago in January of 1700. The probability of a 9.0+ CSZ event occurring in the next 50 years ranges from 7 - 12%. Notably, 10 - 20 “smaller” Magnitude 8.3 - 8.5 earthquakes occurred over the past 10,000 years that primarily affected the southern half of Oregon and northern California. The average return period for these events is roughly 240 years. The combined probability of any CSZ earthquake occurring in the next 50 years is 37 - 43%.

New research from Oregon State University suggests that the CSZ has at least four segments that sometimes rupture independently of one another. Magnitude-9 ruptures affecting the entire subduction zone have occurred 19 times in the past 10,000 years. Over that time, shorter segments have ruptured farther south in Oregon and Northern California, producing magnitude-8 quakes. As such, the risks of a subduction zone quake may differ from north to south. Quakes originating in the northern portion of the CSZ tend to rupture the full length of the subduction zone. In southern Oregon and Northern California, quakes along the subduction zone appear to strike more frequently.

Benioff (Deep) Zone

Deep intraplate earthquakes may have magnitudes up to 7.5, with probable recurrence intervals of about 500 to 100 years (recurrence intervals are poorly determined by current geologic data).

Crustal Zone

Establishing a probability for crustal earthquakes is difficult given the small number of historic events in the region. Based on the historical seismicity in Western Oregon and on analogies to other geologically similar areas, small to moderate earthquakes up to M5 or M5.5 are possible almost anywhere in Western Oregon, including Polk County. Although the possibility of larger crustal earthquakes in the M6+ range cannot be ruled out, the probability of such events is likely to be very low. Earthquakes generated by volcanic activity in Oregon's Cascade Range are possible, but likewise unpredictable. For more information, see DOGAMI reports linked above.

Vulnerability Assessment

The local faults, the county's proximity to the Cascadia Subduction Zone, potential slope instability, and the prevalence of certain soils subject to liquefaction and amplification combine give the county a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places Polk County predominately within the "Willamette Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades), however, portions of the county are within the "Coastal Zone" (the area outside of the tsunami zone, from the Oregon coastline to the summit of the Coast Range)⁷. Within the Valley Zone damage and shaking is expected to be widespread but moderate, an event may be disruptive to daily life and commerce, and the main priority is expected to be restoring services to business and residents.⁸ Within the Coastal Zone, damage and shaking is expected to be severe and communities may be isolated, the main priority after an event would be to keep the population sheltered, fed, and healthy.⁹

Figure 2-5 below shows the expected shaking/ damage potential for Polk County as a result of a Cascadia Subduction Zone (CSZ) earthquake event. The figure shows that the county

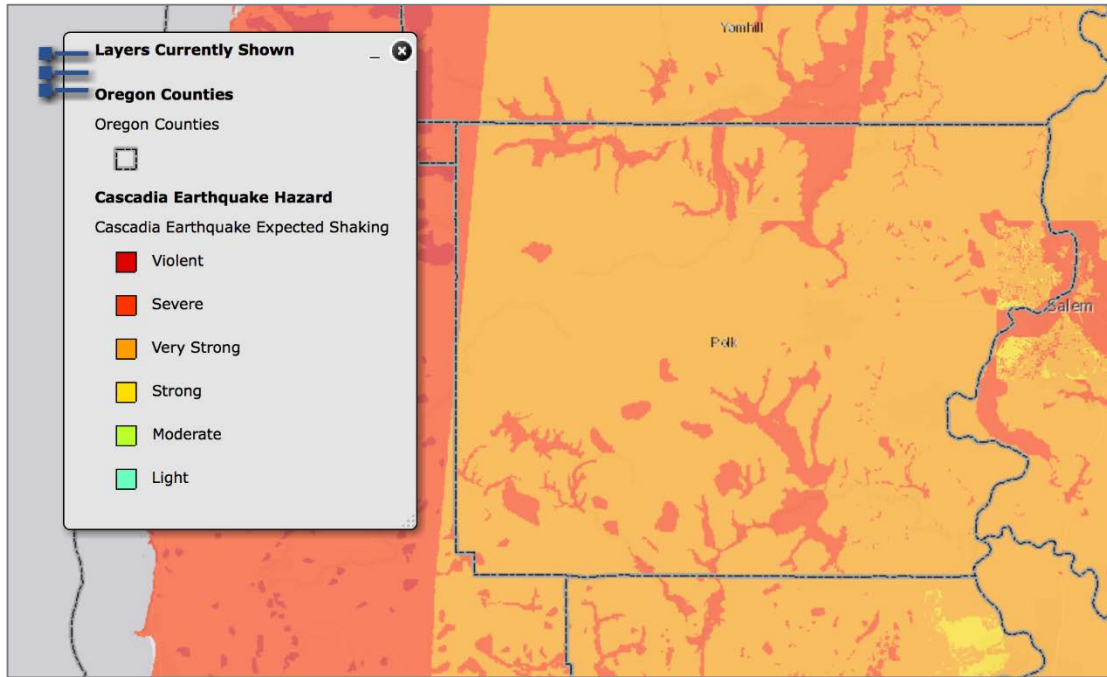
⁷ Oregon Seismic Safety Policy Advisory Commission, *Oregon Resilience Plan* (2013)

⁸ Ibid.

⁹ Ibid.

may experience “very strong” to “severe shaking” that may last two to four minutes. The strong shaking may be extremely damaging to lifeline transportation routes including Highway 22 and Highway 99W. For more information on expected losses due to a CSZ event see the [Oregon Resilience Plan](#).

Figure 2-5 Cascadia Subduction Zone Expected Shaking



Source: [Oregon HazVu: Statewide Geohazards Viewer \(HazVu\)](#)

A comprehensive risk and vulnerability assessment is not available. As of the publication of this NHMP FEMA is providing an opportunity for the county and cities to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. The Risk Report would provide a quantitative risk assessment that informs communities of their risks related to certain natural hazards (including earthquake). If pursued, once complete the county can incorporate the risk assessment into this plan to provide greater detail to sensitivity and exposure to the earthquake hazard.

According to the previous version of this plan Polk County has approximately 21,405 residential structures (worth \$3.5B), 104 non-residential structures (value unknown), 18 government facilities (worth \$5.9M), six emergency response facilities (worth \$9.9M), 20 educational facilities (worth \$45.8M), nine care facilities (value unknown), ten utilities (worth \$1.5M) and one dam (worth \$25M) which would be impacted by strong shaking events.

There are 171 residential structures (worth \$24.5M) located in very strong shaking areas with no residential structures or critical facilities located in locations which could experience severe ground shaking.¹⁰

¹⁰ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

The NHMP Steering Committee rated the county as having a **“moderate” vulnerability to the Cascadia Subduction Zone (CSZ) earthquake or crustal earthquake hazards**, meaning that between 1-10% of the region’s population or assets would be affected by a major crustal earthquake emergency or disaster. All of Polk County is subject to earthquakes, however, the western portion of the county is more susceptible to damages because of its proximity to the Cascadia Subduction Zone.

1999 Assessment

Factors included in an assessment of earthquake risk include population and property distribution in the hazard area, the frequency of earthquake events, landslide susceptibility, buildings, infrastructure, and disaster preparedness of the region. This type of analysis can generate estimates of the damages to the county due to an earthquake event in a specific location.

Seismic activity can cause great loss to businesses, either a large-scale corporation or a small retail shop. Losses not only result in rebuilding cost, but fragile inventory and equipment can be destroyed. When a company is forced to stop production for just a day, business loss can be tremendous. Residents, workers, businesses, and industry all suffer temporary loss of income when their source of finances is damaged or disrupted.

The potential losses from an earthquake in Polk County extend beyond those to human life, homes, property and the landscape. A recent earthquake damage model has not been conducted for Polk County, however, based upon data from a 1999 DOGAMI report rough loss estimates are available. The economic base in Polk County is estimated at \$2.33 billion in 1999 dollars (\$3.31 billion in 2016 dollars), ranking it 17 of 36 Oregon counties in 1999). It is expected that the county will incur total direct losses valuing \$249 million in 1999 dollars (\$354 million in 2016 dollars) for the Cascadia model and \$529 million in 1999 dollars (\$752 million in 2016 dollars) for the 500-year model. The CSZ event direct losses amount to a loss ratio of 6-percent, while the 500-year model event direct losses amount to a loss ratio of 14-percent.¹¹ Table 2-2(a) and (b) adjusts the economic loss estimates from DOGAMI’s 1999 report to account for inflation and reflect potential economic loss in 2016 dollars.

While the expected losses have increased due to increased development and population in the county, as well as inflation, the loss ratio and relative damage for the county is expected to be similar. See table on the following page for more information on expected losses. Local business economies are at substantial risk if an earthquake damages or otherwise necessitates the closure of any of the major transportation routes.

For more information, see: [Special Papers: SP-29, Earthquake damage in Oregon Preliminary estimates of future earthquake losses \(1999\)](#)

¹¹ DOGAMI, Special Papers: SP-29, Earthquake Damage in Oregon Preliminary Estimates of Future Earthquake Losses (1999). The loss ratio is determined as a percentage of the expected losses to the county’s economic base.

Table 2-2(a) Polk County Earthquake Damage Summary

Polk County	8.5 Cascadia Subduction Zone Event	500-year model
Injuries	124	266
Death	2	6
Displaced households	538	1,064
Short-term shelter needs	419	825
Economic losses for buildings	249 million (\$354 million*)	\$529 million (\$752 million*)
Operational the day after the quake		
Fires Stations	55%	n/a
Police Stations	46%	n/a
Schools	45%	n/a
Bridges	72%	n/a
Economic losses to		
Highways	\$28 million (\$40 million*)	\$72 million (\$102 million*)
Airports	\$6 million (\$8.5 million*)	\$13 million (\$18.5 million*)
Communication Systems		
Economic losses	\$688,000 (\$978,000*)	\$2 million (\$2.8 million*)
Operating the day of the quake	55%	n/a
Debris generated (<i>thousands of tons</i>)	219	378

These figures have a high degree of uncertainty and should be used only for general planning purposes. Because of rounding, numbers may not add up to 100%.

Because the 500 year model includes several earthquakes, the number of facilities operational the "day after" cannot be calculated.

Source: Y. Wang & J.L. Clark, Special Paper 29, Earthquake Damage in Oregon: Preliminary Estimates of Future Earthquake Losses. 1999. DOGAMI.

Note: * - 1999 dollars were adjusted for inflation to represent estimated economic loss in 2016 dollars using the State of Oregon Employment Department Inflation Calculator.

Table 2-2(b) Polk County Earthquake Damage Summary

8.5 Cascadia event	Percentage of buildings in damage categories				
	Building type	None	Slight	Moderate	Extensive
Agriculture	37	15	17	18	14
Commercial	19	12	26	25	18
Education	30	13	20	21	16
Government	18	11	25	27	20
Industrial	17	11	25	27	21
Residential	60	22	10	5	3

500 year model	Percentage of buildings in damage categories				
	Building type	None	Slight	Moderate	Extensive
Agriculture	18	17	21	20	24
Commercial	9	9	24	28	31
Education	15	14	22	24	27
Government	8	8	22	28	34
Industrial	7	8	22	28	33
Residential	31	31	24	9	6

Source: Y. Wang & J.L. Clark, Special Paper 29, Earthquake Damage in Oregon: Preliminary Estimates of Future Earthquake Losses. 1999. DOGAMI.

2007 Rapid Visual Survey

In 2007, DOGAMI completed a rapid visual screening (RVS) of educational and emergency facilities in communities across Oregon, as directed by the Oregon Legislature in Senate Bill 2 (2005). RVS is a technique used by the Federal Emergency Management Agency (FEMA), known as FEMA 154, to identify, inventory, and rank buildings that are potentially vulnerable to seismic events. DOGAMI ranked each building surveyed with a 'low,' 'moderate,' 'high,' or 'very high' potential for collapse in the event of an earthquake. It is important to note that these rankings represent a probability of collapse based on limited observed and analytical data and are therefore approximate rankings. To fully assess a building's potential for collapse, a more detailed engineering study completed by a qualified professional is required, but the RVS study can help to prioritize which buildings to survey.

DOGAMI surveyed 23 buildings in Polk County (not including facilities located in Salem). Buildings with a 'high' or 'very high' potential for collapse are listed below. Additional information can be found within the [RVS study](#) on DOGAMI's website (www.oregongeology.org).

'Very High' Collapse Potential

- Dallas Police Department (Dallas)
- Henry Hill Elementary School (Independence)
- Independence Elementary School (Independence)

'High' Collapse Potential

- Dallas High School (Dallas)
- LaCreole Middle School (Dallas)
- Lyle Elementary School (Dallas)
- Whitworth Elementary School (Dallas)
- Dallas Academy (Dallas)
- Dallas Fire Station (Dallas)
- Willamina Middle School at Grand Ronde (Grand Ronde)
- Central High School (Independence)
- Henry Hill Elementary School (Independence)
- Talmadge Middle School (Independence)
- Independence Police Department (Independence)
- Polk County Fire District 1 (Independence)

Mitigation Successes

Seismic retrofit grant awards per the [Seismic Rehabilitation Grant Program](#)¹² have been funded to retrofit Dallas Fire Department/ Station (2009-2010 grant award, \$887,725), Whitworth Elementary School (Dallas; Phase One of 2015-2016 grant award, \$1,492,900)¹³.

In addition, the following structures have also had some structural and/ or non-structural seismic retrofitting:

- *Whitworth Elementary School (Dallas School District 2), brick flue was removed and a stainless steel flue was installed, funded per 2009 local school bond (completed in August 2010).*
- *Lyle Elementary School (Dallas School District 2), brick flue was removed and a stainless steel flue was installed, funded per 2009 local school bond (completed in August 2010).*
- *Dallas High School (Dallas School District 2), brick flue was removed and a stainless steel flue was installed, funded per 2009 local school bond (completed in August 2010).*
- *Morrison Campus Alternative School (1251 Main St., Dallas School District 2), brick flue was removed and a stainless steel flue was installed, stadium concrete foundation was installed, dry rot removed and structural upgrades to columns, press box support was engineered and upgraded; funded per 2009 local school bond (completed in August 2010, stadium upgrades in September 2011).*
- *Independence Elementary School remodeled.*¹⁴
- *Central High School significant upgrade.*¹⁵

For more information, see: [Open-File-Report: O-2007-02 - Statewide seismic needs assessment: Implementation of Oregon 2005 Senate Bill 2 relating to public safety, earthquakes, and seismic rehabilitation of public buildings, 2007](#), and

[DOGAMI Statewide Seismic Needs Assessment Using Rapid Visual Screening \(RVS\)](#)

¹² The Seismic Rehabilitation Grant Program (SRGP) is a state of Oregon competitive grant program that provides funding for the seismic rehabilitation of critical public buildings, particularly public schools and emergency services facilities.

¹³ Additional information on seismic retrofits on the Whitworth School is found on the DOGAMI RVS webpage: http://www.oregongeology.org/sub/projects/rvs/activity-updates/2016/Dallas_SD2_SB1566Form2016.pdf

¹⁴ Polk County Itemizer-Observer, *Will they Stand or Fall: Are Polk County governments ready for the 'big one'?*, September 9, 2015, <http://www.polkio.com/news/2015/sep/09/will-they-stand-or-fall/>

¹⁵ Ibid.

2008 Assessment

In 2008, the Oregon Department of Geology and Mineral Industries (DOGAMI) developed regional earthquake hazard information to assess potential damages and losses for various earthquake scenarios in the Mid-Willamette Valley¹⁶. More specifically, DOGAMI:

- Identified the primary geologic hazards of Yamhill, Marion, Polk, Benton, Linn, and Lane Counties and the City of Albany;
- Developed countywide earthquake and landslide hazard maps for each county; and
- Developed future earthquake damage estimates for each community.

Damage and loss estimates for each community were analyzed for two earthquake scenarios:

- A magnitude ~6.7 crustal fault earthquake (Mill Creek)
- A magnitude 8.5 Cascadia Subduction Zone earthquake

Information was consolidated into the Hazards U.S. Multi-Hazard methodology and computer application (HAZUS – MH), which is a federally developed program used to model various earthquake scenarios and estimate associated damage and loss. The following is a brief summary of damage and loss estimates for Polk County in a magnitude 8.5 Cascadia Subduction Zone earthquake scenario:

- Estimated fatalities during late afternoon business hours: 49
- Injuries from minor to life threatening: 720
- Households displaced: 1,822
- People needing shelter: 464
- Injuries requiring hospitalization: 186
- Approximately 29% of buildings would be at least moderately damaged.

Note: Polk County has one hospital with 6 beds (up to 15). The hospital is expected to incur moderate damage due to earthquake impacts in the HAZUS M8.5 CSZ scenario

For more information, see: [Interpretive Map Series: IMS-024 - Geologic hazards, earthquake and landslide hazard maps, and future earthquake damage estimates for six counties in the Mid/Southern Willamette Valley including Yamhill, Marion, Polk, Benton, Linn, and Lane Counties, and the City of Albany, Oregon, 2008](#)

More information on this hazard can be found in the [Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP \(2015\)](#).

¹⁶ Burns, William J., R. Jon Hofmeister, and Yumei Wang. Geologic Hazards, Earthquake and Landslide Hazard Maps, and Future Earthquake Damage Estimates for Six Counties in the Mid/Southern Willamette Valley including Yamhill, Marion, Polk, Benton, Linn, and Lane Counties, and the City of Albany, Oregon. Oregon Department of Geology and Mineral Industries Interpretive Map Series IMS-24. 2008.

Flood

Significant Changes Since Previous Plan:

The Flood hazard profile has been edited to reference new history since the 2009 Plan. This section has also been reformatted. A description of erosion is included in this profile.

Characteristics

Flooding results when rain and snowmelt creates water flow that exceed the carrying capacity of rivers, streams, channels, ditches, and other watercourses. In Oregon, flooding is most common from October through April when storms from the Pacific Ocean bring intense rainfall. Most of Oregon's destructive natural disasters have been floods.¹⁷ The principal types of flood that occur in Polk County include: riverine floods and urban floods.

Riverine or overbank flooding of rivers and streams is the most common type of flood hazard. Riverine flooding most frequently occurs in winter and late spring. Air rises and cools over the Coast Range and its foothills and heavy rainfall develops over high-elevation streams, as storms move from the Pacific across the Oregon Coast. In this region, as much as four to six inches of rain can fall over a 24-hour period. Severe and prolonged storms can raise rivers and streams to their flood stages for three to four days or longer.

Urban flooding occurs in developed areas where the amount of water generated from rainfall and runoff exceeds the stormwater systems' capacity. As land is converted from agricultural and forest uses to urban uses, it often loses its ability to adsorb rainfall. Rain flows over impervious surfaces such as concrete and asphalt and into nearby storm sewers and streams. This runoff can result in the rapid rise of floodwaters. During urban floods, streets can become inundated, and basements can fill with water. Storm drains often back up because of the volume of water and become blocked by vegetative debris like yard waste, which can cause additional flooding. Development in the floodplain can raise the base flood elevation and cause floodwaters to expand past their historic floodplains.

Location and Extent

Polk County lies within the Mid-Willamette Valley between the Coastal Range and the Cascade Range, striated with rivers and tributaries. Melting snow and heavy winter rains combine to produce devastating flood events because of the County's alluvial floodplain topography on the main valley floor. These waterways easily exceed their banks because of the relatively flat terrain.

Floods frequently occur in Polk County during periods of heavy rainfall. The primary sources of riverine flooding include: the Willamette, Luckiamute, Little Luckiamute, and Yamhill rivers, in addition the North and South Ash, Berry, Gold, Gooseneck, Maxfield, Mill, Pedee, Rickreall, Ritner, Rowell, Salt, Soap, and Teal creeks along with many lesser creeks and

¹⁷ Taylor, George H. and Chris Hannan. *The Oregon Weather Book*. Falls City, OR: Oregon State University Press. 1999

tributaries. Communities near these waterways are all susceptible to flood damage during a flood event. A common thread from these water courses is their potential to disrupt infrastructure by causing landslides, inundating roads, and eroding river banks and bridge abutments.

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. Flood studies often use historical records, such as stream-flow gauges, to determine the probability of occurrence for floods of different magnitudes. The probability of occurrence is expressed in percentages as the chance of a flood of a specific extent occurring in any given year.

The magnitude of flood used as the standard for floodplain management in the United States is a flood having a one percent probability of occurrence in any given year. This flood is also known as the 100-year flood or base flood. The most readily available source of information regarding the 100-year flood is the system of Flood Insurance Rate Maps (FIRMs) prepared by FEMA. These maps are used to support the National Flood Insurance Program (NFIP). The FIRMs show 100-year floodplain boundaries for identified flood hazards. These areas are also referred to as Special Flood Hazard Areas (SFHAs) and are the basis for flood insurance and floodplain management requirements.

FEMA released the current Digital Flood Insurance Rate Map (DFIRM) for Polk County on December 19, 2006 which included data from city and unincorporated communities. This map delineates the flood extent within the County.

Areas with significant development in the mapped floodplains include North Dallas, East of West Salem along the Willamette River, Northwest of Independence along the North fork of Ash Creek, South of Monmouth along the South fork of Ash Creek, and Southeast of Falls City along the Little Luckiamute River. Portions of the following smaller communities are also within FEMA-mapped floodplains: Rickreall, Pedee, Willamina, Grand Ronde, and McCoy. For more information, refer to Table 2-3 and the following Flood Insurance Study (FIS) and associated Flood Insurance Rate Maps (FIRM):

- [Polk County Flood Insurance Study \(December 19, 2006\)](#)

Table 2-3 Flood Insurance Rate Maps (FIRMs)

Flood Source	Flood Insurance Rate Map (FIRM)	Notes
Willamette River	41053C0575F, 41053C0425F, 41053C0450F, 41053C0410F, 41053C0270F, 41053C0286F, 41053C0287F, 41053C0279F, 41053C0283F, 41053C0281F, 41053C0277F, 41053C0150F	Drainage area of 7,270 square miles 100-year peak discharge of 506,000 cubic feet per second (cfs) 500-year peak discharge of 675,000 cfs
Little Luckiamute River	41053C0355F, 41053C0360F, 41053C0400F	Drainage area of 22.4 square miles 100-year peak discharge of 5,390 cfs 500-year peak discharge of 7,070 cfs Peak discharge had a 5 percent chance of occurrence.
Lukiamute River	41053C0350F, 41053C0500F, 41053C0525F, 41053C0375F, 41053C0400F, 41053C0425F, 41053C0575F	Drainage area of 116 square miles 100-year peak discharge of 15,800 cfs 500-year peak discharge of 20,200 cfs
Yamhill River	41053C0040F, 41053C0030F, 41053C0035F, 41053C0045F, 41053C0065F, 41053C0055F	Drainage area of 129 square miles 100-year peak discharge of 18,600 cfs 500-year peak discharge of 21,800 cfs Peak flow of 19,000 cfs at the USGS stream gage near Wallace Bridge, about two miles upstream from Willamina.
North Ash Creek	41053C0236F, 41053C0238F, 41053C0239F, 41053C0237F, 41053C0241F, 41053C0242F, 41053C0245F, 41053C0265F, 41053C0401F, 41053C0402F	
South Ash Creek	41053C0245F, 41053C0400F, 41053C0403F, 41053C0404F, 41053C0402F	
Berry Creek	41053C0550F, 41053C0575F	
Gold Creek	41053C0200F, 41053C0045F	
Gooseneck Creek	41053C0200F, 41053C0045F, 41053C0065F, 41053C0075F	
Mill Creek	41053C0200F, 41053C0225F, 41053C0075F, 41053C0065F	Drainage area of 27.5 square miles 100-year peak discharge of 6,640 cfs 500-year peak discharge of 7,890 cfs
Pedee Creek	41053C0375F, 41053C0525F	
Rickreall Creek	41053C0200F, 41053C0225F, 41053C0217F, 41053C0236F, 41053C0237F, 41053C0241F, 41053C0242F, 41053C0265F, 41053C0270F, 41053C0286F	Drainage area of 46 square miles 100-year peak discharge of 13,300 cfs 500-year peak discharge of 17,200 cfs
Rowell Creek	41053C0200F, 41053C0040F	
Salt Creek	41053C0225F, 41053C0250F, 41053C0100F	
Soap Creek	41053C0575F	
Teal Creek	41053C0355F, 41053C0360F	

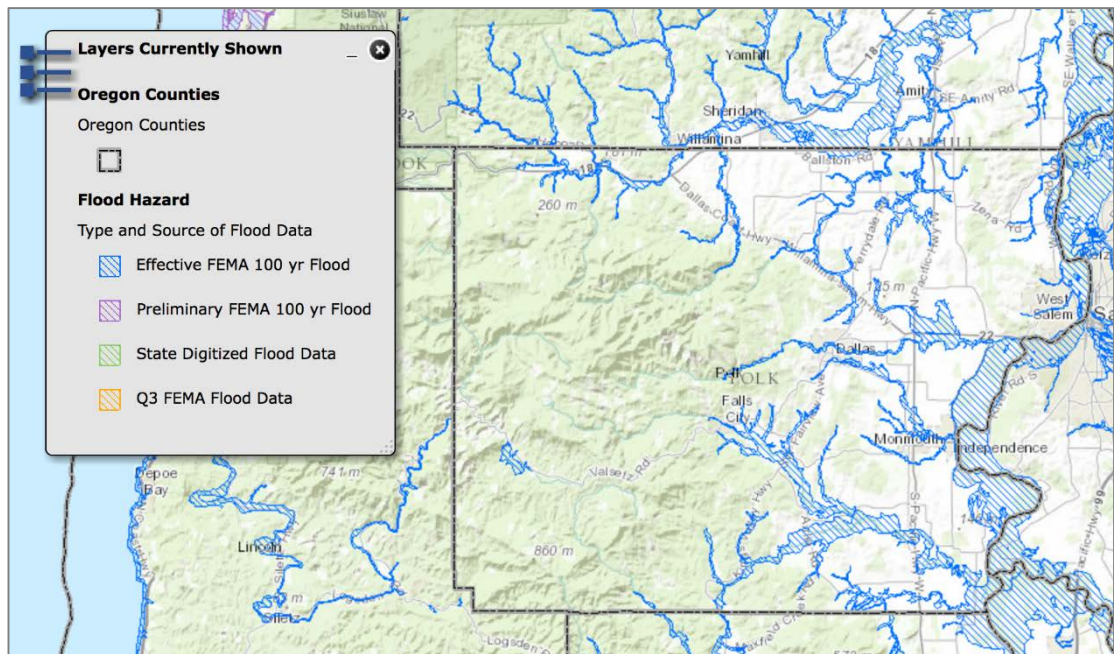
Source: Polk County Flood Insurance Study (December 19, 2006)

The FEMA-mapped floodplains in Polk County include, for the most part, only areas along the larger rivers and creeks which also have significant population and/or development. However, many agricultural fields are mapped floodplains (generally A zone). Many other areas in the county have significant flood risk, but are not included in the FIRMs because of small stream size or low population in the area. Flood hazard evaluation for Polk County must also take into account these localized high flood risk or repetitive flooding areas which lie outside mapped floodplains.

Additional reports may be available via DOGAMI's Publications Search website:
<http://www.oregongeology.org/pubs/search.php>

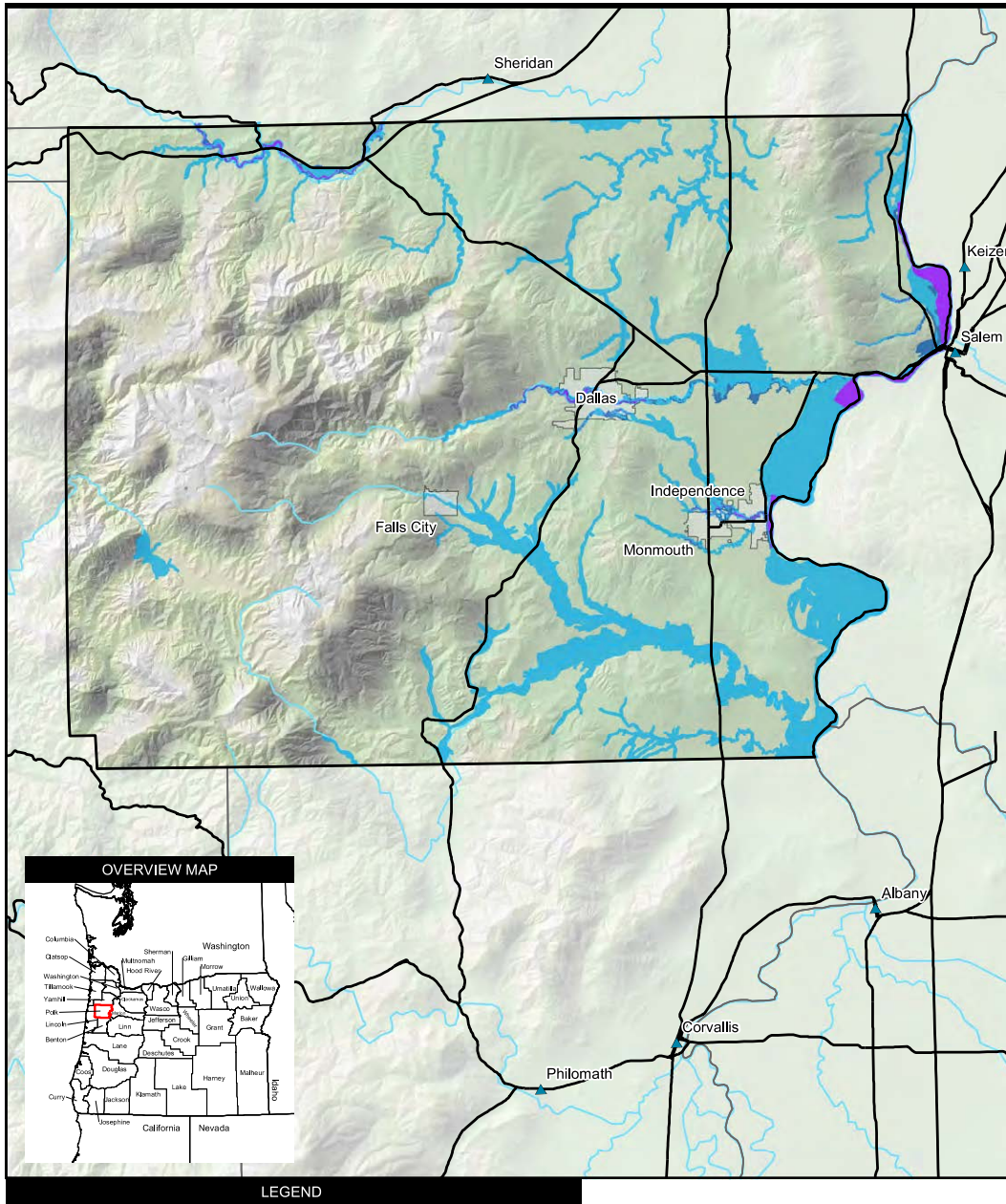
The special flood hazard that identifies the location and extent of the flood hazard is included as Figure 2-6 and Map 2-3, for more detailed mapping see the [2006 FIS](#) or the community profile for Polk County located on the [Oregon Risk MAP website](#). The [Polk County Website](#) also has information on flood hazards.

Figure 2-6 Special Flood Hazard Area



Source: [Oregon HazVu: Statewide Geohazards Viewer \(HazVu\)](#)

Map 2-3 Flood Hazard Area



Source: Polk County NHMP (2009).

History

Polk County, as well as much of western Oregon, has recorded several very destructive floods throughout the years. Listed below are historical flooding events that affected Polk County. The majority of flood events can be attributed to the Luckiamute and Willamette Rivers and Rickreall Creek.

Three significant flood events have been added since the previous plan (shown in *italics* below):¹⁸

- December 1964: Nearly every river in the state of Oregon exceeded its flood stages as weather stations set new precipitation records. This “Christmas Flood” event triggered debris flows, bridge failures and flooding that caused thousands to evacuate and closed airports, railways, and hundreds of miles of roads across the state. The event ultimately killed 20 people and caused more than \$157 million in damages.
- January 1965: Residents were still recovering from the Christmas Flood when they were hit again by the January 31, 1965 flood. What made these back-to-back floods so disastrous was the heavy rainfall onto near-record early snow depths. The resulting water could not soak into frozen ground.
- February 1987: Rains caused the Willamette and Luckiamute rivers and Rockreall Creek to overtop their banks, inundate homes, and create highway problems from extensive mudslides.
- February 1996: Virtually every county in the state received a disaster declaration due to a combination of warm temperatures, heavy snow pack, and four days of record-breaking rain. Many areas had already received above-average rainfall. Rivers were at or reaching their capacities and flood stages. Increased runoff and atypical sediment and debris from recent logging activities contributed to conditions ripe for flooding and landslides. Hundreds of homes were destroyed, power outages were widespread, thousands were evacuated to public shelters, and five people died. Flood-related damage estimates exceeded \$1 billion.
- November 1996-January 1997: A tropical air mass swept across the state, once again bringing record-breaking precipitation. The stormy weather continued into December and early January 1997, as 26 major rivers reached flood stage. Snow melt and intense rain caused extensive flooding that led to widespread landslides, erosion, power outages, damaged homes and businesses, closed roads, and eventually resulted in a Presidential Disaster Declaration.
 - Polk County’s Luckiamute and Willamette Rivers experienced extreme high water flooding along with the rest of the State. Laurel Mountain, west of the City of Dallas, far exceeded any Oregon location’s record rainfall receiving 204.12 inches of rain (17 feet) which ultimately flowed into the Luckiamute River and Rockreall Creek. The Willamette River’s rapid water rise forced many residents along its course to evacuate. Telecommunications, including some emergency communications, were disrupted. FEMA disbursed repair

¹⁸ Polk County Flood Insurance Study (2011); Taylor, George and Raymond Hatton, 1999, The Oregon Weather Book; National Climatic Data Center Storm Events, Polk County Community Development Department.

and response assistance totaling more than \$3,000,000 to the State's public entities.

- December 2007: Severe storms, winds, mudslides, landslides, and flooding occurred between December 1 and 17, 2007 shutting down roads and highways including Interstate 5. Public infrastructure, homes, and personal property were damaged. In Oregon, 73,000 residents were without power, and wastewater treatment plants were overwhelmed. A major disaster was declared for the State of Oregon on December 8, 2007 with Polk County included in the declaration. Estimated losses within Polk County are \$1,043,278.87.
- *Jan 15-18, 2011: Flooding of Luckiamute River results in the closing of Sarah Helmick State Park and covers Maple Grove Road near Monmouth. No reported injuries or damages.*
- *Jan 18, 2012: Independence OR – flooding of Ash Creek trapped a driver at car-door water level. No reported injuries or damages.*
- *Dec 8, 2015: Flooding of the Luckiamute River prompting the closing of Sarah Helmick State Recreation Area and Luckiamute Landing State Natural Area. 2,000 utilities customers in Salem and Keizer areas went without power as a result. No reported injuries or damages.*

Note: Other notable flooding events occurred in January 1972, November 1973, January 1974, December 1995, December 2003- January 2004, March 2006, and December 2006.

Erosion

Erosion is a process that involves the wearing away, transport, and movement of land. Erosion is typically a gradual process; however, it can also occur quickly as the result of a flash flood, coastal storm, or other event. Most of the geomorphic change that occurs in a river system is in response to a peak flow event. It is a natural process but its effects can be exacerbated by human activity.

Generally, erosion occurs when the flow of the river changes and is directed towards the banks or mid-channel islands. These changes can be caused by surface wind stress and gravity waves that occur during storm events (primarily severe winter storms), transporting sediment by bottom currents.

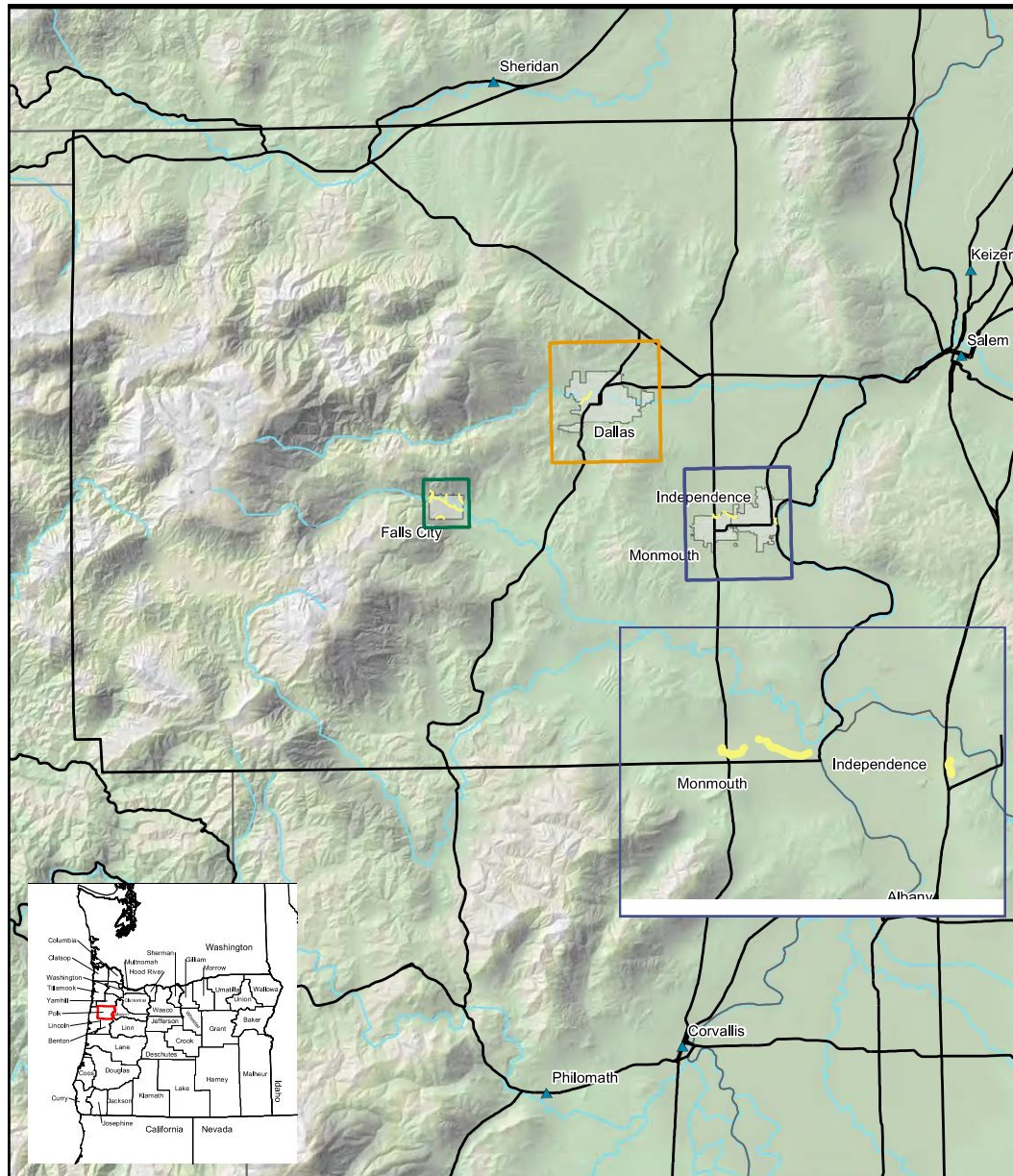
As shown in Map 2-4, several areas along the rivers and creeks in Polk County have been identified as vulnerable to riverine erosion. Riverine erosion in local creeks was a particular concern during the 1964 flood event.

Erosion loss has historically occurred in Polk County. Rivers and creeks that have been identified to be subject to the effects of erosion include the Willamette, Luckiamute, Little Luckiamute, and South Yamhill Rivers, and Rickreall, Ash, Boughey, Glenn, Gibson, Berry, Dutch, Everz, and Teal Creeks. The annual amounts of rain and wind that assail the bank combined with debris flows within the watersheds and loss of plant cover in riparian areas induce erosion; particularly during severe storm events.

Erosion is considered a particular concern in the following locations:

- Falls City: affecting Little Luckiamute River and Berry, Dutch, Everz, and Teal creeks.
- Independence: affecting the Willamette River to the east of Riverview Park.

Map 2-4 Erosion Hazard Area



Source: Polk County NHMP (2009). While erosion has been identified as occurring within the county, only one event was reported to result in damage. Based on past events and the lack of development in proximity to erosion hazard areas, the magnitude and severity of erosion impacts in Polk County are considered negligible, with the potential for critical facilities to

be shut down for 24 hours or less, and less than 10% of property or critical infrastructure being severely damaged.

Probability Assessment

Polk County and the incorporated Cities of Dallas, Falls City, Independence, and Monmouth, participate in the National Flood Insurance Program (NFIP) and are required to regulate floodplain development. Any structure built in the floodplain after 1974 must meet NFIP requirements for elevation and flood proofing. Polk County and the incorporated jurisdictions use FEMA developed floodplain maps as the basis for implementing floodplain regulations. FEMA has mapped the 10, 50, 100, and 500-year floodplains in portions of Polk County (see Figure 2-6 and referenced FIS for more information). This corresponds to a 10%, 2%, 1% and 0.2% chance of a certain magnitude flood in any given year. The 100-year flood is the benchmark upon which the NFIP is based.

Flooding in western Oregon generally occurs when storms from the Pacific Ocean bring intense or prolonged rainfall to the west coast. Polk County typically experiences the most severe floods from winter rainfall floods in December, January, and February. These floods are occasionally exacerbated by frozen snow packs where rain and snowmelt combine while the ground is frozen, preventing ground seepage capability. The county is also subject to flooding from river overflows, as well as flooding from local stormwater drainage. The county is susceptible to winter rain flooding from October through April; while the months between May and July bring snowmelt and runoff floods.

Based on the available data and research for Polk County the NHMP Steering Committee determined the **probability of experiencing a flood is “high”**, meaning at least one incident could be expected within the next 35-year period.

Vulnerability Assessment

Flooding can occur every year depending on rainfall, snowmelt, or how runoff from development impacts streams and rivers. Surveys by the Department of Geology & Mineral Industries (DOGAMI), the county, and FEMA have established the 100-year floodplain.

Changes to development patterns since 2009 have the potential to incur increased risk of flooding. However, County development regulations restrict, but do not prohibit, new development in areas identified as floodplain. This reduces the impact of flooding on future buildings.

The floodplains in Polk County are generally located along the Willamette, Luckiamute, and Little Luckiamute river basins and their tributaries.

Damage estimates have been completed for Polk County in the past, but are no longer accurate. Consequently, estimations of potential dollar losses to vulnerable structures are not currently available. FEMA recommends that communities use HAZUS software (HAZUS = Hazards United States; a geographic information system-based natural hazard loss estimation software package) to produce loss estimates that accurately reflect local conditions. The HAZUS-MH Flood Model allows planners and other practitioners to carry out a wide range of flood hazard analyses, including:

- Studies of specific return intervals of floods (e.g., 100-year return interval)
- Studies of discharge frequencies, including analysis of discharges from specific streams and the exposure to buildings and population from the resultant flooding.
- Studies of annualized losses from flooding.
- ‘Quick look’ assessments, which allow the user to quickly evaluate potential flooding from specific flood depths at specific locations.
- ‘What if’ scenarios, which allow users to evaluate the consequences of specific actions, such as the introduction of flow regulation devices, acquisition of flood-prone properties, and other mitigation measures.

The flood loss estimation methodology consists of two modules that carry out basic analytical processes: flood hazard analysis and flood loss estimation analysis. The flood hazard analysis module uses characteristics, such as frequency, discharge, and ground elevation to estimate flood depth, flood elevation, and flow velocity. The flood loss estimation module calculates physical damage and economic loss from the results of the hazard analysis.

A comprehensive risk and vulnerability assessment is not available. As of the publication of this NHMP FEMA is providing an opportunity for the county and cities to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. The Risk Report would provide a quantitative risk assessment that informs communities of their risks related to certain natural hazards (including flood). If pursued, once complete the county can incorporate the risk assessment into this plan to provide greater detail to sensitivity and exposure to the earthquake hazard.

Per the previous version of this plan approximately 8,288 residential structures (value \$1.2B), 25 non-residential structures (value unknown), three government facilities (value unknown), two educational facilities (value \$7M), one care facility (value unknown), three utility facilities (value unknown), and one dam (value \$25M).

Within the 500-year floodplain, Polk County has 9,422 residential structures (worth \$1.3B), 50 non-residential structures (value unknown), one government facility (value unknown), and one educational facility (value unknown).

In Polk County, 101 residential structures (worth \$14.5M), one government facility (value unknown), one emergency response facility (worth \$3M), and one utility facility (value unknown) are considered at risk of riverine erosion.¹⁹

As such, the NHMP Steering Committee rated the county as having a **“moderate” vulnerability to flood hazards**, meaning that between 1-10% of the region’s population or assets would be affected by a major flood event.

More information on this hazard can be found in the [Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP \(2015\)](#).

¹⁹ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

Landslide

Significant Changes Since Previous Plan:

The Landslide hazard profile has been edited to reference new history since the 2009 Plan. New landslide susceptibility information based on updated Lidar data provided by DOGAMI (O-16-02) has also been included. This section has also been reformatted.

Characteristics

A landslide is any detached mass of soil, rock, or debris that falls, slides or flows down a slope or a stream channel. Landslides are classified according to the type and rate of movement and the type of materials that are transported. In a landslide, two forces are at work: 1) the driving forces that cause the material to move down slope, and 2) the friction forces and strength of materials that act to retard the movement and stabilize the slope. When the driving forces exceed the resisting forces, a landslide occurs.

Polk County is subject to landslides or debris flows (mudslides), especially in the Coast Range, which may affect buildings, roads, and utilities.

Additionally, landslides often occur together with other natural hazards, thereby exacerbating conditions, as described below:

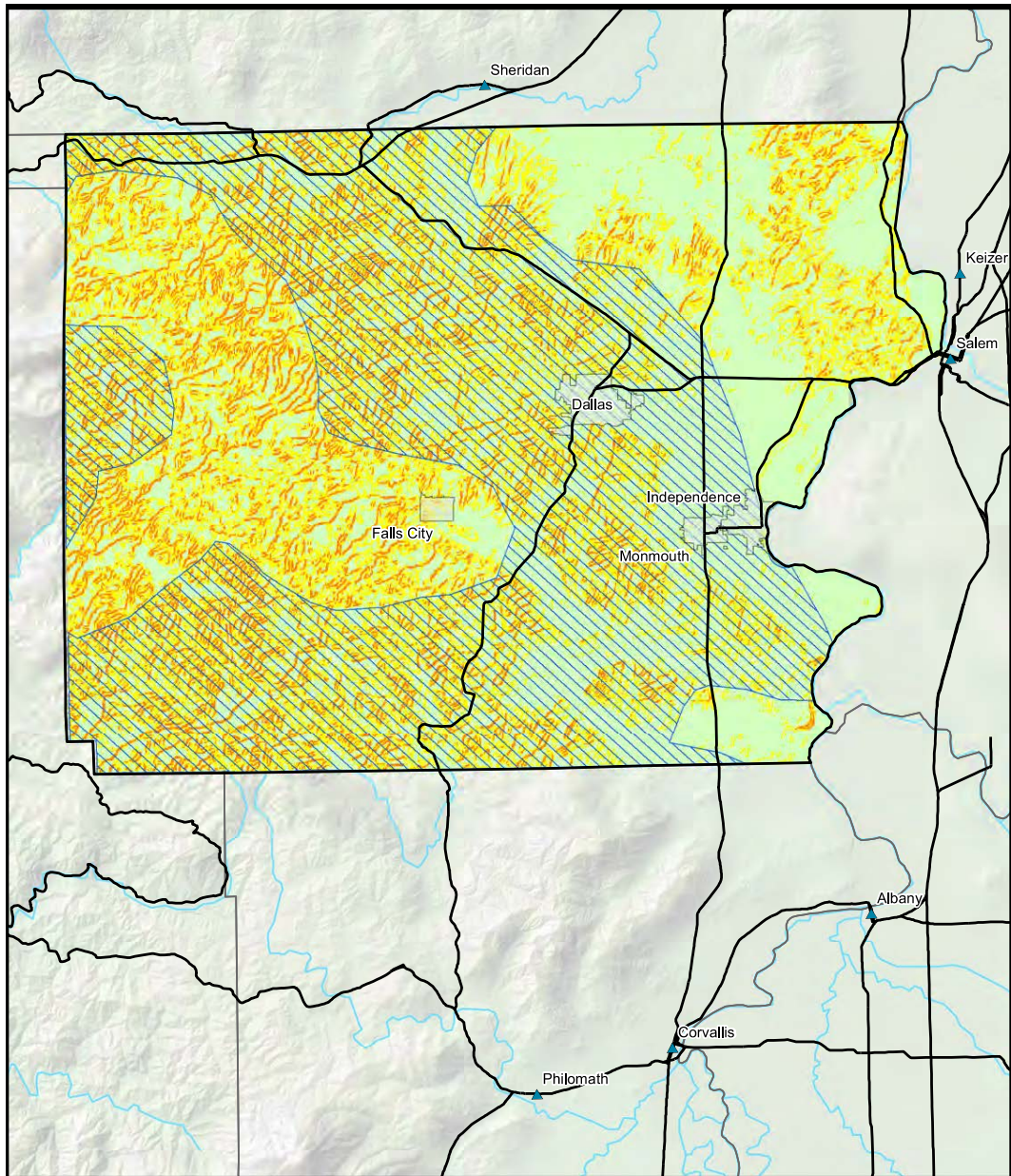
- Shaking due to earthquakes can trigger events ranging from rockfalls and topples to massive slides.
- Intense or prolonged precipitation that causes flooding can also saturate slopes and cause failures leading to landslides.
- Landslides into a reservoir can indirectly compromise dam safety, and a landslide can even affect the dam itself.
- Wildfires can remove vegetation from hillsides, significantly increasing runoff and landslide potential.

Location and Extent

The characteristics of the minerals and soils present in Polk County indicate the potential types of hazards that may occur. Rock hardness and soil characteristics can determine whether or not an area will be prone to geologic hazards such as landslides.

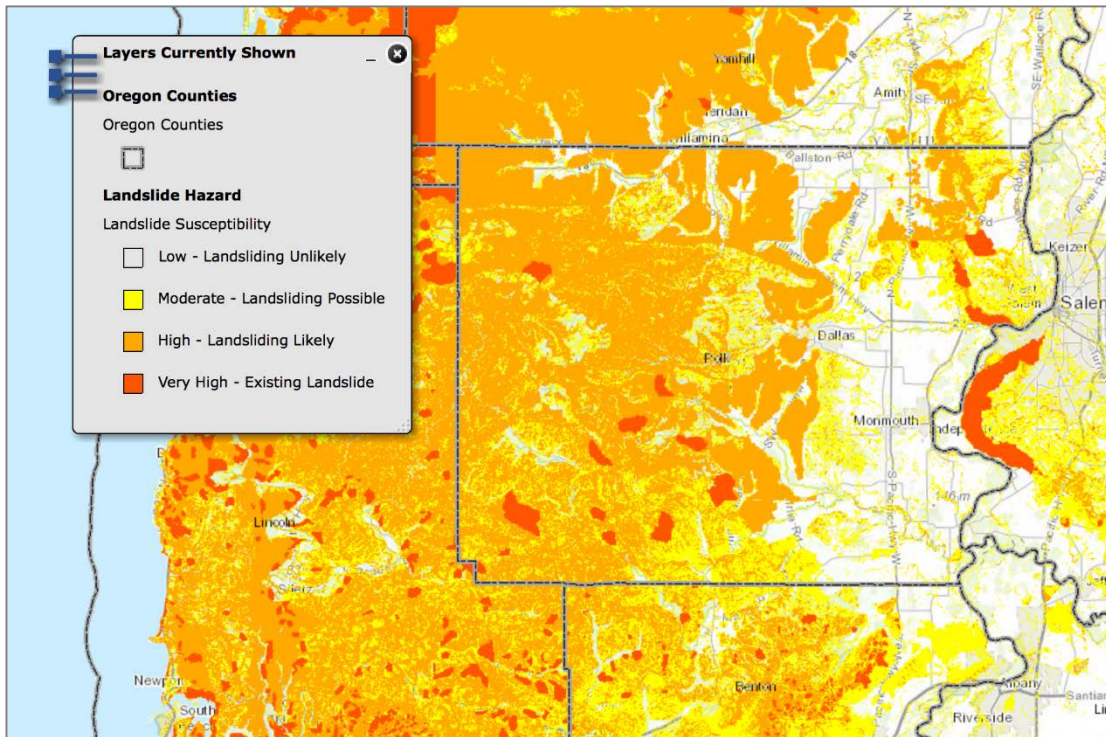
Landslides and debris flows are possible in any of the higher slope portions of Polk County, including much of the western portion of the county. Landslide prone areas also include portions of the hilly areas west of Falls City (see Map 2-5 and Figure 2-7).

Map 2-5 Landslide Hazard Area



Source: Polk County NHMP (2009).

Figure 2-7 Landslide Susceptibility Exposure



Source: [DOGAMI Statewide Landslide Information Layer for Oregon \(SLIDO\)](#)

For Polk County, many high landslide potential areas are in the hilly-forested areas western portion of the county. The western region of the county is hilly, primarily managed for timberland, and is sparsely populated. Landslides in these areas may damage or destroy some timber and impact logging roads. Many of the major highways in Polk County are at risk for landslides at one or more locations with a high potential for road closures and damage to utility lines. Especially in the western portions of the county, with a limited redundancy of the road network, such road closures may isolate some communities. In addition to direct landslide damages to roads and highways, affected communities are also subject to the economic impacts of road closures due to landslides, which may disrupt access to/egress from communities.

Table 2-4 shows landslide susceptibility exposure for Polk County and the incorporated cities. Approximately 46% of the county land has High landslide susceptibility exposure and just over 2% has Very High landslide susceptibility. While the cities generally have less exposure, nearly 60% of Falls City is within the High landslide susceptibility area. Note that even if a county or city has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard and assets.

More detailed landslide hazard assessment at specific locations requires a site-specific analysis of the slope, soil/rock and groundwater characteristics at a specific site. Such assessments are often conducted prior to major development projects in areas with moderate to high landslide potential, to evaluate the specific hazard at the development site.

Table 2-4 Landslide Susceptibility Exposure

Jurisdiction	Area, ft ²	Low	Moderate	High	Very High
Polk County	20,738,900,872	31.2%	20.5%	46.0%	2.3%
Dallas	135,561,360	67.3%	13.4%	19.3%	0.0%
Falls City	33,481,019	24.6%	16.1%	59.3%	0.0%
Independence	82,442,831	88.4%	9.8%	1.8%	0.0%
Monmouth	58,577,531	91.1%	8.7%	0.2%	0.0%

Source: DOGAMI Open-File Report, O-16-02, Landslide Susceptibility Overview Map of Oregon (2016)

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

For more information, refer to the following report and maps provided by DOGAMI:

- [Open File Report: O-16-02, Landslide Susceptibility Overview Map of Oregon](#)
- [Open File Report: O-15-01, Landslide Susceptibility analysis of lifeline routes in the Oregon Coast Range \(2015\)](#)
- [Open-File Report: O-10-03, Digital geologic map of the southern Willamette Valley, Benton, Lane, Linn, Marion, and Polk Counties, Oregon](#)
- [Special Paper 34: Slope failures in Oregon: GIS inventory for three 1996/97 storm events, 2000](#)

Additional reports are available via DOGAMI's Publications Search website:
<http://www.oregongeology.org/pubs/search.php>

History

Landslides are not common in Polk County. Much of the terrain is relatively flat with few hills. However, landslides have occurred in Polk County potentially threatening infrastructure. Many slides take place in undeveloped areas and are unreported or even unnoticed. Figure 2-7 shows that landslide prone landscape is generally in the western portion of the county which is remote and primarily managed for timberland. A statewide survey of winter storm landslides during 1996 and 1997, conducted by the Oregon Department of Geology and Mineral Industries (DOGAMI), reported 9,582 documented slides.²⁰ The actual number occurring was estimated to be many times the documented number.

Landslides in Polk County are often associated with heavy rain events and landslides were reported during rain events in October 1950, November 1951, December 1951, December 1955, November 1958, March 1963, October 1967, March 1971, November 1981, December 1995, February 2002, December 2006. Below, the most severe landslide events are listed. Two (2) landslide event/s have been added since the previous plan (as shown in *italics* below):

²⁰ DOGAMI, Special Paper 34: Slope Failures in Oregon: GIS Inventory for three 1996/97 storm events (2000)

- October 1962, wind/ rain event; flood, landslides, tree toppling, utility disruption (Columbus Day Storm)
- December 1964, rain event, most severe flooding since 1870
- Feb. 1996: Entire State - Deep snow pack, warm temperatures, record-breaking rains. Flooding, landslides, power-outages. (FEMA-1099-DR-OR); \$478,472 - Road damage, homes damaged from floodwater undercutting.
- Nov. – Dec. 1996: Entire State - Record-breaking precipitation; local flooding / landslides (FEMA-1107-DR-OR and FEMA-1149-DR-OR, *did not include Polk County*).
- *December 2005-January 2006: severe storms, flooding, landslides, and mudslides (FEMA-1632-DR-OR).*
- December 2007, snow and rain event; Heavy snowfall, rains, rapid temperature warming created widespread flooding, tree blockages, landslides, transportation and utility disruptions, and five deaths in Oregon. Statewide wind 50-100 mph - \$180M damages.
- December 2008: snow, mudslide, and landslide event; A severe storm, record and near-record snow, mudslides, and landslides occurred between December 20 through 26, 2008.
- *January, 2012: Heavy rain, landslides, downed trees, 24-hour rainfall of over 4-inches (FEMA-4055-DR-OR).*
- *December 2015: Severe Winter Storms, Straight-line Winds, Flooding, Landslides, and Mudslides (FEMA-4258-DR-OR)*

For additional history see flood section above for events that included landslides.

Probability Assessment

The probability of rapidly moving landslides occurring depends on a number of factors; these include steepness of slope, slope materials, local geology, vegetative cover, human activity, and water (surface and ground). There is a strong correlation between intensive winter rainstorms and the occurrence of rapidly moving landslides (debris flows). Given the correlation between precipitation / snow melt and rapidly moving landslides, it would be feasible to construct a probability curve. Many slower moving slides present in developed areas have been identified and mapped; however, the probability and timing of their movement is difficult to quantify. The installation of slope indicators or the use of more advanced measuring techniques could provide information on these slower moving slides.

Based on the available data and research for Polk County the NHMP Steering Committee determined the **probability of experiencing a landslide is “high”**, meaning at least one incident is likely within the next 35-year period.

Vulnerability Assessment

Landslides can affect structures (residential, commercial, industrial), utility services, transportation systems, and critical lifelines among others. Communities may suffer immediate damages and loss of service. 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 electric power are all essential to service community needs. Loss of electricity has the most widespread impact on other

utilities and on the whole community. Natural gas pipes may also be at risk of breakage from slight landslide movements as small as an inch or two.

Roads and bridges are subject to closure during landslide events. Because many Polk County residents are dependent on roads and bridges for travel to work, delays and detours are likely to have an economic impact on county residents and businesses. To evaluate landslide mitigation for roads, the community can assess the number of vehicle trips per day, detour time around a road closure, and roads used for commercial traffic or emergency access. Particular vulnerabilities include major routes including Highway 51, 99, 223, and 22. In addition, the following roads within Polk County are susceptible to slides:

- High Frequency: Black Rock, Mill Creek, James Howe, and Liberty
- Lower Frequency: Buena Vista, Pioneer, and Pedee

Lifelines and critical facilities should remain accessible if possible during a natural hazard event. The impact of closed transportation arteries may be increased if the closed road or bridge is a critical lifeline to hospitals or other emergency facilities. Therefore, inspection and repair of critical transportation facilities and routes is essential and should receive high priority. Losses of power and phone service are also potential consequences of landslide events. Due to heavy rains, soil erosion in hillside areas can be accelerated, resulting in loss of soil support beneath high voltage transmission towers in hillsides and remote areas. Flood events can also cause landslides, which can have serious impacts on gas lines. Water and waste-water utilities may need treatment to quickly improve water quality by reducing excessive water turbidity and reestablishing wastewater disposal capability.

Mercer Reservoir is the drinking water source for Dallas and its spillway is vulnerable to impacts from landslide/debris flows. Falls City has experienced landslide debris flows from supersaturated soils.

A quantitative landslide hazard assessment requires overlay of landslide hazards (frequency and severity of landslides) with the inventory exposed to the hazard (value and vulnerability) by considering:

1. Extent of landslide susceptible areas;
2. Inventory of buildings and infrastructure in landslide susceptible areas;
3. Severity of earthquakes or winter storm event (inches of rainfall in 24 hours);
4. Percentage of landslide susceptible areas that will move and the range of movements (displacements) likely; and
5. Vulnerability (amount of damage for various ranges of movement).

A comprehensive risk and vulnerability assessment is not available. As of the publication of this NHMP FEMA is providing an opportunity for the county and cities to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. The Risk Report would provide a quantitative risk assessment that informs communities of their risks related to certain natural hazards (including landslide). If pursued, once complete the county can incorporate the risk assessment into this addendum to provide greater detail to sensitivity and exposure to the landslide hazard.

According to the previous version of this plan approximately 14,232 residential structures (value \$2B), 60 non-residential structures (value unknown), two government facilities (value

unknown), two emergency response facilities (value \$3M), eight educational facilities (value \$13.1M), five care facilities (value unknown) and six utility facilities (value \$1.7M) are located within areas of moderate landslide risk.

Additionally, 8,850 residential structures (value \$1.3B), 19 non-residential structures (value unknown), and two educational facilities (value unknown) are located within areas of high landslide risk.²¹

Since a recent comprehensive risk assessment is not available, current data does not allow for specific estimates of life and property losses during a given scenario. In addition, most of the area that is susceptible to landslides is remote and does not have a lot of development. As such, the NHMP Steering Committee rated the county as having a “**low**” **vulnerability to landslide hazards**, meaning that less than 1% of the region’s population or assets would be affected by a major disaster.

More information on this hazard can be found in the [Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP \(2015\)](#).

²¹ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

Volcano

Significant Changes Since Previous Plan:

There has been no new history applicable to the Volcano hazard since the 2009 Plan. This section has been reformatted.

Characteristics

The Pacific Northwest, lies within the “ring of fire,” an area of very active volcanic activity surrounding the Pacific Basin. Volcanic eruptions occur regularly along the ring of fire, in part because of the movement of the Earth’s tectonic plates. The Earth’s outermost shell, the lithosphere, is broken into a series of slabs known as tectonic plates. These plates are rigid, but they float on a hotter, softer layer in the Earth’s mantle. As the plates move about on the layer beneath them, they spread apart, collide, or slide past each other. Volcanoes occur most frequently at the boundaries of these plates and volcanic eruptions occur when molten material, or magma, rises to the surface.

The primary threat to lives and property from active volcanoes is from violent eruptions that unleash tremendous blast forces, generate mud and debris flows, or produce flying debris and ash clouds. The immediate danger area in a volcanic eruption generally lies within a 20-mile radius of the blast site.

Location and Extent

Volcanic eruption is not an immediate threat to the residents of Polk County, as there are no active volcanoes within the county. Nevertheless, the secondary threats caused by volcanoes in the Cascade region must be considered. Volcanic ash can contaminate water supplies, cause electrical storms, create health problems, collapse roofs, and impact agricultural crops.

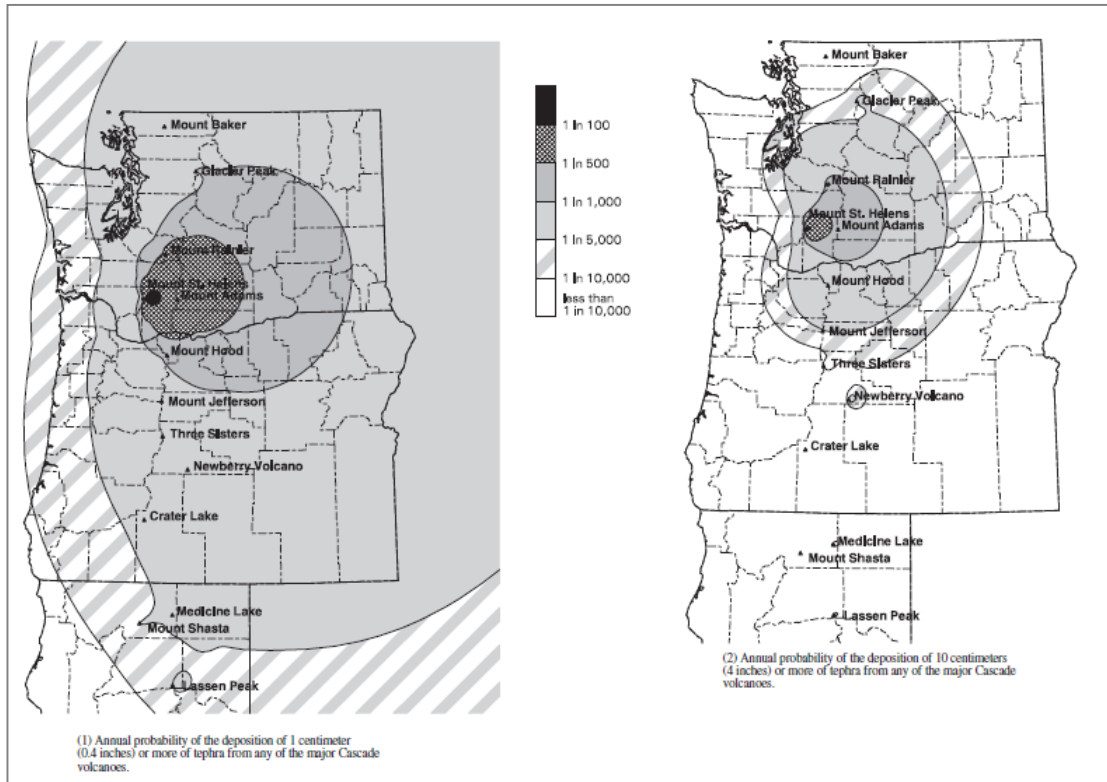
Polk County is located on the Pacific Rim. Tectonic movement within the earth's crust can renew nearby dormant volcanoes resulting in ash fallout in Polk County. Volcanic activity is possible from Mount Jefferson, Mount Hood and Mount Saint Helens, Three Sisters, Mount Bachelor, and the Newberry Crater areas. Because the distance to these potentially active volcanic areas is so great, the only adverse effect that would impact areas of Polk County is ash fallout, with perhaps some impact on water supplies. The area affected by ash fallout depends upon the height attained by the eruption column and the atmospheric conditions at the time of the eruption.

Geologic hazard maps have been created for most of the volcanoes in the Cascade Range by the USGS Volcano Program at the Cascade Volcano Observatory in Vancouver, WA and are available at http://vulcan.wr.usgs.gov/Publications/hazards_reports.html.

Scientists use wind direction to predict areas that might be affected by volcanic ash; during an eruption that emits ash, the ash fall deposition is controlled by the prevailing wind direction. The predominant wind pattern over the Cascades originates from the west, and previous eruptions seen in the geologic record have resulted in most ash fall drifting to the east of the volcanoes. Regional tephra fall shows the annual probability of ten centimeters

or more of ash accumulation from Pacific Northwest volcanoes. Figure 2-8 depicts the potential and geographical extent of volcanic ash fall in excess of ten centimeters from a large eruption of Mt. St. Helens.

Figure 2-8 Regional Tephra-fall Maps



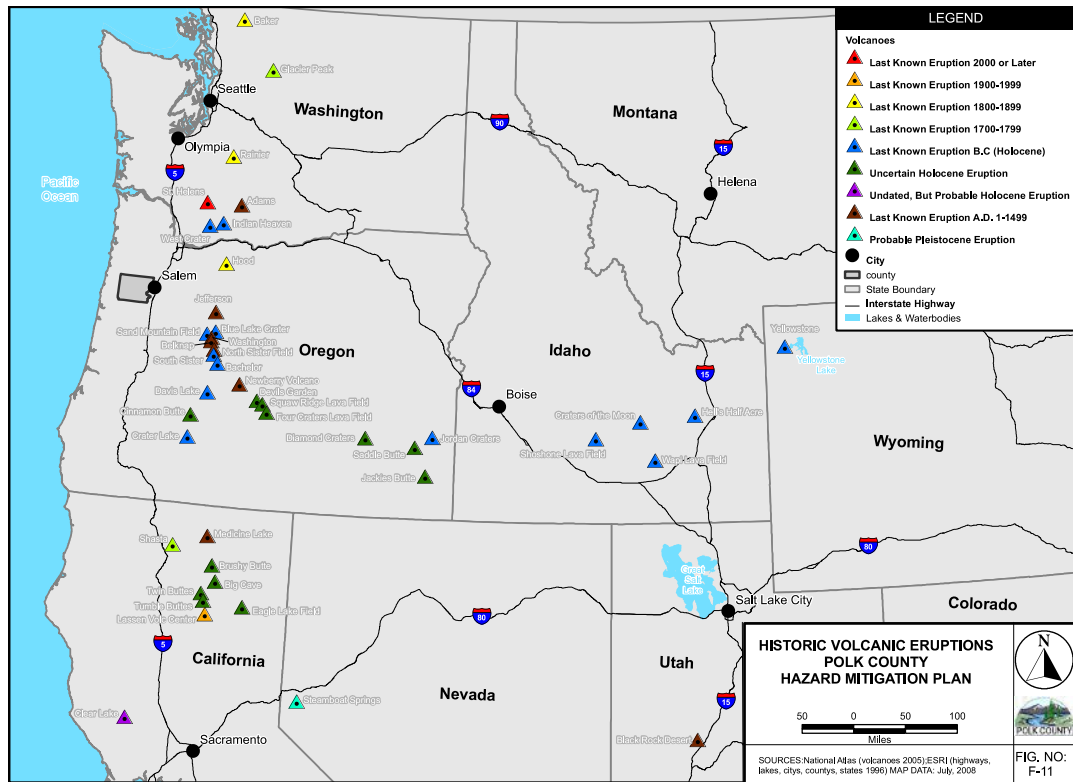
Source: USGS “Volcano Hazards in the Mount Jefferson Region, Oregon”

History

Mount Hood and Mount St. Helens are two active volcanoes in the vicinity of Polk County. Mount Hood is northeast of the county and is more than 500,000 years old. It has had two significant eruptive periods, one about 1,500 years ago and another about 200 years ago. Mount St. Helens is located in southern Washington State and has been active throughout its 50,000-year lifetime. Additionally, in the past 200 years, seven of the Cascade volcanoes have erupted, including (from north to south): Mt. Baker, Glacier Peak, Mt. Rainier, Mount St. Helens (Washington); Mt. Hood (Oregon); Mt. Shasta, and Mt. Lassen (California).

There has been no recent volcanic activity in close proximity to the county. The 1980 explosion of Mount Saint Helens in southern Washington State is the latest on record; both Mount St. Helens and Mount Hood remain listed as active volcanoes.

Map 2-6 Historic Volcanic Eruptions



Source: Polk County NHMP (2009).

Probability Assessment

The United States Geological Survey-Cascades Volcano Observatory (CVO) produced volcanic hazard zonation reports for Mount St. Helens and Mount Hood in 1995 and 1997. The reports include a description of potential hazards that may occur to immediate communities. The CVO created an updated annual probability of tephra (ash) fall map for the Cascade region in 2001, which could be a rough guide for Polk County in forecasting potential tephra hazard problems. The map identifies the location and extent of the hazard.

The CVO Volcanic tephra fall map is based on the combined likelihood of tephra-producing eruptions occurring at Cascade volcanoes. Probability zones extend farther east of the range because winds blow from westerly directions most of the time. The map shows annual probabilities for a fall of one centimeter (about 0.4 inch). The patterns on the map show the dominating influence of Mount St. Helens as a tephra producer. Because small eruptions are more numerous than large eruptions, the probability of a thick tephra fall at a given locality is lower than that of a thin tephra fall. The annual probability of a fall of one centimeter or more of tephra is about 1 in 10,000 for Polk County. This is small when compared to other risks faced by the county. The USGS map on the previous page illustrates potential tephra fall in the region.

Based on the available data and research for Polk County the NHMP Steering Committee determined the **probability of experiencing volcanic activity is “low”**, meaning one incident (or less) is likely within the next 100-year period.

Vulnerabilities

Risks for Polk County associated with regional volcanic activity would be ash fall, air quality, water quality, impacts to agricultural crops, and possible economic or social disruption due to air traffic issues due to the ash cloud.

At the time of this update, sufficient data was not available to determine volcanic eruption vulnerability in terms of explicit types and numbers of existing and future buildings, infrastructure, or critical infrastructure. Due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all residential and critical facilities and infrastructure within the County are at risk.

Though unlikely, the impacts of a significant ash fall are substantial. Persons with respiratory problems are endangered, transportation, communications, and other lifeline services are interrupted, drainage systems become overloaded/ clogged, buildings can become structurally threatened, and the economy takes a major hit. Any future eruption of a nearby volcano (e.g., Hood, St. Helens, or Adams) occurring during a period of easterly winds would likely have adverse consequences for the county.

As such, the NHMP Steering Committee rated the county as having a **“moderate” vulnerability to volcanic activity**, meaning that between 1-10% of the region’s population or assets would be affected by a major disaster (volcanic ash).

More information on this hazard can be found in the [Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP \(2015\)](#).

Wildfire

Significant Changes Since Previous Plan:

The Wildfire hazard has been edited to reference new history since the 2009 Plan. This section has also been reformatted.

Characteristics

Wildfires occur in areas with large amounts of flammable vegetation that require a suppression response due to uncontrolled burning. Fire is an essential part of Oregon's ecosystem, but can also pose a serious threat to life and property particularly in the state's growing rural communities. Wildfire can be divided into three categories: interface, wildland, and firestorms. The increase in residential development in interface areas has resulted in greater wildfire risk. Fire has historically been a natural wildland element and can sweep through vegetation that is adjacent to a combustible home. New residents in remote locations are often surprised to learn that in moving away from built-up urban areas, they have also left behind readily available fire services providing structural protection.

The following three factors contribute significantly to Wildfire behavior and can be used to identify Wildfire hazard areas.

Topography: As slope increases, the rate of Wildfire spread increases. South-facing slopes are also subject to more solar radiation, making them drier and thereby intensifying Wildfire behavior. However, ridgetops may mark the end of Wildfire spread, since fire spreads more slowly or may even be unable to spread downhill.

Fuel: The type and condition of vegetation plays a significant role in the occurrence and spread of Wildfires. Certain types of plants are more susceptible to burning or will burn with greater intensity. Dense or overgrown vegetation increases the amount of combustible material available to fuel the fire (referred to as the "fuel load"). The ratio of living to dead plant matter is also important. The risk of fire is increased significantly during periods of prolonged drought as the moisture content of both living and dead plant matter decreases. The fuel's continuity, both horizontally and vertically, is also an important factor which contributes to the wildfire's rate of spread and crown fires.

Weather: The most variable factor affecting Wildfire behavior is weather. Temperature, humidity, wind, and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures, low humidity, and high wind speeds, can lead to extreme Wildfire activity. By contrast, cooling, higher humidity, and little to no wind often signals reduced Wildfire occurrence and easier containment.

The frequency and severity of Wildfires is also dependent upon other hazards, such as lightning, drought, equipment use, railroads, recreation use, arson, and infestations. If not promptly controlled, Wildfires may grow into an emergency or disaster. Even small fires can threaten lives and resources, and destroy improved properties. In addition to affecting people, Wildfires may severely affect livestock and pets. Such events may require emergency watering/feeding, evacuation, and shelter.

The indirect effects of Wildfires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life, and can burn seed sources within the topsoil layer. Exposed soils erode quickly and enhance siltation of rivers and streams, thereby enhancing flood potential, harming aquatic life, and degrading water quality. Lands stripped of vegetation are also subject to increased debris flow hazards, as described above.

Location and Extent

Wildfire hazard areas are commonly identified in regions of the Wildland Urban Interface (WUI). The interface is the urban-rural fringe where homes and other structures are built into a densely forested or natural landscape or adjacent to non-irrigated farmland. The interface area in Polk County is generally considered to be east of the coastal mountain range due to the combination of fuel conditions and residential development. If left unchecked, it is likely that fires in these areas will threaten lives and property. One challenge Polk County faces is from the increasing number of houses being built in the urban/rural fringe as compared to twenty years ago. The “interface” between urban or suburban areas and the resource lands has significantly increased the threat to life and property from fires. Responding to fires in the expanding Wildland Urban Interface area may tax existing fire protection systems beyond original design or current capability.

Ranges of the wildfire hazard are further determined by the ease of fire ignition due to natural or human conditions and the difficulty of fire suppression. The wildfire hazard is also magnified by several factors related to fire suppression/control, such as the surrounding fuel load, weather, topography, and property characteristics.

Fire susceptibility throughout the county dramatically increases in late summer and early autumn as summer thunderstorms with lightning strikes increases and vegetation dries out, decreasing plant moisture content and increasing the ratio of dead fuel to living fuel. However, various other factors, including humidity, wind speed and direction, fuel load and fuel type, and topography can contribute to the intensity and spread of wildland. In addition, common ignition sources of Wildfires include arson and negligence from industrial and recreational activities.

Polk County is approximately 90% forested with Douglas fir, spruce, and hemlock dominating the western half of the county; oak dominating the eastern half. The non-forested areas, east of the coast range, comprise either agricultural crop lands or urban development.

The actual fire hazard in these areas may be lower than expected because a high percentage of forest lands in Polk County are actively managed for timber. Harvested areas typically have lower fire risk because they are relatively free of dead and downed material that would contribute to the fuel load. In addition, forests within Polk County are relatively free of major insect and disease problems which often plague other forests in Oregon. Finally, typical rainfall amounts for Polk County are rated as either “moderately high” or “high”, averaging 40 to 80 inches per year. High rainfall also reduces the threat of wildfires.

Table 2-5 shows the following areas of special concern for WUI fires that were identified by each committee:

Table 2-5 Wildfire-Urban Interface

Community	Areas of Special Concern
Dallas	Populated areas of the interface adjoining natural cover and wildland areas. Can occur in hilly area around Bridlewood Water Treatment Plant, Mercer Reservoir, Watershed Infrastructure, and homes in SE portion of the community.
Falls City	Populated areas of the interface adjoining natural cover and wildland areas. Fire in the hills bordering the town could propagate into the City. Prior fire events have had favorable wind keeping the fire confined to the hills.
Independence	Populated areas of the interface adjoining natural cover and wildland areas. No damages occurred to date.
Monmouth	Populated areas of the interface adjoining natural cover and wildland areas. Droughts for last decade have increased elements compatible for wildfires; growing rural population leads to more accidental fires. Willamette Valley contains wheat crops, which are very prone to fire.

Source: 2009 Steering Committee (Updated in 2017)

History

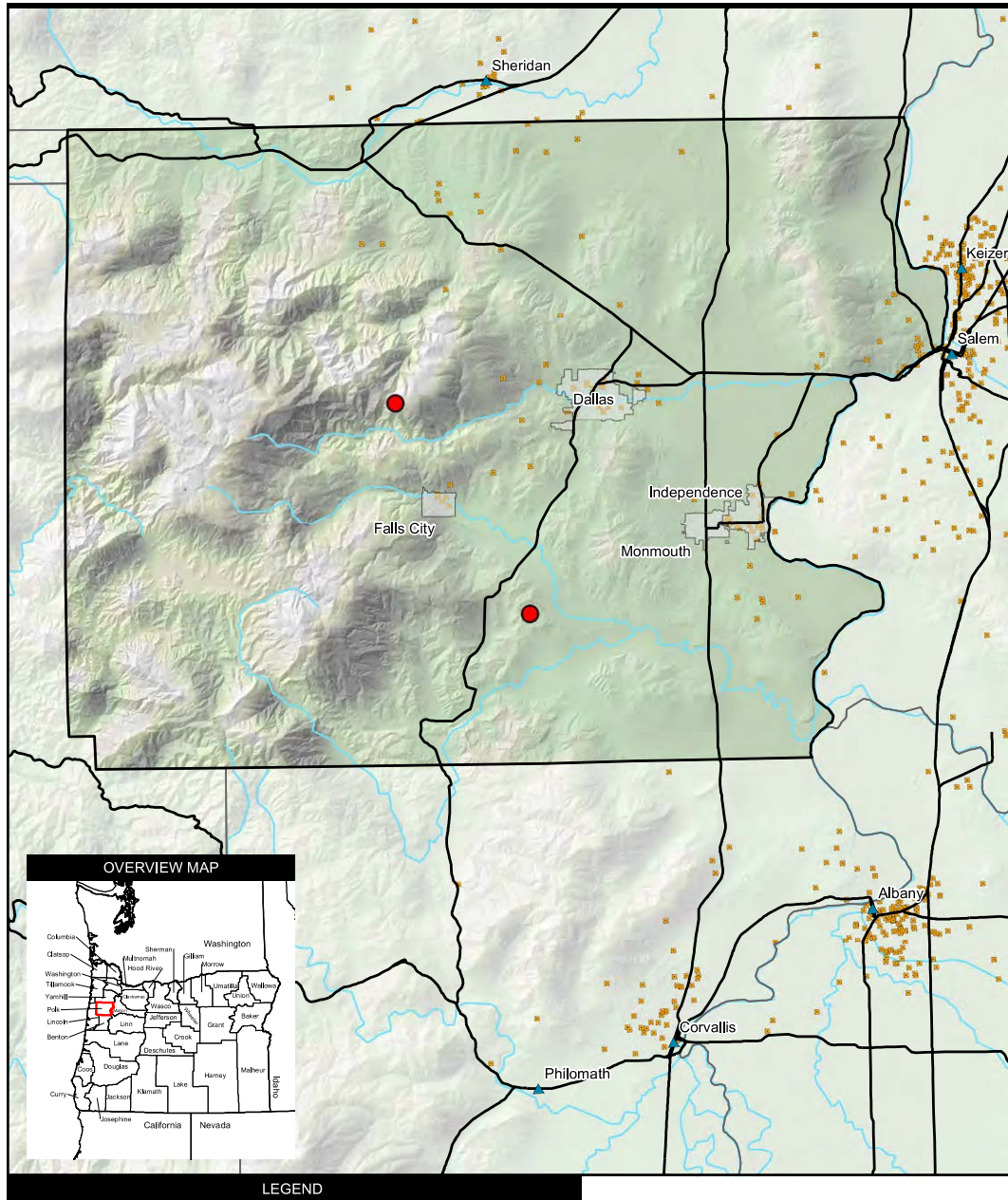
ODF records of historical fires show that minor wildland fires occur regularly in Polk County. Fire protection services have generally been able to contain these fires before they exceed 10 acres. The county’s success in controlling wildland fires is likely due to a combination of well- run fire protection services, moderately high to high levels of rainfall, and the fact that most of the county’s forests are disease-free and actively managed for timber.

Due to successful fire control, the minor wildland fires which have occurred in Polk County have damaged relatively few residential areas, scattered buildings, and natural resources in the affected forests. However, if a major wildland fire were to occur in the county, it would have the potential to severely impact residential structures, roads, power lines, and other critical infrastructure.

Significant conflagration fires have taken place in Polk County; such as the 1849 Siletz fire that burned at least two million acres of forestland (including 800,000 acres in portions of Lincoln and Polk counties), an unnamed fire in 1945 (12,785-acres), and the Rockhouse fire (5,000 acres), and Shady Lane fire (1,100 acres) in 1987. The Shady Lane fire, affecting the Rickreall Watershed, was declared a State Conflagration and received FEMA Fire Suppression Assistance and caused sediment damage to the Mercer Reservoir the sources of the City of Dallas’ water supply.²² Recent wildfires (1962-2004) are shown in Map 2-7.

²² Polk County Community Wildfire Protection Plan (2009)

Map 2-7 Wildfire History (1962-2004)



Source: Polk County NHMP (2009).

There have been two significant wildfire events since the previous plan (as shown in *italics* below):

- *August 17, 2013. 200-acre wildfire along Highway 22 burned near a winery close to Dallas. Firefighters from Dallas, Yamhill, Polk County, Sheridan, Willamina, McMinnville and Depoe Bay were dispatched.*
- *July 24, 2015. 250- to 300-acre wildfire West of Monmouth – contained after several hours. No injuries or reported damages to property.*

Probability Assessment

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). Once a fire has started, several conditions influence its behavior, including fuel, topography, weather, drought, and development.

Based on the available data and research for Polk County the NHMP Steering Committee determined the **probability of experiencing a Wildfire is “moderate”**, meaning one incident is likely within the next 75-year period.

Vulnerability Assessment

The [2009 Polk County Community Wildfire Protection Plan](#) (CWPP) profiles two strategic planning areas: Zone 1 is the forested, mountainous area in the western portion of the county, and Zone 2 is the primarily agricultural areas to the east. Each zone is distinguished based on similar fuel conditions that would require similar initial attack techniques.

The risk rating presented below, and summarized in Table 2-6 and displayed in Map 2-8, is from the Polk County CWPP (2009) and serves to identify where certain constant variables are present.

Ignition Risk: *Most wildfires in Polk County are human-caused and the risk for wildfire ignition becomes greater as the density of homes increases. There are only a few homes in Zone 1, these being located on the eastern edge of the zone. The density of homes outside the incorporated cities is fairly uniform in Zone 2. However, there is a concentration of homes in the suburbs of West Salem and Dallas. Not surprisingly, the number of fire starts in these areas is higher than in most areas.*

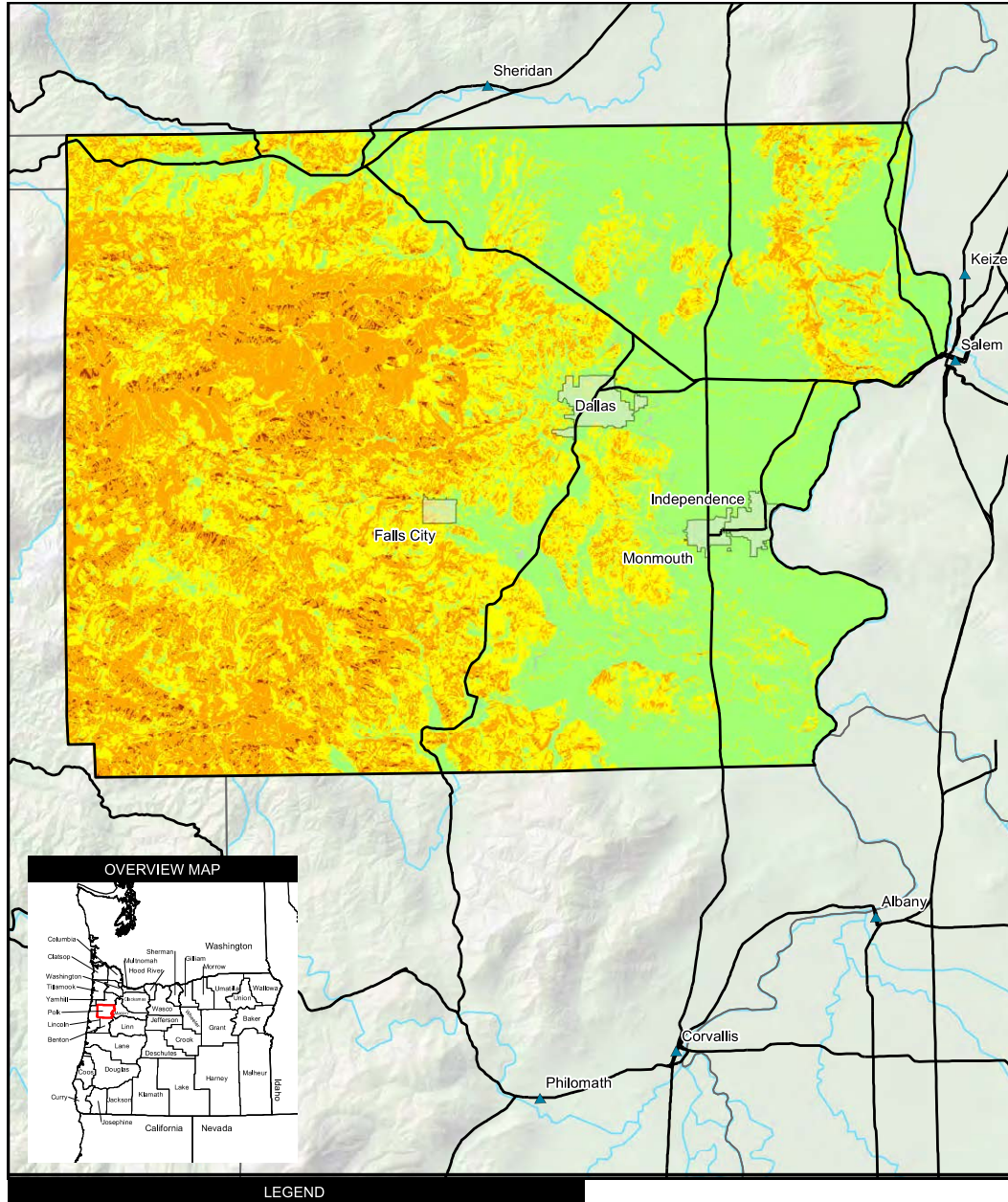
Hazard: *The high scores for this factor are primarily due to heavy fuel loads throughout both zones. Zone 1 does have heavier fuel loads overall, but the fuels in Zone 2 are considered flashy (easy to ignite and fast moving) which balances the heavier loads in Zone 1.*

Values: *Zone 1 has important natural resource values while Zone 2 has agricultural products and homes at risk from wildfire. Both have important infrastructure to be considered.*

Protection Capability: *While Zone 1 is vulnerable because response time from organized fire departments is high, it has proven mitigation efforts in place with loggers who are often on-site and have equipment for firefighting. Zone 2 lacks in community preparedness but response time from fire protection districts is good. Response capability for the Salem and Dallas Fire Departments is very strong.*

Overall Wildfire Risk Rating: Both Zones 1 and 2 are considered a High Risk based on the combined scores of the four factors. Total scores that are more than 119 are considered in the High Risk category.

Map 2-8 Wildfire Hazard Area



Source: Polk County NHMP (2009).

Table 2-6 Wildfire Risk Assessment Summary

Factor	Criteria	Possible Score	Zone 1 Score	Zone 2 Score
Ignition Risk	Wildfire History	5-20	10	20
	Home Density	0-10	0	2
	Other Wildfire Risk	0-10	5	10
Ignition Rating			<i>Moderate</i>	<i>High</i>
Hazard	Weather	20	20	20
	Slope	0-3	2	1
	Aspect	0-5	3	5
	Elevation	0-2	2	2
	Vegetation	0-20	20	20
	Crown Fire	0-10	10	5
Hazard Rating			<i>High</i>	<i>High</i>
Values	Natural Resources	0-15	15	8
	Home Density	0-30	0	7
	Infrastructure	0-20	20	20
Values Rating			<i>Moderate</i>	<i>Moderate</i>
Protection	Response Capability	0-36	36	8
	Community Preparedness	0-4	0	4
Protection Rating			<i>High</i>	<i>Moderate</i>
Total		0-195	143	132
Overall Risk Rating			High	High

Source: Polk County CWPP (2009)

A comprehensive risk and vulnerability assessment is not available. The Polk County CWPP provides some risk and vulnerability information related to Independence that has been incorporated into this plan as applicable.

Per the previous version of this plan the County has critical facilities and infrastructure located within areas of moderate, high, and very high risk.²³

Moderate risk areas contain 21,451 residential structures (value \$3.07B), 104 non-residential structures (value unknown), 18 government facilities (value \$5.9M), six

²³ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

emergency response facilities (value \$9.9M), 20 educational facilities (value \$45.8M), eight care facilities (value unknown), ten utilities (value \$1.5M) and one dam (value \$25M).

High risk areas contain 16,614 residential structures (value \$2.4B), 58 non-residential structures (value unknown), four government facilities (value \$851K), three emergency response facilities (value \$3.6M), nine educational facilities (value \$13.1M), four care facilities (value unknown), and six utility facilities (value \$1.7M).

Very high risk areas contain 7,707 residential structures (value \$1.1B), 13 non-residential structures (value unknown), three educational facilities (value unknown), and one utility facility (value unknown) with 2,664 residential structures (value \$3.07) and eight non-residential structures (value unknown) in extreme fire risk areas.

As such, the NHMP Steering Committee rated the county as having a **“moderate” vulnerability to Wildfire hazards**, meaning that between 1-10% of the region’s population or assets would be affected by a major disaster.

More information on this hazard can be found in the [Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP \(2015\)](#).

Windstorm

Significant Changes Since Previous Plan:

The Windstorm Hazard has been edited to reference new history since the 2009 Plan. This section has also been reformatted.

Characteristics

A windstorm is generally a short duration event involving straight-line winds and/or gusts in excess of 50 mph. The most persistent high winds take place along the Oregon Coast and in the Columbia River Gorge. High winds in the Columbia Gorge are well documented. The Gorge is the most significant east-west gap in the Cascade Mountains between California and Canada. Wind conditions in central Oregon are not as dramatic as those along the coast or in the Gorge, yet can cause dust storms or be associated with severe winter conditions such as blizzards. A majority of the destructive surface winds striking Oregon are from the southwest. Some winds blow from the east but most often do not carry the same destructive force as those from the Pacific Ocean.

Though tornadoes are not common in Oregon, these events do occasionally occur and sometime produce significant property damage and even injury. Tornadoes are the most concentrated and violent storms produced by earth's atmosphere, and can produce winds in excess of 300 mph. They have been reported in most of the regions throughout the state since 1887. Most of them are caused by intense local thunderstorms, common between April and October.

Location and Extent

The most common type of wind pattern affecting Polk County is straight-line winds, which originate as a downdraft of rain-cooled air, and spread out rapidly when they reach. Straight-line winds can produce gusts of up to 100 mph. For Polk County, the wind hazard levels are generally highest near the Willamette River and then fairly uniform across most of the rest of the county. In the mountainous areas, however, the level of wind hazard is strongly determined by local specific conditions of topography and vegetation cover. Mountainous terrain slows down wind movement, which is why Oregon's sheltered valley areas have the slowest wind speed in the state. However, in the foothills, the wind speeds may increase due to down-sloping winds from the mountains.

Although windstorms can affect the entire county, they are especially dangerous in developed areas with significant tree stands and major infrastructure, especially above ground utility lines. A windstorm will frequently knock down trees and power lines, damage homes, businesses, public facilities, and create a significant amount of storm related debris.

History

Windstorms with various intensity occur yearly. More destructive storms occur once or twice per decade, most recently in December 2015. One damaging windstorm (tornado) occurred north of Independence in Polk County, November 11, 1925. The tornado damaged

only a few structurally weak buildings and trees. Another tornado was documented in February, 1926 that damaged homes and trees in Polk County.

The following windstorms have occurred within, and/or near Polk County. Four (4) windstorm events were added to this hazard history section since the previous plan (shown in *italics* below):²⁴

- November 10-11, 1951 (Statewide): Extensive timber, building, and utility losses and disruption. Damage was experienced statewide with wind speeds ranging from 40-80 mph.
- December 1951 (Statewide): Serious damage to buildings and utility system disruption. Statewide wind speeds ranging from 40-100 mph.
- December 1955 (Statewide): In addition to extensive damage to buildings, power and telephone lines throughout the state, heavy destruction occurred in the Willamette Valley orchards. Statewide wind speeds ranging from 55-70 mph.
- November 1958 (Statewide): Extensive timber, building, and utility losses and disruption. All highways closed at one or more points from fallen trees. Statewide wind speeds ranging from 50-75 mph.
- October 1962 (Columbus Day Storm, Statewide): Downed trees and power lines, utility disruption, the Columbus Day storm was the equivalent of a Category IV hurricane in terms of central pressures and wind speeds. The storm, which started east of the Philippines as Typhoon Freda, measured 1,000 miles long as it hit the West Coast. There were a total of 38 fatalities, 84 houses destroyed, 5,000 houses severely damaged, and \$200M damages statewide. Statewide wind speeds ranging from 29-138. Wind speeds in Portland hit 116 mph.
- March 1963 (Statewide): Widespread destruction with wind speeds ranging from 39-100 mph.
- October 1967 (Statewide): Extensive agricultural, timber, power and telephone utilities, and home loses. There was one fatality and 15 injuries with wind speeds ranging from 70- 115 mph,
- March 1971 (Most of Oregon): Damages included extensive roof damage, toppled trees, power line breakages, and extensive utility disruption. Statewide wind speeds ranging from 40-71 mph.
- November 1981 (Most of Oregon): Most destructive windstorm since the 1962 Columbus Day storm. There were 11 fatalities and \$50M damages statewide. Average sustained wind speeds of 57 mph, with wind speeds ranging from 75-92 mph along coast, gusts.

²⁴ Taylor, George H., and Ray Hatton, 1999, *The Oregon Weather Book; The Spatial Hazard Events and Losses Database for the United States*, [Online Database]. Columbia, SC: University of South Carolina. Available at <http://www.sheldus.org>; U.S. Department of Commerce. National Climatic Data Center. Available at <https://www.ncdc.noaa.gov/>; National Weather Service Forecast Office. Available at <http://www.wrh.noaa.gov/pqr/paststorms/wind.php>; FEMA Disaster Declarations for Oregon. Available at https://www.fema.gov/disasters/grid/state-tribal-government/88?field_disaster_type_tid_1=All#

- February 1989 (Statewide): Together with below-freezing temperatures (-40°F) and stiff winds, more than one foot of snow fell on some areas. Damages included burst pipes, flooding and water damage, icy roads caused numerous accidents and injuries, several fires were also reported.
- December 1995 (Statewide): Very wet soil from an unusually rainy fall resulted in the toppling of many trees in the Willamette Valley. 100-119 mph coastal area winds creating extensive tree damage to forests, structures, autos, and utilities. (FEMA-1107-DR-OR)
- November 1997 (Western Oregon): Wind speed hit 52 mph in Willamette Valley. Trees were uprooted and considerable damage to small airports was reported.
- February 2002 (Western Oregon): Strongest storm to strike western Oregon in several years. Included downed power lines (due to tree fall), damage to buildings, and water supply problems (lack of power). Resulted in a Presidential declaration for coastal counties who experienced 70 mph winds, south of Polk County. Estimated damage costs \$6.14 million. (FEMA-1405-DR-OR)
- January 2006 (Western Oregon): Wind speeds up to 58 mph caused a total of \$500K in damages within Yamhill, Polk, Marion, Clackamas, Columbia, Washington, and Multnomah Counties.
- February 2006 (Western Oregon): Wind speeds up to 77 mph caused a total of \$277K in damages within Linn, Lane, Marion, Benton, Polk, and Yamhill Counties.
- December 2007 (Most of Oregon): Heavy snowfall, rains, rapid temperature warming created widespread flooding, tree blockages, landslides, transportation and utility disruptions, and 5 deaths in Oregon. Statewide wind speeds ranging from 50-100 mph and damages totaled \$180M.
- *January 17–21, 2012 (Willamette Valley): A severe winter storm that included high wind speeds, flooding, landslides, and mudslides. (FEMA-4055-DR-OR)*
- *March 11, 2012 (Western Oregon): [Executive Order No. 12-06](#): State of Emergency declared in Polk County due to damaging winds, heavy rains, flooding, mudslides, and landslides impacting Federal highways. Damages are estimated at \$5,856,881 of damage to federal-aid highways in the region.*
- *February 6–14, 2014 (Western Oregon): A strong winter storm system affected the Pacific Northwest February 6–10, 2014. The storm brought a mixture of arctic air, strong east winds, significant snowfall and freezing rain to several counties in northwest Oregon. (FEMA-4169-DR-OR, Polk not included in declaration)*
- *December 6-23, 2015 (Western Oregon): A severe winter storm, including straight-line winds, flooding, and landslides and mudslides occurring Dec. 6-23, 2015. Total estimated damages amounted to \$2.6M of individual assistance and \$24.4M of public assistance, 894 residences were impacted (11 destroyed, 75 major damage). Per capita damage estimate within Polk County of \$5.24. (FEMA-4258-DR-OR)*

Several additional, small windstorm events have occurred since the previous plan, see the [Storm Events Database](#) provided by the National Oceanic and Atmospheric Administration for more information.

Probability Assessment

Windstorms in the county usually occur in the winter from October to March, and their extent is determined by their track, intensity (the air pressure gradient they generate), and local terrain. Summer thunderstorms may also bring high winds along with heavy rain and/or hail. The National Weather Service uses weather forecast models to predict oncoming windstorms, while monitoring storms with weather stations in protected valley locations throughout Oregon.

Table 2-7 below shows the wind speed probability intervals that structures 33 feet above the ground would expect to be exposed to within a 25, 50 and 100-year period. The table shows that structures in Region 3, which includes Polk County, can expect to be exposed to 60 mph winds in a 25-year recurrence interval (4% annual probability).

Table 2-7 Probability of Severe Wind Events (Region 3)

	25-Year Event (4% annual probability)	50-Year Event (2% annual probability)	100-Year Event (1% annual probability)
Region 3: Mid/Southern Willamette Valley	60 mph	68 mph	75 mph

Source: Oregon State Natural Hazard Mitigation Plan, 2009

Based on the available data and research for Polk County, the NHMP Steering Committee determined the **probability of experiencing a windstorm is “high”**, meaning one incident is likely within the next 35-year period.

Vulnerabilities

Many buildings, utilities, and transportation systems within Polk County are vulnerable to wind damage. This is especially true in open areas, such as natural grasslands or farmlands. It is also 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.

Fallen trees are especially troublesome. They can block roads and rails for long periods of time, impacting emergency operations. In addition, up-rooted or shattered trees can down power and/or 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. In Polk County, trees are more likely to blow over during the winter (wet season).

A comprehensive risk and vulnerability assessment is not available for the windstorm hazard. Due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all residential and critical facilities and infrastructure within the County are at risk.

As such, the NHMP Steering Committee rated the county as having a “**high**” vulnerability to **windstorm hazards**, meaning that more than 10% of the region’s population or assets would be affected by a major disaster.

More information on this hazard can be found in the [Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP \(2015\)](#).

Winter Storm

Significant Changes Since Previous Plan:

The Winter Storm hazard has been edited to reference new history since the 2009 Plan. This section has also been reformatted.

Characteristics

Winter storms affecting Polk County are generally characterized by a combination of heavy rains and high winds throughout the county, sometimes with snowfall, especially at higher elevations. Heavy rains can result in localized or widespread flooding, as well as debris slides and landslides. High winds commonly result in tree falls which primarily affect the electric power system, but which may also affect roads, buildings and vehicles. This chapter deals primarily with the snow and ice effects of winter storms.

The winter storms that affect Polk County typically are not local events affecting only small geographic areas. Rather, winter storms are usually large cyclonic low-pressure systems that move in from the Pacific Ocean and affect large areas of Oregon and/or the whole Pacific Northwest. These storms are most common from October through March.

Ice storms are comprised of cold temperatures and moisture, but subtle changes can result in varying types of ice formation which may include freezing rain, sleet and hail. Of these, freezing rain can be the most damaging of ice formations.

Outside of mountainous areas, significant snow accumulations are much less likely in western Oregon than on the east side of the Cascades. However, if a cold air mass moves northwest through the Columbia Gorge and collides with a wet Pacific storm, then a larger than average snow fall may result.

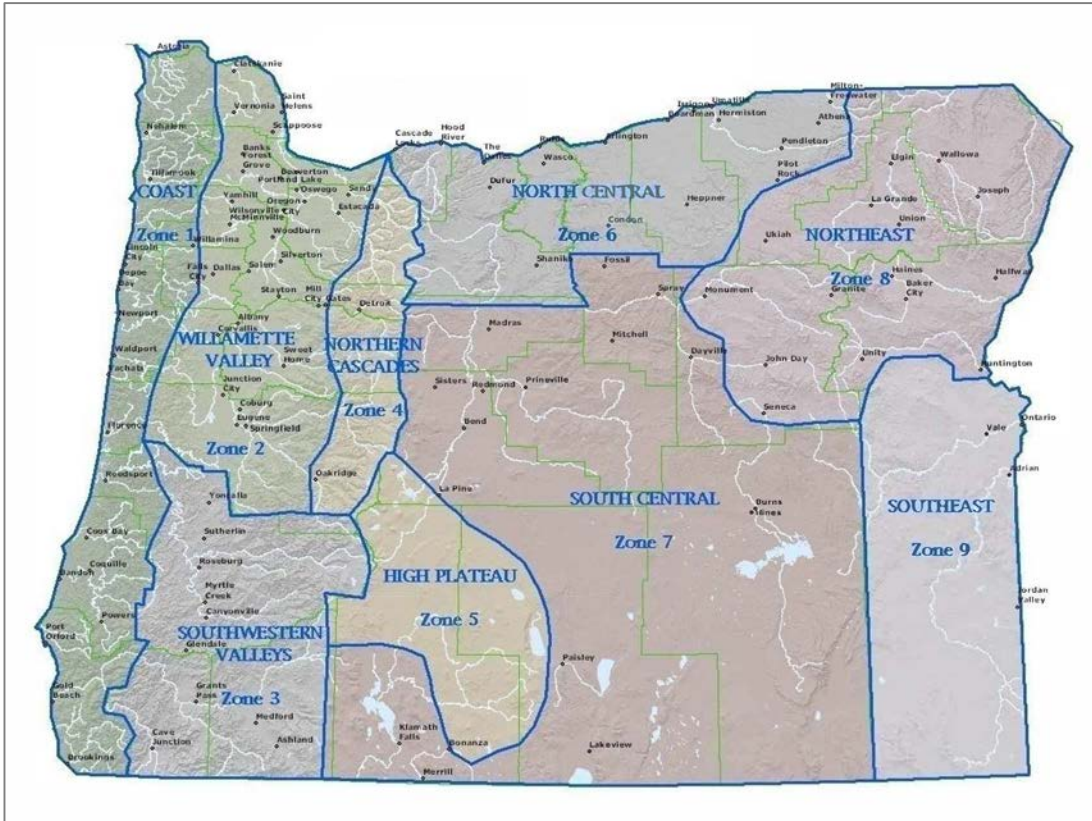
Location and Extent

Ice storms occasionally occur in northern areas of Oregon, resulting from cold air flowing westward through the Columbia Gorge. Sleet and hail can create hazards for motorists when it accumulates, but freezing rain can cause the most dangerous conditions within a community. Ice buildup can bring down trees, communication towers, and wires creating hazards for property owners, motorists, and pedestrians alike. The most common freezing rain problems occur near the Columbia Gorge. The Gorge is the most significant east-west air passage through the Cascades. Rain arriving from the west can fall on frozen streets, cars, and other sub-freezing surfaces, creating dangerous conditions.

The National Climatic Data Center has established climate zones in the United States for areas that have similar temperature and precipitation characteristics. Oregon’s latitude,

topography, and proximity to the Pacific Ocean give the state diversified climates. Polk County is located within [Zone 1: Coast](#) and [Zone 2: Willamette Valley](#). The climate in Zone 1 and Zone 2 generally consists of cool, wet winters and warm, dry summers; the coastal area of Polk County (Zone 1) maintains cooler temperatures during the summer.²⁵ The wet winters result in potentially destructive winter storms that produce heavy snow, ice, rain and freezing rain, and high winds generally within the Zone 2 portion of the county.

Figure 2-9 Oregon Climate Divisions



Source: Oregon Climate Service,

The principal types of winter storms that occur include:

- **Snowstorms:** require three variables: cold air, moisture, and air disturbance. In Oregon, the further inland and north one moves, the more snowfall can be expected. Blizzards are included in this category.
- **Ice storms:** are a type of winter storm that forms when a layer of warm air is trapped between two layers of cold air. Frozen precipitation melts when it hits the warm air layer, and refreezes when hitting the cold air layer below the inversion. Ice storms can include sleet (when the rain freezes before hitting the ground) or freezing rain (when the rain freezes once hitting the ground).

²⁵ Oregon Climate Service, "Climate of Polk County,"

- **Extreme Cold:** Often times low temperatures accompany winter storms. Low temperatures can become dangerous because snow and ice storms can cause power outages, leaving many people without adequate heating.

Unlike most other hazards, it is not simple to systematically map winter storm hazard zones. The entire County is susceptible to damaging severe weather. Winter storms that bring snow and ice can impact infrastructure, business, and individuals. Resources that exist at higher elevations have an increased risk of snow and ice, however, the entire County is susceptible to dangerous winter storm conditions.

History

Winter storms with various intensities occur yearly. However, more destructive winter storms occur once or twice per decade, most recently in December/ January 2016. The following winter storms have occurred within, or near Polk County. Seven (7) winter storm events were added to this hazard history section since the previous Plan (shown in *italics* below).²⁶

- January 1950 (Willamette Valley): Winter storm event with the heaviest snowfall since 1890. Many highway closures occurred with considerable property damage. A total of 68 inches of snow fell in Polk County. Damages included floods caused by melting snow, collapsed buildings, fallen trees, utility disruption, and sub-freezing temperatures that caused frozen pipes.
- January 1956 (Western Oregon): The snowstorm began with 3.5 inches of snowfall which was followed by sub-freezing temperatures. Freezing temperatures and heavy fog disrupted transportation and caused school closures.
- March 1960 (Statewide): Large snowstorm with the heaviest snowfall accumulation since 1950, 11-inches, resulted in numerous accidents, several with serious injuries throughout Polk County.
- January 1963 (Willamette Valley): Four inches of snowfall and large amounts of ice caused transportation and utility disruption.
- January 1969 (Statewide): Ten inches of snowfall was reported in Dallas leading to school and business closures, transportation and utility disruption. Sub-freezing temperatures caused burst pipes.
- November 1970 (County): An ice event caused electrical, heat, transportation and utility systems disruption, small fires, and school closures.
- January 1978 (Willamette Valley): A freezing rain event led to transportation disruption with eight deaths and numerous accidents.

²⁶ Taylor, George H., and Ray Hatton, 1999, *The Oregon Weather Book; The Spatial Hazard Events and Losses Database for the United States*, [Online Database]. Columbia, SC: University of South Carolina. Available at <http://www.sheldus.org>; U.S. Department of Commerce. National Climatic Data Center. Available at <https://www.ncdc.noaa.gov/>; National Weather Service Forecast Office. Available at <http://www.wrh.noaa.gov/pqr/paststorms/wind.php>; FEMA Disaster Declarations for Oregon. Available at https://www.fema.gov/disasters/grid/state-tribal-government/88?field_disaster_type_term_tid_1=All#

- January 1980 (Statewide): A series of storms brought snow, ice, wind, and freezing rain and caused six fatalities.
- February 1985 (Statewide): Western valleys received between 2-4 inches of snow which led to massive power failures (tree limbs broke power lines).
- December 1985 (Willamette Valley): Heavy snowfall was reported throughout the region.
- March 1988 (Statewide): Strong winds associated with heavy snow were reported throughout the state.
- February 1989 (Statewide): Together with below-freezing temperatures (-40°F) and stiff winds, more than one foot of snow fell on some areas. Damages included burst pipes, flooding and water damage, icy roads caused numerous accidents and injuries, several fires were also reported.
- February 1990 (Statewide): The Willamette Valley was coated with 2 to 4 inches of snowfall, while the higher hills around Portland received up to 1 foot.
- December 1992 (Western Oregon): Heavy snow fell throughout western Oregon causing a temporary closure of Interstate-5.
- February 1993 (Western Oregon): About one foot of heavy snow fell within a 24-hour period. The wet snow load broke tree limbs and powerlines which caused utility disruption.
- February 1996 (portions of Willamette Valley): Freezing rain fell for two days leading to the disruption of transportation, one death, and numerous accidents.
- Winter 1998-1999 (Statewide): Series of storms led to one of the snowiest winters in Oregon history.
- December 2003 – January 2004 (Statewide): Wet snow blanketed highways in the Willamette Valley, causing power lines and trees to topple. Most airports experienced closures and delays. (FEMA-1510-DR-OR).
- December 2006 (Most of Oregon): Polk County federally declared disaster due to damages from freezing rain. (FEMA-1632-DR-OR)
- December 2007 (Most of Oregon): Heavy snowfall, rains, rapid temperature warming created widespread flooding, tree blockages, landslides, transportation and utility disruptions, and 5 deaths in Oregon. Statewide wind speeds ranging from 50-100 mph and damages totaled \$180M.
- December 2008 (Willamette Valley): A series of storms dropped feet of snow over portions of the Willamette Valley. The onset of cold air moved in around December 14 and lingered through Christmas morning (FEMA-1824-DR-OR)
- *November 2011 (Polk County): Heavy snowfall occurred with accumulations between 5 and 7 inches.*
- *January 17–21, 2012 (Willamette Valley): A severe winter storm that included high wind speeds, flooding, landslides, and mudslides. (FEMA-4055-DR-OR)*
- *March 2012 (Western Oregon): A mixture of snow, rain, and wind occurred throughout much of the coast and Willamette Valley. Storm included snowfall*

accumulations of up to 7-inches and included damages due to downed trees and closed roads.

- *December 2013 (Willamette Valley): Region experienced heavy snowfall with accumulations up to 9-inches.*
- *February 6–14, 2014 (Western Oregon): A strong winter storm system affected the Pacific Northwest February 6–10, 2014. The storm brought a mixture of arctic air, strong east winds, significant snowfall and freezing rain to several counties in northwest Oregon. (FEMA-4169-DR-OR, Polk County was not included in declaration)*
- *December 6-23, 2015 (Western Oregon): A severe winter storm, including straight-line winds, flooding, and landslides and mudslides occurring Dec. 6-23, 2015. Total estimated damages amounted to \$2.6M of individual assistance and \$24.4M of public assistance, 894 residences were impacted (11 destroyed, 75 major damage). Per capita damage estimate within Polk County of \$5.24. (FEMA-4258-DR-OR)*
- *December 2016 (Western Oregon): A winter storm event affected the region bringing snow, high winds, freezing rain, and flooding. (FEMA-4296-DR-OR, Polk County was not included in declaration)*

Probability Assessment

The recurrence interval for a severe winter storm is about every 13 years. However, there can be many localized storms between these periods from November through February. Polk County experiences minor winter storms a couple times every year, to every other year and more severe winter storms once or twice per decade.

Based on the available data and research for Polk County the NHMP Steering Committee determined the **probability of experiencing a winter storm is “high”**, meaning one incident is likely within the next 35-year period.

Vulnerabilities

Given current available data, no quantitative assessment of the risk of winter storm was possible at the time of this NHMP update. However, assessing the risk to the county from winter storms should remain an ongoing process determined by community characteristics and physical vulnerabilities. Weather forecasting can give County resources (emergency vehicles, warming shelters) time to prepare for an impending storm, but the changing character of the county population and resources will determine the impact of winter storms on life and property in Polk County.

The most likely impact of snow and ice events on Polk County are road closures limiting access/egress to/from some locations, especially roads to higher elevations. Winter storms with heavy wet snow or high winds and ice storms may also result in power outages from downed transmission lines and/or poles.

Winter storms which bring snow, ice and high winds can cause significant impacts on life and property (for more information on [windstorms see the previous section](#)). Deaths related to winter storms can occur as a result of traffic accidents on icy roads, and hypothermia from prolonged exposure to the cold. Low temperatures and temporary loss of home

heating can be particularly hard on the elderly, young children and other vulnerable individuals.

Property is at risk due to flooding and landslides that may result if there is a heavy snowmelt. Additionally, ice, wind and snow can affect the stability of trees, power and telephone lines and TV and radio antennas. Down trees and limbs can become major hazards for houses, cars, utilities and other property. Such damage in turn can become major obstacles to providing critical emergency response, police, fire and other disaster recovery services.

Severe winter weather also can cause the temporary closure of key roads and highways, air and train operations, businesses, schools, government offices and other important community services. Below freezing temperatures can also lead to breaks in un-insulated water lines serving schools, businesses, industries, and individual homes. All of these effects, if lasting more than several days, can create significant economic impacts for the affected communities, surrounding region, and region. In the rural areas of Oregon severe winter storms can isolate small communities, farms, and ranches.

A comprehensive risk and vulnerability assessment is not available for the winter storm hazard. Due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all residential and critical facilities and infrastructure within the County are at risk.

As such, the NHMP Steering Committee rated the county as having a **“high” vulnerability to winter storm hazards**, meaning that more than 10% of the region’s population or assets would be affected by a major winter storm disaster.

More information on this hazard can be found in the [Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP \(2015\)](#).

Federal Disaster and Emergency Declarations

Reviewing past events can provide a general sense of the hazards that have caused significant damage in the county. Where trends emerge, disaster declarations can help determine priority hazard mitigation projects.

President Dwight D. Eisenhower approved the first federal disaster declaration in May 1953 following a tornado in Georgia. Since then, federally declared disasters have been approved within every state as a result of natural hazard related events. As of June 2017, FEMA has approved a total of 32 major disaster declarations, 65 fire management assistance declarations, and two (2) emergency declarations in Oregon.²⁷ When governors ask for presidential declarations of major disaster or emergency, they stipulate which counties in their state they want included in the declaration. Table 2-8 summarizes the major disasters declared in Oregon that affected Polk County, since 1953. The table shows that there have been ten (10) major disaster declarations for the county (two since the previous plan). All of which were related to weather events resulting primarily in flooding, landslides, and wind related damage.

Fire Management Assistance may be provided after a State submits a request for assistance to the FEMA Regional Director at the time a "threat of major disaster" exists. There has been one fire management assistance declaration on record for the county.

An Emergency Declaration is more limited in scope and without the long-term federal recovery programs of a Major Disaster Declaration. Generally, federal assistance and funding are provided to meet a specific emergency need or to help prevent a major disaster from occurring. Polk County has only one recorded Emergency Declaration related to the 2005 Hurricane Katrina evacuation.

²⁷ FEMA, *Declared Disasters by Year or State*, http://www.fema.gov/news/disaster_totals_annual.fema#markS. Accessed December, 2016.

Table 2-8 FEMA Major Disaster (DR), and Emergency (EM), and Fire Management Assistance (FMA) Declarations for Polk County

Declaration Number	Declaration Date	Incident Period		Incident	Individual Assistance	Public Assistance Categories
		From	To			
DR-184	12/24/1964	12/24/1964	12/24/1964	Heavy rains and flooding	Yes	A, B, C, D, E, F, G
DR-413	1/25/1974	1/25/1974	1/25/1974	Severe Storms, Snowmelt, Flooding	Yes	A, B, C, D, E, F, G
DR-1099	2/9/1996	2/4/1996	2/21/1996	Severe Storms/Flooding	Yes	A, B, C, D, E, F, G
DR-1510	2/19/2004	12/26/2003	1/14/2004	Severe Winter Storm	None	A, B, C, D, E, F, G
DR-1632	3/20/2006	12/18/2005	1/21/2006	Severe Storms, Flooding, Landslides, and Mudslides	None	A, B, C, D, E, F, G
DR-1683	2/22/2007	12/14/2006	12/15/2006	Severe Winter Storm and Flooding	None	A, B, C, D, E, F, G
DR-1733	12/8/2007	12/1/2007	12/17/2007	Severe Storms, Flooding, Landslides, and Mudslides	None	A, B, C, D, E, F, G
DR-1824	3/2/2009	12/13/2008	12/26/2008	Severe Winter Storm, Record and Near Record Snow, Landslides, and Mudslides	None	A, B, C, D, E, F, G
DR-4055	3/2/2012	1/17/2012	1/21/2012	Severe Winter Storm, Flooding, Landslides, and Mudslides	None	A, B, C, D, E, F, G
DR-4258	2/17/2016	12/6/2015	12/23/2015	Oregon Severe Winter Storms, Straight-line Winds, Flooding, Landslides, and Mudslides	None	A, B, C, D, E, F, G
FM-2066	10/10/1987	10/9/1987	-	Shady Lane Fire	None	-
EM-3228	9/7/2005	8/29/2005	10/1/2005	Hurricane Katrina Evacuation	None	B

Source: [FEMA, Oregon Disaster History. Major Disaster Declarations.](#)

Vulnerability Summary

Community vulnerabilities are an important component of the NHMP risk assessment. For more in-depth information regarding specific community vulnerabilities, reference Volume II, Jurisdictional Addenda and Appendix B: Community Profile. Changes to population, economy, built environment, critical facilities, and infrastructure have not significantly influenced vulnerability. New development has complied with the standards of the Oregon

Building Code and the county's development code including their floodplain ordinance. Data sources for the following community vulnerability information can be found in Appendix B – *Community Profile*, unless otherwise noted below.

Population

The socio-demographic qualities of the community population such as language, race and ethnicity, age, income, and educational attainment are significant factors that can influence the community's ability to cope, adapt to and recover from natural disasters. Historically, 80 percent of the disaster burden falls on the public.²⁸ Of this number, a disproportionate burden is placed upon special needs groups, particularly children, the elderly, the disabled, minorities, and low-income persons. Population vulnerabilities can be reduced or eliminated with proper outreach and community mitigation planning.

Population Vulnerabilities

- As of 2015, approximately 17% of Polk County's population is over the age of 64; that number is projected to rise to about 19% (or roughly 22,000 individuals) by 2035.
- The Polk County age dependency ratio²⁹ is 58.3, which is higher than that of the State of Oregon (52.3); the age dependency figure for the county is expected to increase to 60.6 by the year 2035.
- Polk County's real median income is decreasing, with the largest decreases in Independence and Monmouth.
- Approximately 17% of the total Polk County population lived at or below the poverty line in 2014, with 7.3% in "deep poverty" (earning less than half the federal poverty level).
- Approximately 11.7% of families are below the poverty line (9% for families with children).
- While over 90% of the population over the age of 25 has graduated high school or higher and about 29% have a bachelor's degree or higher, the cities of Falls City and Independence have about 20% of their population without a high school diploma (or equivalent).
- Approximately 10% of the population between the ages of 18-64 are without health insurance.
- Approximately 15% of the Polk County population is estimated to have a disability. Of that, approximately 4,600 individuals over 64 (38%) are disabled.
- Approximately 52% of Polk County renters spend more than 30% of their income on housing.

Economy

Economic diversification, employment and industry are measures of economic capacity. However, economic resilience to natural disasters is far more complex than merely restoring

²⁸ Hazards Workshop Session Summary #16, *Disasters, Diversity, and Equity*, University of Colorado, Boulder (2000).

²⁹ Age Dependency Ratio: the ratio of population typically not in the work force (less than 15, greater than 64)

employment or income in the local community. Building a resilient economy requires an understanding of how the component parts of employment sectors, workforce, resources and infrastructure are interconnected in the existing economic picture. The current and anticipated financial conditions of a community are strong determinants of community resilience, as a strong and diverse economic base increases the ability of individuals, families and the community to absorb disaster impacts for a quick recovery.

Economic Vulnerabilities

- According to the Oregon Employment Department, Polk County unemployment has decreased from 10.6% in 2010 to less than 5.7% in 2016.
- The largest sectors of employment in Polk County are Local Government (18.6%), Manufacturing (11.8%), Trade, Transportation, and Utilities (11.3%), Natural Resources and Mining (9.4%), and Leisure and Hospitality (8.3%).
- The Professional and Business Services sector is expected to have the most growth from 2015 to 2024 at 28%. Education and Health Services (17%) and Construction (17%) are the next closest growth sectors.

Environment

The capacity of the natural environment is essential in sustaining all forms of life including human life, yet it often plays an underrepresented role in community resiliency to natural hazards. The natural environment includes land, air, water and other natural resources that support and provide space to live, work and recreate.³⁰ Natural capital such as wetlands and forested hill slopes play significant roles in protecting communities and the environment from weather-related hazards, such as flooding and landslides. When natural systems are impacted or depleted by human activities, those activities can adversely affect community resilience to natural hazard events.

Environmental Vulnerabilities

- Forest, wetland, and riparian ecosystems are particularly vulnerable to drought, wildfire, and severe storm impacts.

Built Environment, Critical Facilities, and Infrastructure

Critical facilities (i.e. police, fire, and government facilities), housing supply and physical infrastructure are vital during a disaster and are essential for proper functioning and response. The lack or poor condition of infrastructure can negatively affect a community's ability to cope, respond and recover from a natural disaster. Following a disaster, communities may experience isolation from surrounding cities and counties due to infrastructure failure. These conditions force communities to rely on local and immediately available resources.

³⁰ Mayunga, J. "Understanding and Applying the Concept of Community Disaster Resilience: A capital-based approach. Summer Academy for Social Vulnerability and Resilience Building," (2007).

Housing Vulnerabilities

- Manufactured dwellings and other non-permanent residential structures account for 7.5% of the housing in Polk County. Manufactured dwellings account for 27.2% of the housing in Falls City. These structures are particularly vulnerable to certain natural hazards, such as earthquake, windstorms, and heavy flooding events.
- Based on U.S. Census data, approximately 60% of the residential housing in Polk County was built before the current seismic building standards of 1993 (around 75% in Falls City).³¹
- Approximately 30% of residential structures were constructed prior to the local implementation of the flood elevation requirements of the 1970's (county Flood Insurance Rate Maps –FIRMs- were not completed until the late 1970s and early 1980s).
- The housing vacancy rate in Polk County was estimated at just under 7% in 2014 (around 12% in Falls City).

Critical Facilities and Infrastructure Vulnerabilities

- Virtually all state and county roads and bridges in Polk County are vulnerable to multiple hazards such as flooding, landslides, and earthquakes. Impacts to the transportation system can result in the isolation of vulnerable populations, limit access to critical facilities, such as hospitals, and adversely impact local commerce, employment and economic activity.
- There is one general hospital in the county located in Dallas.
- All of Polk County's power is generated outside the region; there is no redundancy in power transmission and only limited redundancy in the power distribution network.
- Polk County contains two (2) "high threat potential" dams (Croft and Mercer reservoirs) and seven (7) "significant threat potential" dams.

National Flood Insurance Program (NFIP) Vulnerability

FEMA modernized the Polk County Flood Insurance Rate Maps (FIRMs) in December 2006. The table below shows that as of December 2016, Polk County (including NFIP participating incorporated cities except for Salem) has 428 National Flood Insurance Program (NFIP) policies in force. Of those, 183 are for properties that were developed before development of the initial FIRM. The last Community Assistance Visit (CAV) for Polk County was on August 22, 2000 (the most recent CAV was for Dallas was June 2004). The county is a member of the Community Rating System (CRS) and has a Class 8 rating; none of the incorporated cities are current CRS members. The table shows that the majority of flood insurance policies are for residential structures, primarily single-family homes.

There have been 40 paid claims in the county totaling just over \$682,000 (33 Pre-FIRM claims paid and zero (0) substantial damage claims paid to date). In addition, there is one (1)

³¹ Ibid.

Repetitive Loss (RL) Property³² located in Polk County and no Severe Repetitive Loss Properties.³³

Table 2-9 Flood Insurance Detail

Jurisdiction	Effective FIRM and FIS	Initial FIRM Date	Total Policies	Pre-FIRM Policies	Policies by Building Type				Minus Rated A Zone
					Single Family	2 to 4 Family	Other Residential	Non-Residential	
Polk County	-	-	428	183	334	27	25	42	28
Unincorporated	12/19/2006	2/15/1978	189	95	150	6	0	33	17
Dallas	12/19/2006	4/5/1988	156	68	131	14	6	5	8
Falls City	12/19/2006	7/7/1981	0	0	0	0	0	0	0
Independence	12/19/2006	4/5/1988	61	16	38	0	19	4	3
Monmouth	12/19/2006	4/5/1988	22	4	15	7	0	0	0

Jurisdiction	Insurance in Force	Total Paid Claims	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Paid Amount	Repetitive Loss Properties	Severe Repetitive Loss Properties	CRS Class Rating	Last CAV
Polk County	\$ 93,520,500	40	33	0	\$ 682,241	1	0	-	-
Unincorporated	\$ 37,538,000	31	25	0	\$ 578,415	1	0	8	8/22/2000
Dallas	\$ 33,852,300	9	8	0	\$ 103,826	0	0		6/3/2004
Falls City	\$ -	0	0	0	\$ -	0	0		none
Independence	\$ 16,665,200	0	0	0	\$ -	0	0		4/20/2004
Monmouth	\$ 5,465,000	0	0	0	\$ -	0	0		4/20/2004

Source: Information compiled by Department of Land Conservation and Development, September 2016.

Note 1: The data in this table differs from the data in Figure 2-12 due to the date of the underlying data.

Note 2: NFIP Information for the cities of Salem and Willamina is not provided in this NHMP. See Salem's Stand-alone NHMP and Yamhill County's NHMP for information for those cities.

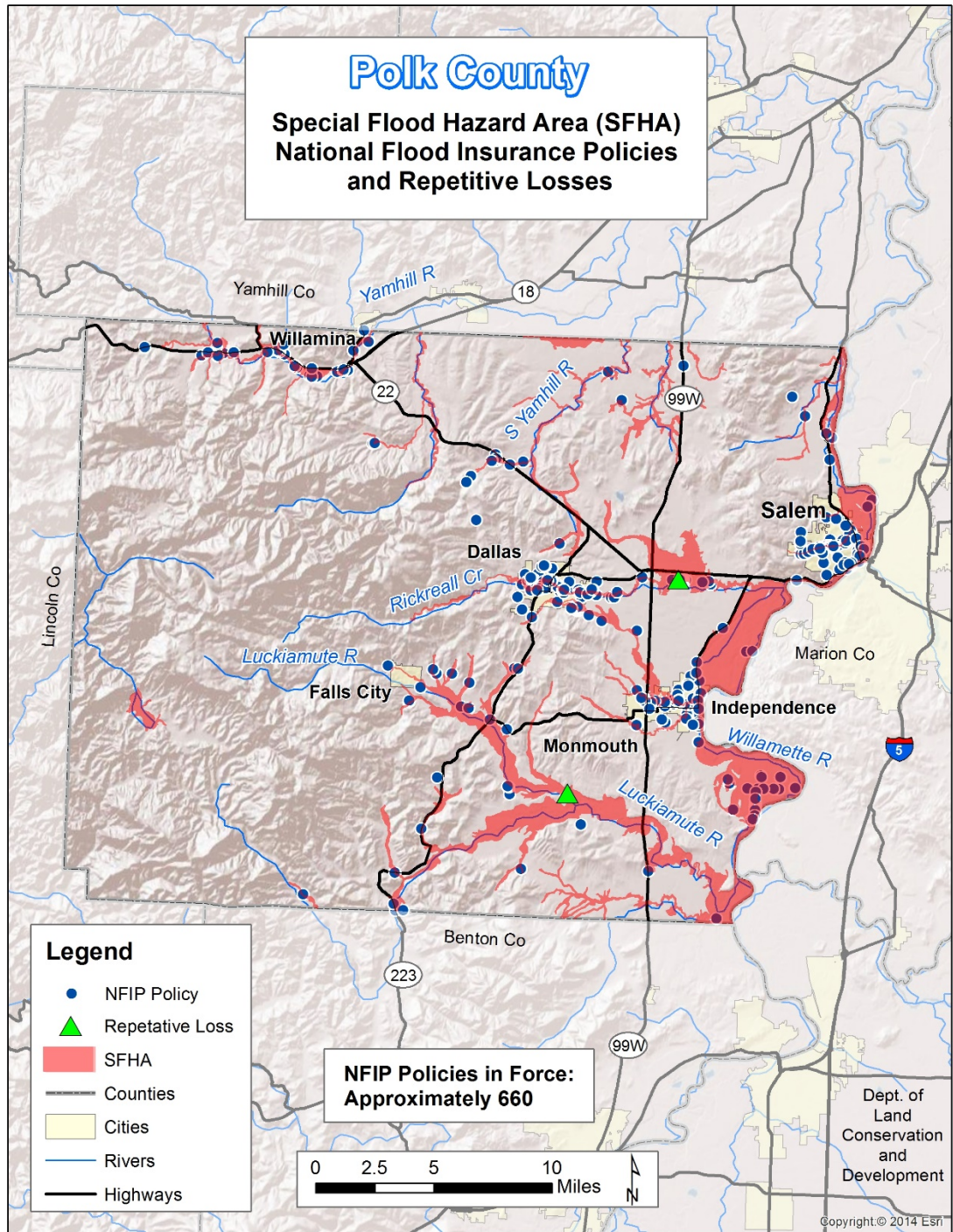
Mitigation Successes

A dwelling on Elkins Road, southwest of Monmouth in unincorporated Polk County was mitigated in 2015. The dwelling now has its lowest floor one foot higher than the design flood elevation (DFE) established for the project.

³² A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

³³ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000 and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

Figure 2-12 NFIP Policies, Repetitive Loss, & Severe Repetitive Loss Properties



Source: Department of Land Conservation and Development, data circa 2014, October 2016.

Risk Assessment

Multi-jurisdictional Risk Assessment - §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.

Dallas, Independence, Falls City, and Monmouth participated in County Steering Committee meetings and worked with OPDR to complete a jurisdiction specific hazard analysis; for more information on the process see Appendix A. City specific information is presented in Volume II, *Jurisdictional Addenda*.

Probability Summary

Table 2-10 below presents the probability scores for each of the natural hazards present in Polk County for which descriptions are provided herein, and in Volume II with detail for the participating cities. As shown in the table with **bold text**, several hazards are rated with high probabilities.

Table 2-10 Natural Hazard Probability Assessment Summary

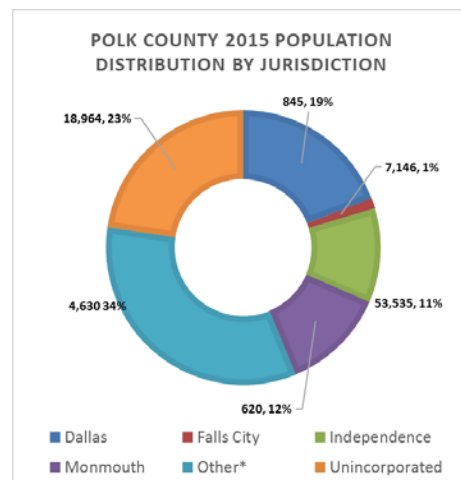
Hazard	Polk County	Dallas	Falls City	Independence	Monmouth
Drought	Moderate	Moderate	Moderate	Moderate	Low
Earthquake (Cascadia)	Moderate	Low	Moderate	Moderate	Moderate
Earthquake (Crustal)	Moderate	Low	Low	Low	Low
Flood	High	High	High	Moderate	Moderate
Landslide	High	Low	High	Low	Low
Volcano	Low	Low	Low	Low	Low
Wildfire	Moderate	Low	High	Low	Low
Windstorm	High	Moderate	High	High	Moderate
Winter Storm	High	High	High	High	High

Source: Polk County and City NHMP Steering Committees 2016.

Vulnerability Summary

Vulnerability assesses the extent to which people are susceptible to injury or other impacts resulting from a hazard as well as the exposure of the built environment or other community assets (social, environmental, economic, etc.) to hazards. The exposure of community assets to hazards is critical in the assessment of the degree of risk a community has to each hazard. Identifying the populations, facilities and infrastructure at risk from various hazards can assist the county in prioritizing resources for mitigation, and can assist in directing damage assessment efforts after a hazard event has occurred. The exposure of county and city assets to each hazard and potential implications are explained in each hazard section.

Vulnerability includes the percentage of population and property likely to be affected under an “average” occurrence of the hazard. Polk County



evaluated the best available vulnerability data to develop the vulnerability scores presented below. For the purposes of this NHMP, the county and cities utilized the Oregon Military Department – Office of Emergency Management (OEM) Hazard Analysis methodology vulnerability definitions to determine hazard probability.

Table 2-11 below presents the vulnerability scores for each of the natural hazards present in Polk County and for participating cities. As shown in the table with **bold text**, the windstorm and winter storm hazards are the only hazards that are rated with a high vulnerability for the county.

Table 2-11 Community Vulnerability Assessment Summary

Hazard	Polk County	Dallas	Falls City	Independence	Monmouth
Drought	Moderate	Moderate	Moderate	Moderate	Low
Earthquake (Cascadia)	Moderate	High	High	High	High
Earthquake (Crustal)	Moderate	Moderate	Low	Moderate	Moderate
Flood	Moderate	Moderate	Moderate	Moderate	Moderate
Landslide	Low	Low	Moderate	Low	Low
Volcano	Moderate	Low	Moderate	Moderate	Low
Wildfire	Moderate	Low	High	Low	Low
Windstorm	High	Moderate	Moderate	Moderate	Moderate
Winter Storm	High	Moderate	Low	Moderate	Moderate

Source: Polk County and City NHMP Steering Committees 2016.

Hazard Analysis Matrix

The hazard analysis matrix 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 (assessed in the previous sections), and (2) the likelihood or probability of the harm occurring. The table below presents the entire updated hazard analysis matrix for Polk County. The hazards are listed in rank order from high to low. Table 2-12 below shows that hazard scores are influenced by each of the four categories combined. With considerations for past historical events, the probability or likelihood of a particular hazard event occurring, the vulnerability to the community, and the maximum threat or worst-case scenario, windstorm and winter storm events rank as the top hazard threats to the county (top tier). Floods, Cascadia Subduction Zone earthquake, crustal earthquake, and drought events rank in the middle (middle tier). Wildfire, Landslide, and Volcano (volcanic ash) comprise the lowest ranked hazards in the county (bottom tier).

Table 2-12 Hazard Analysis Matrix – Polk County

Hazard	History	Probability	Vulnerability	Maximum Threat	Total Threat Score	Hazard Rank	
Windstorm	20	70	40	100	230	# 1	<i>Top Tier</i>
Winter Storm	20	70	40	100	230	# 1	
Flood - Riverine	20	70	25	50	165	#3	<i>Middle Tier</i>
Earthquake - Cascadia	2	35	25	100	162	#4	
Earthquake - Crustal	2	35	25	100	162	#4	
Drought	10	35	25	90	160	#6	
Wildfire (WUI)	10	35	25	50	120	#7	<i>Bottom Tier</i>
Landslide	8	70	5	10	93	#8	
Volcano	2	7	25	50	84	#9	

Source: Polk County Steering Committee (2016)

For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with a sense of hazard priorities, but does not predict the occurrence of a particular hazard.

Hazard Analysis Methodology

The hazard analysis methodology in Oregon (primarily to inform Emergency Operations Planning) was first developed by FEMA circa 1983, and gradually refined by the Oregon Military Department’s Office of Emergency Management over the years.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible). Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%. We include the hazard analysis summary here to ensure consistency between the EOP and NHMP.

The Oregon method provides the jurisdiction with a sense of hazard priorities, or relative risk. It doesn't predict the occurrence of a particular hazard, but it does "quantify" the risk of one hazard compared with another. By doing this analysis, planning can first be focused where the risk is greatest.

In this analysis, severity ratings, and weight factors, are applied to the four categories of history, vulnerability, maximum threat (worst-case scenario), and probability as demonstrated below.

History (Weight Factor = 2)

History is the record of previous occurrences. Events to include in assessing history of a hazard in different jurisdictions are events for which the following types of activities were required:

- The Emergency Operations Center (EOC) or alternate EOC was activated;
- Three or more Emergency Operations Planning (EOP) functions were implemented, e.g., alert & warning, evacuation, shelter, etc.;

- An extraordinary multi-jurisdictional response was required; and/or
- A "Local Emergency" was declared.

LOW = 0 to 1 event in the past 100 years, scores between 1 and 3 points

MODERATE = 2 to 3 event in the past 100 years, scores between 4 and 7 points

HIGH = 4+ events in the past 100 years, scores between 8 and 10 points

Probability (Weight Factor = 7)

Probability is the likelihood of future occurrence within a specified period of time.

LOW = one incident likely within 75 to 100 years, scores between 1 and 3 points

MODERATE = one incident likely within 35 to 75 years, scores between 4 and 7 points

HIGH = one incident likely within 10 to 35 years, scores between 8 and 10 points

Vulnerability (Weight Factor = 5)

Vulnerability is the percentage of population and property likely to be affected under an "average" occurrence of the hazard.

LOW = < 1% affected, scores between 1 and 3 points

MODERATE = 1 - 10% affected, scores between 4 and 7 points

HIGH = > 10% affected, scores between 8 and 10 points

Maximum Threat (Weight Factor = 10)

Maximum threat is the highest percentage of population and property that could be impacted under a worst-case scenario.

LOW = < 5% affected, scores between 1 and 3 points

MODERATE = 5 - 25% affected, scores between 4 and 7 points

HIGH = > 25% affected, scores between 8 and 10 points

Jurisdiction Specific Risk Assessment

Multi-jurisdictional Risk Assessment - §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.

The four participating cities in Polk County: Dallas, Falls City, Independence, and Monmouth completed a jurisdiction specific hazard analysis. The multi-jurisdictional risk assessment information is located herein and within the Risk Assessment section of each jurisdiction's addendum, which is located in Volume II of this NHMP.

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SECTION 3: MITIGATION STRATEGY

Section 3 outlines Polk County's strategy to reduce or avoid long-term vulnerabilities to the identified hazards. Specifically, this section presents a mission and specific goals and actions thereby addressing the mitigation strategy requirements contained in 44 CFR 201.6(c). The NHMP Steering Committee reviewed and updated the mission, goals and action items documented in this plan. Additional planning process documentation is in Appendix A.

Mitigation Plan Mission

The plan mission states the purpose and defines the primary functions of Polk County's NHMP. It is intended to be adaptable to any future changes made to the plan and need not change unless the community's environment or priorities change.

The mission of the Polk County NHMP is:

To assist in reducing risk, preventing loss, and protecting life, property, and the environment from future natural hazard events. The plan fosters collaboration and coordinated partnerships among public and private partners. This can be achieved by increasing public awareness and education and identifying activities to guide the county towards building a safer community.

The 2017 NHMP Steering Committee reviewed the previous plan's mission statement and agreed to retain it without modifications.

Mitigation Plan Goals

Mitigation plan goals are more specific statements of direction that Polk County citizens, and public and private partners can take while working to reduce the county's risk from natural hazards. These statements of direction form a bridge between the broad mission statement and particular action items. The goals listed here serve as checkpoints as agencies and organizations begin implementing mitigation action items.

Stakeholder participation was a key aspect in developing the original plan goals in 2006. Meetings with the project Steering Committee, stakeholder interviews and public workshops all served as methods to obtain input and priorities in developing goals for reducing risk and preventing loss for natural hazards in Polk County.

The 2017 Polk County NHMP Steering Committee reviewed the previous plan goals in comparison to the State Natural Hazard Mitigation Plan (2015) goals and determined that they would retain their goals without modifications.

All the plan goals are important and are listed below in no particular order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider to implement first, should funding become available.

Below is a list of the plan goals:

GOAL 1: PUBLIC EDUCATION AND AWARENESS

Provide public information and education/awareness to all residents of the county concerning natural hazard areas and mitigation efforts.

GOAL 2: PREVENTIVE AND IMPLEMENTATION

Develop and implement activities to protect human life, commerce, property and natural systems.

GOAL 3: COLLABORATION AND COORDINATION

Strengthen hazard mitigation by increasing collaboration and coordination among citizens, public agencies, non-profit organizations, businesses, and industry.

GOAL 4: FUNDING AND PARTNERSHIPS

Seek partnerships in funding and resources for future mitigation efforts.

GOAL 5: EMERGENCY OPERATIONS

Coordinate and integrate natural hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL 6: NATURAL RESOURCES UTILIZATION

Link land use planning, development criteria, codes, and natural resources and watershed planning with natural hazard mitigation.

The participating cities agreed to retain the plan mission and goal statements.

Action Item Development Process

Development of action items was a multi-step, iterative process that involved brainstorming, discussion, review, and revisions. Action items can be developed through a number of sources. The figure below illustrates some of these sources.

Figure 3-1 Development of Action Items



The majority of the action items were first created during the previous NHMP planning processes. During these processes, Steering Committees developed maps of local vulnerable populations, facilities, and infrastructure in respect to each identified hazard. Review of these maps generated discussion around potential actions to mitigate impacts to the vulnerable areas. The Oregon Partnership for Disaster Resilience (OPDR) provided guidance in the development of action items by presenting and discussing actions that were used in other communities. OPDR also took note of ideas that came up in Steering Committee meetings and drafted specific actions that met the intent of the Steering Committee. All actions were then reviewed by the Steering Committee, discussed at length, and revised as necessary before becoming a part of this document.

Priority Actions

Action items identified through the planning process are an important part of the mitigation plan. Action items are detailed recommendations for activities that local departments, citizens, and others could engage in to reduce risk. Due to resource constraints, Polk County and participating cities are listing a set of high priority actions (Table 3-2) in an effort to focus attention on an achievable set of high leverage activities over the next five-years. This plan identifies priority actions based on an evaluation of high impact hazards, resource availability and FEMA identified best practices.

Note 1: See Volume II, Jurisdictional Addenda, for the Priority Actions for each participating city.

Action Item Matrix

The action item matrix (Table 3-3) presents a pool of mitigation actions. The majority of these actions carry forward from prior versions of this plan. This expanded list of actions is available for local consideration as resources, capacity, technical expertise and/or political will become available.

Priority Actions

The county is listing a set of high priority actions in an effort to focus attention on an achievable set of high leverage activities over the next five-years. The county's priority actions are listed below in Table 3-1.

Action Item Pool

Table 3-2 presents a pool of mitigation actions. This expanded list of actions is available for local consideration as resources, capacity, technical expertise and/or political will become available.

The majority of these actions carry forward from prior versions of this plan.

See Volume II, *Jurisdictional Addenda*, for the Action Item Matrix for each participating city.

Table 3-1 Polk County Priority Action Items

Year Action Created	Action Item #	Description	Managing Department / Agency	Timeframe	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility	Status
Priority Actions							
Multi-Hazard Actions (MH)							
2006 (Revised 2017)	MH #1	Identify primary and secondary transportation routes to interconnect critical facilities. Create a map with these emergency routes to be used in the event of a natural hazard.	Emergency Management - HMT	Ongoing	General Fund	BC: TBD TF: Yes	Implemented
2017	MH #2	Reduce potential isolation of critical facilities in the event of a natural hazard by creating redundancy. Create a map with alternatives transportation routes. Create a plan for multiple communication alternatives.	Public Works/Emergency Management	1-5 years	General Fund	BC: TBD TF: Yes	New
2017	MH #3	Utilize social media as a communication outlet in the event of a natural hazard.	Emergency Management	Ongoing	General Fund	BC: TBD TF: Yes	New
Windstorm Action (WS)							
2006 (Revised 2017)	WS #1	Develop and implement programs to keep trees from threatening lives, property, and public infrastructure during windstorm events. Identify hazard trees, encourage harvesting of hazard trees within utility and road corridors, and those blown down during storm events.	Emergency Management- HMT, Public Works, Community Development	Ongoing	General Fund, HMGP	BC: TBD TF: Yes	Implemented

Source Polk County NHMP Steering Committee, updated 2017

Table 3-2 Polk Action Items

Year Action Created	Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility	Status
Mitigation Action Pool							
Multi-Hazard Actions (MH)							
2006 (Revised 2017)	MH #4	Review and update Polk County Emergency Operations Plan on an annual basis. Balance the objectives of existing program's goals with natural hazard mitigation.	Emergency Management - (HMT) and Planning Division	Ongoing	General Fund	BC: TBD TF: Yes	Implemented
2006 (Revised 2017)	MH #5	Identify coordination and collaborative opportunities to maximize or leverage funding opportunities that address multi-jurisdictional projects. Consider opportunities for public and private partnerships.	Emergency Management- HMT	Ongoing	General Fund, HMGP, HMA, HSGP	BC: TBD TF: Yes	Implemented
2006	MH #6	Strengthen emergency services preparedness and response by linking emergency services with natural hazard mitigation programs, and enhance public education on a regional scale.	Emergency Management - HMT	Ongoing	General Fund, HSGP, HMGP	BC: TBD TF: Yes	Implemented
2006 (Revised 2017)	MH #7	Develop, enhance, implement, and sustain education programs aimed at mitigating natural hazards and reducing the risk to citizens, public agencies, private property owners, businesses, and schools. Include materials concerning mitigation, preparedness, and safety procedures for all natural hazards.	School districts, facility safety personnel; Willamette ESD; Emergency Management- HMT; County Admin	Ongoing	General Fund, HMGP, HMA, HSGP	BC: TBD TF: Yes	Implemented
2009 (Revised 2017)	MH #8	Develop, incorporate, and cross reference mitigation planning provisions into zoning ordinances and all community planning processes such as comprehensive, capital improvement, land use, transportation, and emergency operations plans, etc to demonstrate multi-benefit considerations and facilitate using multiple funding sources. Pay particular attention to maintaining the floodway, protecting critical infrastructure, and private residences.	Emergency Management- HMT, Planning, County Admin	Ongoing	General Fund, EOC, HMGP, HSGP, HMA	BC: TBD TF: Yes	Implemented
2009 (Revised 2017)	MH #9	Update and maintain critical facility list needing emergency back-up power systems. Prioritize critical facilities susceptible to short term power disruption. (i.e. first responder and medical facilities, schools, correctional facilities, and water and sewage pump stations, etc.). Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities as funding becomes available.	GIS, Community Development	Ongoing	General Fund, HSGP	BC: TBD TF: Yes	Implemented

Source Polk County NHMP Steering Committee, updated 2017.

MH=Multi-Hazard

Table 3-2 Polk Action Item Pool (continued)

Year Action Created	Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility	Status
Mitigation Action Pool							
2009 (Revised 2017)	MH #10	Install lightning rods and lightning grade surge protection devices on any new critical electronic components such as warning systems, communications equipment, and computers for critical facilities.	County Admin/ Public Works	Ongoing	General Fund, HMGP	BC: TBD TF: Yes	Implemented
2006 (Revised 2017)	MH #11	Update the county's debris management plan. Enhance strategies for debris management and/or removal after windstorm events.	Emergency Management - HMT	Ongoing	General Fund, PA	BC: TBD TF: Yes	Implemented
Drought Actions (DR) - including expansive soils							
2006 (Revised 2017)	DR #1	Encourage dissemination of ideas by county-based agencies on effective methods of water use curtailment and provide information about emergency water rights for domestic uses.	Community Development Department	Ongoing	General Fund, NRCS	BC: TBD TF: Yes	Implemented
2006	DR #2	Encourage water providers to inter-tie water systems	Community Development Department	Ongoing	General Fund	BC: TBD TF: Yes	Implemented
2006	DR #3	Support the technical service and low interest loans provided to farmers and ranchers so that they can develop livestock watering systems.	Polk SWCD	Ongoing	General Fund	BC: TBD TF: Yes	Implemented
2006	DR #4	Encourage storage of water, especially off stream storage.	Community Development Department	Ongoing	General Fund	BC: TBD TF: Yes	Implemented
2006	DR #5	Support agencies' plan for long-range water resources development that leads to additional water supplies and help determine funding sources for the studies.	Community Development Department/ OWRD	Ongoing	General Fund, NRCS	BC: TBD TF: Yes	Implemented
2006 (Revised 2017)	DR #6	Notify property owners when expansive soils are identified on their property.	County Community Development Department	Ongoing	General Fund, HMGP	BC: TBD TF: Yes	Implemented
2006 (Revised 2017)	DR #7	Require road design, engineering, and construction processes that address expansive soil conditions. Water absorption prevention, impermeable membrane, soil compaction, and drainage methods need to be considered once geologic studies determine soil composition. Develop revisions for and revise the Polk County Road Standards for areas of the county with expansive soils.	Public Works	Ongoing	General Fund	BC: TBD TF: Yes	Partially Implemented

Source Polk County NHMP Steering Committee, updated 2017
MH=Multi-Hazard, DR=Drought

Table 3-2 Polk Action Item Pool (continued)

Year Action Created	Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility	Status
Mitigation Action Pool							
Earthquake Actions (EQ)							
2006 (Revised 2017)	EQ #1	Encourage reduction of nonstructural and structural earthquake hazards in homes, schools, businesses, and government offices. Inform residents and business owners of the value of earthquake hazard insurance.	Emergency Management - HMT	Ongoing	General Fund, HMGP, NEHRP	BC: TBD TF: Yes	Implemented
2006 (Revised 2017)	EQ #2	Encourage seismic strength evaluations of critical facilities to identify vulnerabilities and to meet current seismic standards. Improve local capabilities to perform earthquake building safety evaluations.	Emergency Management - HMT	Ongoing	General Fund	BC: TBD TF: Yes	Implemented
2009 (Revised 2017)	EQ #3	Use priority transportation route map to identify and prioritize bridges that that are not seismically adequate. Retrofit these bridges as funding becomes available.	County Public Works	Ongoing	General Fund, FHWA	BC: TBD TF: Yes	Implemented
2009 (Revised 2017)	EQ #4	Implement and enforce the State Building Codes. Inspect and/or certify all new construction as applicable.	Community Development Department, Building	Ongoing	General Fund	BC: TBD TF: Yes	Implemented
Flood Actions (FL) - including erosion							
2006 (Revised 2017)	FL #1	Develop an outreach program to educate public concerning NFIP participation benefits, floodplain development, land use regulation, and NFIP flood insurance availability to facilitate continued compliance with the NFIP. Conduct workshops for target audiences on National Flood Insurance Programs, mitigation activities.	Community Development Department	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes	Implemented
2009 (Revised 2017)	FL #2	Identify and mitigate repetitively flooded structures and infrastructures, analyze the threat to these facilities, and prioritize mitigation actions to acquire, relocate, elevate, and/or flood proof to protect the threatened population. Prioritize most cost beneficial and feasible projects.	Community Development Department	Ongoing	General Fund, HMA, HMGP	BC: TBD TF: Yes	Implemented
2006 (Revised 2017)	FL #3	Continue to coordinate with appropriate agencies, and maintain an inventory of all aggregate operations adjacent to or within the floodplain.	Community Development Department	Ongoing	General Fund	BC: TBD TF: Yes	Implemented

Source Polk County NHMP Steering Committee, updated 2017

EQ=Earthquake, FL=Flood

Table 3-2 Polk Action Item Pool (continued)

Year Action Created	Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility	Status
Mitigation Action Pool							
2009 (Revised 2017)	FL #4	Prioritize locations along County Roads that have frequent flooding. Use this prioritized list to determine projects for reducing frequency of flooding such as: increase culvert sizes and drainage efficiency, construct concrete wing walls at culvert or bridge entrances and outlets to direct water flow into their openings, raise bridge height or convert bridge from a multi-span to a single span to increase water flow and reduce debris catchment.	Public Works	Ongoing	General Fund, HMGP, HMA, PA	BC: TBD TF: Yes	Implemented
2009	FL #5	Install new precipitation measuring gauges and develop monitoring and early warning program.	Public Works	Ongoing	General Fund, NOAA/ NWS, HMGP, HMA	BC: TBD TF: Yes	Implemented
2006	FL #6	Maintain public drainage systems and encourage property owners to maintain private drainage systems.	Public Works	Ongoing	General Fund	BC: TBD TF: Yes	Implemented
2009	FL #7	Develop and provide information to all residents on riverbank erosion and methods to prevent it in an easily distributed format.	Emergency Management - HMT	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes	Implemented
2009	FL #8	Install riprap, or pilings to harden or "armor" a stream bank where severe erosion occurs.	Public Works	Ongoing	General Fund, HMGP, HMA, NRCS	BC: TBD TF: Yes	Implemented
2009	FL #9	Install bank protection such as rock, concrete, asphalt, vegetation, or other armoring or protective materials to provide river bank protection.	Public Works	Ongoing	General Fund, HMGP, HMA, NRCS	BC: TBD TF: Yes	Implemented
2009	FL #10	Harden culvert entrance bottoms with asphalt, concrete, rock, to reduce erosion or scour.	Public Works	Ongoing	General Fund, HMGP, HMA, NRCS	BC: TBD TF: Yes	Implemented
2009 (Revised 2017)	FL #11	Coordinate with FEMA and state agencies to maintain and update Flood Insurance Rate Maps (FIRM) for Polk County as funding becomes available. Use information obtained to update flood ordinance and for feasibility determination and project design at the planning level.	Public Works	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes	Implemented
Landslide Action (LS)							
2006 (Revised 2017)	LS #1	Use LIDAR data to improve knowledge of landslide hazard areas and prioritize primary and secondary lifeline transportation routes based on this information.	GIS and Public Works	Ongoing	General Fund	BC: TBD TF: Yes	Implemented

Source Polk County NHMP Steering Committee, updated 2017

FL=Flood, LS=Landslide

Table 3-2 Polk Action Item Pool (continued)

Year Action Created	Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility	Status
Mitigation Action Pool							
Volcano Action (VE)							
2006	VE #1	Increase awareness of volcanic eruptions and their potential impact to the county.	Emergency Management - HMT	Ongoing	General Fund, NOAA/ NWS, HMGP	BC: TBD TF: Yes	Implemented
Wildfire Actions (WF)							
2006 (Revised 2017)	WF #1	Work with Polk Fire Defense Board in the review of plans and inspection of structures, access, and water supply for fire code compliance. Promote FireWise building siting, design, and construction materials.	Building Division	Ongoing	General Fund, FMAP	BC: TBD TF: Yes	Implemented
2006	WF #2	Advocate accessible water storage facilities in developments not connected to a community water/hydrant system in the wildland/urban interface (WUI).	Community Development Department	Ongoing	General Fund, FMAP, HMA	BC: TBD TF: Yes	Implemented
2006 (Revised 2017)	WF #3	Enhance and promote existing outreach and education programs aimed at mitigating wildfire hazards and reducing or preventing the exposure of citizens, public agencies, private property owners, and businesses to natural hazards particularly those within the WUI. Consider updating maps related to fire hazards and encourage fire-safe construction practices.	Emergency Management - HMT, Community Development, Fire District Departments	Ongoing	General Fund, FMAP	BC: TBD TF: Yes	Implemented
2006 (Revised 2017)	WF #4	Inform citizens about programs that assist landowners in reducing fuel loads on private property. Encourage home landscape cleanup (defensible space) and define debris disposal programs. Identify, develop, implement, and enforce mitigation actions such as fuel breaks and reduction zones for potential wildland fire hazard areas.	Community Development, Emergency Management, Fire Departments	Ongoing	General Fund, FMAP	BC: TBD TF: Yes	Implemented
2006	WF #5	Look for solutions to protect structures located outside of fire districts through partnerships, grant funding, fire protection contracts, or expansion of fire district services.	Polk Fire Defense Board	Ongoing	General Fund, FMAP	BC: TBD TF: Yes	Implemented
2009	WF #6	Identify evacuation routes away from high hazard areas and develop outreach program to educate the public concerning warnings and evacuation procedures.	Emergency Management- HMT, Fire District Depts	Ongoing	General Fund, FMAP	BC: TBD TF: Yes	Implemented
2009 (Revised 2017)	WF #7	Maintain and periodically update Community Wildland Fire Protection Plans for all at-risk communities.	Emergency Management- HMT, Fire District Depts	Ongoing	General Fund, FMAP, HMGP	BC: TBD TF: Yes	Implemented

Source Polk County NHMP Steering Committee, updated 2017

VE=Volcano, WF=Wildfire

Table 3-2 Polk Action Item Pool (continued)

Year Action Created	Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility	Status
Mitigation Action Pool							
Windstorm Action (WS)							
2006 (Revised 2017)	WS #2	Increase and maintain public awareness of severe windstorms and the benefits of mitigation activities through education aimed at households and businesses and increase targeting of special needs populations.	Emergency Management - HMT	Ongoing	General Fund, HMGP	BC: TBD TF: Yes	Implemented
Winter Storm Actions (WT)							
2006	WT #1	Enhance strategies for management of debris from severe winter storms.	GIS and Planning, CAO, utilities, county residents, solid waste franchises, landfills	Ongoing	General Fund	BC: TBD TF: Yes	Implemented
2006	WT #2	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	Emergency Management - HMT	1-5 years	General Fund	BC: TBD TF: Yes	Implemented
2006 (Revised 2017)	WT #3	Develop, implement, and maintain public awareness of severe winter storms and the benefits of mitigation activities through education aimed at households and businesses, and increase targeting of special needs populations. Include strategies for debris management.	Emergency Management - HMT	Ongoing	General Fund	BC: TBD TF: Yes	Implemented
2006 (Revised 2017)	WT #4	Identify and harvest potential high-risk trees that could cause damage from a winter storm along utility and road corridors.	Public Works	Ongoing	General Fund	BC: TBD TF: Yes	Implemented
2009 (Revised 2017)	WT #5	Inform citizens about the most current Uniform International, and State, Building Codes to ensure structures can withstand winter storm hazards such as high winds, rain, water and snow.	County Admin, Community Development Department, Public Works	Ongoing	General Fund	BC: TBD TF: Yes	Implemented
2009	WT #6	Review critical facilities and government building energy efficiency, winter readiness, and electrical protection capability. Identify, prioritize, and implement infrastructure upgrade or rehabilitation project prioritization and development.	County Admin, Community Development Department, Public Works	Ongoing	General Fund, HMGP, HSGP	BC: TBD TF: Yes	Implemented

Source Polk County NHMP Steering Committee, updated 2017
 WS=Windstorm, WT=Winter Storm

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SECTION 4:

PLAN IMPLEMENTATION AND MAINTENANCE

The Plan Implementation and Maintenance section details the formal process that will ensure that the NHMP remains an active and relevant document. The Plan Implementation and Maintenance process includes a schedule for monitoring and evaluating the plan semi-annually, as well as producing an updated plan every five years. Finally, this section describes how the county will integrate public participation throughout the plan maintenance and implementation process.

Implementing the Plan

The success of the Polk County NHMP depends on how well the outlined action items are implemented. In an effort to ensure that the activities identified are implemented, the following steps will be taken: 1) the plan will be formally adopted, 2) a coordinating body will be assigned, 3) a convener shall be designated, 4) the identified activities will be prioritized and evaluated, and 5) the plan will be implemented through existing plans, programs, and policies.

Plan Adoption

The Polk County NHMP was developed and will be implemented through a collaborative process. After the Plan is locally reviewed and deemed complete, the Polk County Community Development or their designee shall submit the plan to the State Hazard Mitigation Officer (SHMO) at the Oregon Military Department – Office of Emergency Management (OEM). OEM submits the plan to 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, the Hazard Mitigation Grant Program funds, and Flood Mitigation Assistance program funds. Following adoption by the county, the participating jurisdictions should convene local decision makers and adopt the Polk County Multijurisdictional NHMP.

Convener

The Polk County Community Development Department will take responsibility for plan implementation and will facilitate the Hazard Mitigation Coordinating Body meetings and will assign tasks such as updating and presenting the plan to the rest of the members of the Coordinating Body (see Jurisdictional Addenda for jurisdiction specific conveners). Plan implementation and evaluation will be a shared responsibility among all of the assigned Hazard Coordinating Body Members. The Convener's responsibilities include:

- Coordinate Steering Committee meeting dates, times, locations, agendas, and member notification;
- Document the discussions and outcomes of committee meetings;

- Serve as a communication conduit between the Steering Committee and the public/stakeholders;
- Identify emergency management-related funding sources for natural hazard mitigation projects; and
- Utilize the Risk Assessment as a tool for prioritizing proposed natural hazard risk reduction projects.

Coordinating Body

The Polk County Convener will form a Natural Hazard Coordinating Body for updating and implementing the NHMP. The Coordinating Body responsibilities include:

- Attend future plan maintenance and plan update meetings (or designating a representative to serve in your place);
- Serve 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;
- Prioritize and recommend funding for natural hazard risk reduction projects;
- Evaluate and update the NHMP in accordance with the prescribed maintenance schedule;
- Develop and coordinate ad hoc and/or standing subcommittees as needed; and
- Coordinate public involvement activities.

Members

The following jurisdictions, agencies, and/ or organizations were represented and served on the NHMP update Steering Committee and may also serve as coordinating body members during the implementation and maintenance phase (for a list of individuals see *Acknowledgements*):

- Polk County
 - Community Development
 - Public Works
 - Emergency Management

To make the coordination and review of the Polk County NHMP as broad and useful as possible, the Coordinating Body will engage additional stakeholders and other relevant hazard mitigation organizations and agencies to implement the identified action items. Note: Each participating city shall convene its own steering committee. Each city convener will communicate their implementation and maintenance activities to the convener of the county steering committee.

Implementation through Existing Programs

The NHMP 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. Polk County, and the participating cities, currently addresses statewide planning goals and legislative requirements through their comprehensive land use plans, capital improvement plans, mandated standards and building codes. To the extent possible, Polk County, and

participating cities, will work to incorporate the mitigation action items into existing programs and procedures.

Many of the recommendations contained in the NHMP are consistent with the goals and objectives of the participating city and county's existing plans and policies. Where possible, Polk County, and participating cities, should implement the recommended actions contained in the NHMP through existing plans and policies. Plans and policies already in existence often 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 action items contained in the NHMP through such plans and policies increases their likelihood of being supported and implemented.

Examples of plans, programs or agencies that may be used to implement mitigation activities include:

- City and County Budgets
- Community Wildfire Protection Plans
- Comprehensive Land Use Plans
- Economic Development Action Plans
- Zoning Ordinances and Building Codes

For additional examples of plans, programs or agencies that may be used to implement mitigation activities refer to list of plans in Appendix B, *Community Profile*.

Plan Maintenance

Plan maintenance is a critical component of the NHMP. Proper maintenance of the plan ensures that this plan will maximize the county and participating city's efforts to reduce the risks posed by natural hazards. This section was developed by OPDR and includes a process to ensure that a regular review and update of the plan occurs. The coordinating body 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.

Meetings

The Coordinating Body will meet on a **semi-annual basis** to complete the following tasks. During the meeting the Coordinating Body 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.

During the second meeting the Coordinating Body will:

- Review existing and new risk assessment data;
- Discuss methods for continued public involvement; and
- Document successes and lessons learned during the year.

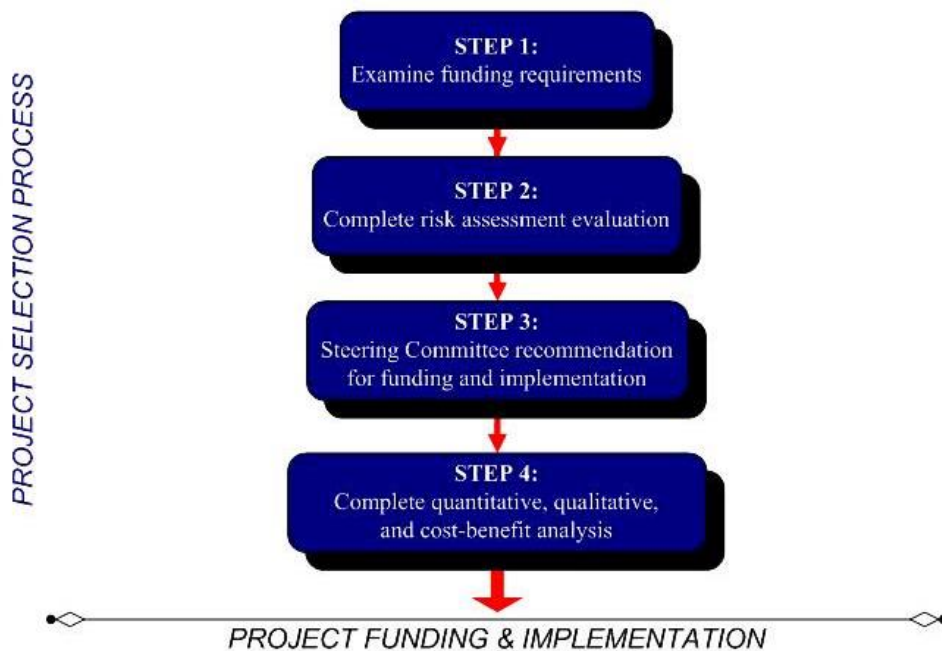
These meetings are an opportunity for the cities to report back to the county on progress that has been made towards their components of the NHMP.

The convener will be responsible for documenting the outcome of the semi-annual meetings in Appendix A. The process the Coordinating Body 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 NHMP that remains current and relevant to the participating jurisdictions.

Project Prioritization Process

The Disaster Mitigation Act of 2000 requires that jurisdictions identify a process for prioritizing potential actions. Potential mitigation activities often come from a variety of sources; therefore, the project prioritization process needs to be flexible. Committee members, local government staff, other planning documents, or the risk assessment may be the source to identify projects. Figure 4-1 illustrates the project development and prioritization process.

Figure 4-1 Action Item and Project Review Process



Source: Oregon Partnership for Disaster Resilience, 2008.

Step 1: Examine funding requirements

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

foundations, among others. Please see Appendix D, *Grant Programs and Resources* for a more comprehensive list of potential grant programs.

Because grant programs open and close on differing schedules, the Coordinating Body will examine upcoming funding streams' requirements to determine which mitigation activities would be eligible. The Coordinating Body may consult with the funding entity, Oregon Military Department – Office of Emergency Management (OEM), or other appropriate state or regional organizations about project eligibility requirements. This examination of funding sources and requirements will happen during the Coordinating Body's semi-annual NHMP maintenance meetings.

Step 2: Complete risk assessment evaluation

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

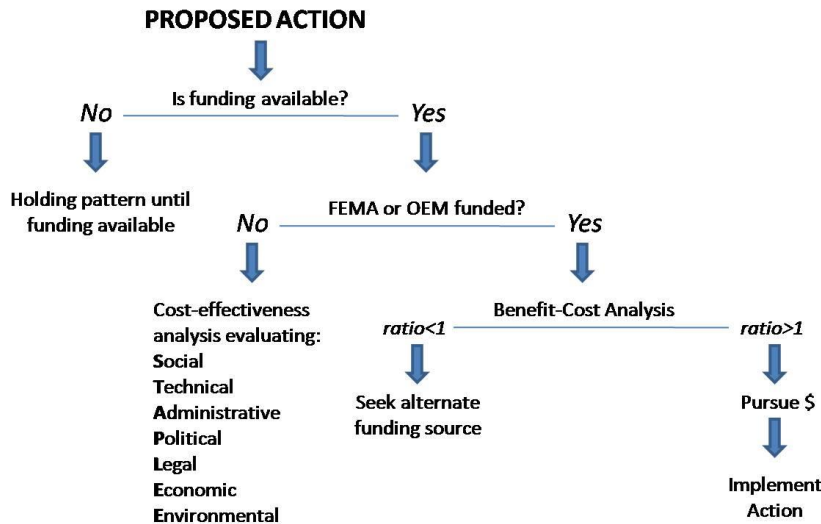
Step 3: Coordinating Body Recommendation

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

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

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

Figure 4-2 Benefit Cost Decision Criteria



Source: Oregon Partnership for Disaster Resilience, 2010.

If the activity requires federal funding for a structural project, the Coordinating Body will use a FEMA-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 Coordinating Body 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. OPDR at the University of Oregon’s Community Service Center has tailored the STAPLE/E technique for use in natural hazard action item prioritization.

Continued Public Involvement and Participation

The participating jurisdictions are dedicated to involving the public directly in the continual reshaping and updating of the Polk County NHMP. Although members of the Coordinating Body represent the public to some extent, the public will also have the opportunity to continue to provide feedback about the plan.

To ensure that these opportunities will continue, the County and participating jurisdictions will:

- Post copies of their plans on corresponding websites; and
- Place articles in the local newspaper or existing newsletters directing the public where to view and provide feedback.

In addition to the involvement activities listed above, Polk County will ensure continued public involvement by posting the Polk County NHMP on the county’s website (<http://www.co.polk.or.us/>). The plan will also be archived and posted on the University of Oregon Libraries’ Scholar’s Bank Digital Archive (<https://scholarsbank.uoregon.edu>).

Five-Year Review of Plan

This plan will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. **The Polk County NHMP is due to be updated by February 6, 2023.** The Convener will be responsible for organizing the coordinating body to address plan update needs. The Coordinating Body will be responsible for updating any deficiencies found in the plan, and for ultimately meeting the Disaster Mitigation Act of 2000's plan update requirements.

The following 'toolkit' can assist the Convener in determining which plan update activities can be discussed during regularly-scheduled plan maintenance meetings, and which activities require additional meeting time and/or the formation of sub-committees.

Table 4-1 Natural Hazards Mitigation Plan Update Toolkit

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

Source: Oregon Partnership for Disaster Resilience, 2010.

Volume II: Jurisdictional Addenda

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Purpose

This document serves as the City of Dallas' Addendum to the Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan (MNHMP, NHMP). This addendum supplements information contained in Volume I (Basic Plan) of this NHMP, which serves as the foundation for this jurisdiction's addendum, and Volume III (Appendices), which provides additional information (particularly regarding participation and mitigation strategy). This addendum meets the following requirements:

- Multi-jurisdictional **Plan Adoption** §201.6(c)(5),
- Multi-jurisdictional **Participation** §201.6(a)(3),
- Multi-jurisdictional **Mitigation Strategy** §201.6(c)(3)(iv), and
- Multi-Jurisdictional **Risk Assessment** §201.6(c)(2)(iii).

Plan Process, Participation, and Adoption

This section of the NHMP addendum addresses 44 CFR 201.6(c)(5), *Plan Adoption*, and 44 CFR 201.6(a)(3), *Participation*.

In the Fall of 2016, the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center (CSC) partnered with the Oregon Military Department's Office of Emergency Management (OEM), and Polk County and cities, including Dallas, to update their NHMP, which expired October 14, 2014. This project is funded through the Federal Emergency Management Agency's (FEMA) FY14 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2014-002).

By developing this addendum to the Polk County NHMP, locally adopting it, and having it approved by FEMA, Dallas will regain eligibility for FEMA Hazard Mitigation, Pre-Disaster Mitigation, and Flood Mitigation Assistance grant program funds.

The Polk County NHMP, and Dallas addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. A project steering committee guided the process of developing the plan. For more information on the composition of the steering committee see the *Acknowledgements, Plan Summary, and Plan Process* (Volume III, Appendix A).

The Community Development/Operations Director of Dallas is the designated local convener and will take the lead in implementing, maintaining, and updating the addendum to the NHMP in collaboration with the designated convener of the Polk County NHMP (County Planning Department).

Representatives from the City of Dallas steering committee convened on the following occasions (see Appendix A for more information):

- July 27, 2016 - Polk County NHMP Kick-Off Meeting
- October 18, 2016 – Polk County NHMP Second Meeting
- December 6, 2016 – Dallas Steering Committee Meeting #1
- December 13, 2016 – Dallas Steering Committee Meeting #2

The city’s addendum reflects decisions decided upon at the plan update meeting and during subsequent work and communication with OPDR.

The Dallas Steering Committee was comprised of the following representatives:

- Convener, Jason Locke, Community Development/Operations Director
- Ron Foggin, City Manager
- Tom Simpson, Police Chief
- Fred Hertel, Fire Chief
- Fred Braun, City Engineer

Public participation was achieved with the establishment of the steering committee, which was comprised of city officials and special districts representing different organizations and sectors. The Steering Committee was closely involved throughout the development of the plan and served as the local oversight body for the plan’s development. In addition, community members outside of the steering committee were provided an opportunity for comment via the plan review process (see Appendix A for more information).

The Polk County NHMP was approved by FEMA on February 6, 2018 and the Dallas addendum was adopted via resolution on January 16, 2018. This NHMP is effective through February 5, 2023.

Mitigation Strategy

This section of the NHMP addendum addresses 44 CFR 201.6(c)(3(iv), *Mitigation Strategy*.

During the 2016/2017 Polk County update process OPDR re-evaluated the Action Items with the county and local steering committees. Following the review actions were updated, noting what accomplishments had been made, and whether the actions were still relevant; any new action items were identified at this time (see Appendix A for more information). Each jurisdiction developed a list of priority actions any actions that were not prioritized were placed in an Action Item Pool and will be considered during the annual Implementation and Maintenance meetings.

Priority Actions

The city is listing a set of high priority actions in an effort to focus attention on an achievable set of high leverage activities over the next five-years. The city’s priority actions are listed below in Table DA-1.

Action Item Pool

Table DA-2 presents a pool of mitigation actions. This expanded list of actions is available for local consideration as resources, capacity, technical expertise and/or political will become available.

The majority of these actions carry forward from prior versions of this plan.

Table DA-I Dallas Priority Action Items

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Priority Actions					
Multi-Hazard Actions (MH)					
MH #1	Perform hydrologic and hydraulic engineering, and drainage studies and analyses. Use information obtained for feasibility determination and project design. This information should be a key component, directly related to a proposed project.	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
MH #2	Harden utility headers located along river embankments to mitigate potential flood, debris, and erosion damages.	Public Works	Ongoing	General Fund	BC: TBD TF: Yes
Earthquake Action (EQ)					
EQ #1	Evaluate critical public facility seismic performance for fire stations, public works buildings, potable water systems, wastewater systems, electric power systems, and bridges within the jurisdiction.	Community Development, Police, Fire, Public Work	Short Term (0-2 Years)	General Fund, HMGP, HMA	BC: TBD TF: Yes
Flood Actions (FL) - including erosion					
FL #1	Install bank protection such as rock, concrete, asphalt, vegetation, or other armoring or protective materials to provide river bank protection.	Public Works	Ongoing	General Fund, HMGP, HMA, NRCS	BC: TBD TF: Yes
FL #2	Establish flood mitigation priorities for critical facilities and residential and commercial buildings located within the 100-year floodplain using survey elevation data.	Community Development, Public Works	Short Term (0-2 Years)	General Fund, HMA	BC: TBD TF: Yes
Wildfire Action (WF)					
WF #1	Participate in the maintenance, implementation, and update of the Polk County Community Wildfire Protection Plan (2009).	PC SW Rural Fire District Polk County & City Manager	Ongoing	General Fund	BC: TBD TF: Yes

Source: City of Dallas NHMP Steering Committee, 2017.

MH=Multi-Hazard, EQ=Earthquake, FL=Flood, WF=Wildfire

Table DA-2 Dallas Action Item Pool

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility
Action Item Pool					
Multi-Hazard Actions (MH)					
MH #3	Cross reference and incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, land use, transportation plans, etc to demonstrate multi-benefit considerations and facilitate using multiple funding source consideration.	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
MH #4	Develop, produce, and distribute information materials concerning mitigation, preparedness, and safety procedures for all natural hazards.	Community Development, Police, Fire	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes
Drought Actions (DR) - including expansive soils					
DR #1	Require building design, engineering, and construction processes that address expansive soil conditions at potentially affected building sites.	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
DR #2	Require road design, engineering, and construction processes that address expansive soil conditions. Water absorption prevention, impermeable membrane, soil compaction, and drainage methods need to be considered once geologic studies determine soil composition.	Public Works	Ongoing	General Fund	BC: TBD TF: Yes
Earthquake Action (EQ)					
EQ #2	Inspect, prioritize, and retrofit any critical facility or public infrastructure that does not meet current Building Codes.	Community Development	Short Term (0-2 Years)	General Fund, HMGP, HMA, SRGP	BC: TBD TF: Yes
Flood Actions (FL) - including erosion					
FL #3	Develop an outreach program to educate public concerning NFIP participation benefits, floodplain development, land use regulation, and NFIP flood insurance availability to facilitate continued compliance with the NFIP.	Community Development	Short Term (0-2 Years)	General Fund, HMA	BC: TBD TF: Yes
FL #4	Develop, implement, and enforce floodplain management ordinances.	Community Development, Public Works	Ongoing	General Fund, FMA	BC: TBD TF: Yes

Source: City of Dallas NHMP Steering Committee, 2017
 MH=Multi-Hazard, DR=Drought, EQ=Earthquake, FL=Flood

Table DA-2 Dallas Action Item Pool (continued)

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility
Action Item Pool					
FL #5	Implement mitigation measures identified by critical facilities' owners, and other facility owners, to protect facilities located within the 100-year floodplain.	Community Development, Public Works	Short Term (0-2 Years)	General Fund, HMA	BC: TBD TF: Yes
FL #6	Increase culvert size to increase its drainage efficiency.	Public Works	Ongoing	General Fund, FMA	BC: TBD TF: Yes
Landslide Actions (LS)					
<i>No specific actions identified; see multi-hazard actions.</i>					
Volcano Actions (VE)					
VE #1	Update emergency response planning and develop client focused outreach program for ash fall events affecting river, air, and highway transportation, and industrial facilities and operations.	City Manager	Long Term (5+ Years)	General Fund, NOAA/ NWS	BC: TBD TF: Yes
VE #2	Evaluate capability of water treatment plant to deal with high turbidity from ash falls, update emergency response plans, and upgrade treatment facilities' physical plant to deal with ash falls.	City Manager & Public Works	Short Term (0-2 Years)	General Fund, NOAA/ NWS	BC: TBD TF: Yes
Wildfire Actions (WF)					
WF #2	Develop, adopt, and enforce burn ordinances that require burn permits, restricts campfires, and controls outdoor burning.	PC SW Rural Fire District Polk County & City Manager	Ongoing	General Fund	BC: TBD TF: Yes
WF #3	Develop outreach program to educate and encourage fire-safe construction practices for existing and new construction in high risk areas.	PC SW Rural Fire District Polk County & City Manager	Ongoing	General Fund	BC: TBD TF: Yes
WF #4	Develop outreach program to educate and encourage home landscape cleanup (defensible space) and define debris disposal programs.	PC SW Rural Fire District Polk County & City Manager	Ongoing	General Fund	BC: TBD TF: Yes
Windstorm Action (WS)					
WD #1	Identify and prioritize critical facilities' overhead utilities that could be placed underground to reduce power disruption from windstorm / tree blow down damage.	Public Works & Pacific Power & Light	Mid-Term (2-5 Years)	General Fund, HMGP, HMA, Utility Co.	BC: TBD TF: Yes

Source: City of Dallas NHMP Steering Committee, 2017
 FL = Flood, VE=Volcano, WF=Wildfire, WD=Windstorm

Table DA-2 Dallas Action Item Pool (continued)

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility
Action Item Pool					
Winter Storm Actions (WT)					
WS #1	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	Public Works	Short Term (0-2 Years)	General Fund	BC: TBD TF: Yes
WS #2	Update or develop, implement, and maintain jurisdictional debris management plans.	Public Works	Mid-Term (2-5 Years)	General Fund, PA	BC: TBD TF: Yes
WS #3	Develop and maintain severe winter storm public outreach program defining mitigation activity benefits through educational outreach aimed at households and businesses while targeting special needs populations.	Police, Fire, Public Work	Short Term (0-2 Years)	General Fund, NOAA/ NWS, HMGP	BC: TBD TF: Yes

Source: City of Dallas NHMP Steering Committee, 2017
 WS = Winter Storm

Plan Implementation and Maintenance

The City Council will be responsible for adopting the City of Dallas addendum to the Polk County NHMP. This addendum designates a coordinating body and a convener to oversee the development and implementation of action items. Because the city addendum is part of the county's multi-jurisdictional NHMP, the city will look for opportunities to partner with the county. The city's steering committee will convene after re-adoption of the City of Dallas addendum on an annual schedule; the county is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The City Clerk will serve as the convener and will be responsible for assembling the steering committee (coordinating body). The steering committee will be responsible for:

- identifying new risk assessment data,
- reviewing status of mitigation actions,
- identifying new actions, and
- seeking funding to implement the city's mitigation strategy (actions).

The convener will also remain active in the county's implementation and maintenance process (see Volume I, Section 4 for more information).

The city will utilize the same prioritization process as the county (See Volume I, Section 4: Plan Implementation and Maintenance and Volume III, Appendix C: Economic Analysis of Natural Hazard Mitigation Projects for more information).

Implementation through Existing Programs

Many of the Natural Hazards Mitigation Plan's recommendations are consistent with the goals and objectives of the city's existing plans and policies. Where possible, the City of Dallas will implement the NHMP'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, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented.

Dallas' acknowledged comprehensive plan is the Dallas Comprehensive Plan. The Oregon Land Conservation and Development Commission first acknowledged the plan in 1998. The City last amended the plan in July 2013. The City implements the plan through the Dallas Zoning and Development Code, which was last amended in 2016.

Dallas currently has the following plans, programs, and policies that relate to natural hazard mitigation. For a complete list visit the city [website](#):

Table DA-3 Legal and Regulatory Resources Available for Hazard Mitigation

Regulatory Tool	Name	Effects on Hazard Mitigation
Plans	Emergency Operations Plan	Identifies emergency planning, policies, procedures, and response to extraordinary emergency situations associated with natural disasters, technological incidents, and national security emergencies.
	Downtown Commercial Master Plan	Guides development and future growth
	Comprehensive Plan	The Dallas Comprehensive Plan includes goals and policies that provide specific direction in making "quasi-judicial" land use decisions; i.e., decisions that require judgment in the application of general policies to specific situations, such as zone changes, annexations, conditional use permits and major variances.
	Transportation System Plan (2008)	The purpose of the TSP is to develop a plan that addresses the transportation issues and needs for all users of Dallas's transportation network over a 20-year planning horizon. The TSP provides for a safe, efficient, multi-modal transportation network.
	Master Sewer Plan	Provides a description and analysis of sewer system and outlines planned improvements.
	Master Water Plan	Provides a description and analysis of water system and outlines planned improvements.
	Stormwater Master Plan	Identifies and prioritizes capital improvements relating to the existing stormwater collection and conveyance system.
	Public Facilities Plan	Comp Plan, Chapter 7. To provide a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for community development.
	Rickreall Creek Basin Plan	The City shall continue to participate in a Watershed Council and coordinate with Polk County, the Water Resources Department and affected property owners in the development and implementation of the Rickreall Creek Basin Plan.

	Rickreall Watershed Management Strategies Assessment (2013)	Inventories the watershed with the goal of identify and prioritize beneficial uses of the watershed while understand its ecological function and is used to assist with management strategies.
Programs	National Flood Insurance Program (NFIP)	Makes affordable flood insurance available to homeowners, business owners, and renters in participating communities. In exchange, those communities must adopt and enforce minimum floodplain management regulations to reduce the risk of damage from future floods.
	Polk Soil & Water Conservation District	The mission of the Polk/Dallas Field Office Service Area is to promote the conservation, wise use and sustained production of the soil, water and related resources.
Policies (Municipal Codes)	Ash Creek Water Control District	Provides a system of responsibilities and outlines planned improvements.
	City Code (May 2016)	Delineates policies, requirements, and responsibilities.
	Development Code Zoning Map	Guides the City of Dallas's community development
	Dallas Charter	To provide for the government of the city of Dallas, Polk County, Oregon.
	Floodplain Ordinance No. 1670	Guides community development within the known floodplain. Comp Plan, Chapter 6 Sec 6.2.6 and Floodplain Ordinance 1670. The City shall ensure against flood damage to persons and property through the effective implementation of flood plain regulations, consistent with FEMA standards.

Table DA-4 Administrative and Technical Resources for Hazard Mitigation

Staff/Personnel Resources	Department/Division Position
Planner(s) or engineer(s) with knowledge of land development and land management practices	Com Dev Jason Locke Police: Jay Fox
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	Community Development Director: Jason Locke
Planner(s) or engineer(s) with an understanding of manmade or natural hazards	Senior Planner: Suzanne Dufner
Floodplain manager	Jason Locke, Community Development Director
Personnel skilled in GIS and/or HAZUS-MH	Public Works: Tom Gilson, Frank Anderson
Director of Emergency Services	EMS Chief: Fred Hertel
Finance (grant writers, purchasing)	Cecilia Ward
Public Information Officers	Emily Gagner, Tom Simpson

Table DA-5 Financial Resources for Hazard Mitigation

Financial Resources	Effect on Hazard Mitigation
General funds	Yes
Authority to levy taxes for specific purposes	Elections to seek voter approval for a serial tax levy or bond measure to be used exclusively for street improvements.
Incur debt through general obligation bonds	No
Incur debt through special tax and revenue bonds	No
Incur debt through private activity bonds	No

Note: See Appendix D – Grant Programs for additional financial resources.

Continued Public Participation

Keeping the public informed of the city’s efforts to reduce the city’s risk to future natural hazards events is important for successful plan implementation and maintenance. The city is committed to involving the public in the plan review and updated process. See Volume I, Section 4, for more information.

Plan Maintenance

The Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan and city addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the county plan update process, the city will also review and update its addendum. The convener will be responsible for convening the steering committee to address the questions outlined below.

- 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?
- Have there been any significant changes in the community's demographics 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?

These questions will help the steering committee determine what components of the mitigation plan need updating. The steering committee will be responsible for updating any deficiencies found in the plan.

Risk Assessment

This section of the NHMP addendum addresses 44 CFR 201.6(b)(2) - Risk Assessment. In addition, this chapter can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards. Assessing natural hazard risk has three phases:

- **Phase 1:** Identify hazards that can impact the jurisdiction. This includes an evaluation of potential hazard impacts – type, location, extent, etc.
- **Phase 2:** Identify important community assets and system vulnerabilities. Example vulnerabilities include people, businesses, homes, roads, historic places and drinking water sources.
- **Phase 3:** Evaluate the extent to which the identified hazards overlap with, or have an impact on, the important assets identified by the community.

The local level rationale for the identified mitigation strategies (action items) is presented herein, and within Section 2, *Risk Assessment*, and Appendix B, *Community Profile*. The risk assessment process is graphically depicted in Figure DA-1 below. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure DA-I Understanding Risk



Hazard Analysis Methodology

This NHMP utilizes a hazard analysis methodology that was first developed by FEMA circa 1983, and gradually refined by the Oregon Military Department's Office of Emergency Management over the years.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible). Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%.

This method provides the jurisdiction with a sense of hazard priorities, or relative risk. It doesn't predict the occurrence of a particular hazard, but it does "quantify" the risk of one hazard compared with another. By doing this analysis, planning can first be focused where the risk is greatest.

In this analysis, severity ratings, and weight factors, are applied to the four categories of history, vulnerability, maximum threat (worst-case scenario), and probability as shown in the table below. See Volume I, Section 2 (Risk Assessment) for more information.

Hazard Analysis

The Dallas steering committee developed their hazard vulnerability assessment (HVA), using the county's HVA as a reference. Changes from the county's HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Dallas, which are discussed throughout this addendum.

Table DA-6 shows the HVA matrix for Dallas showing each hazard listed in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in

planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with sense of hazard priorities, but does not predict the occurrence of a particular hazard.

Two chronic hazards (flood and windstorm) and one catastrophic hazard (Cascadia Subduction Zone earthquake) rank as the top hazard threats to the city (Top Tier). The Windstorm, drought, and crustal earthquake hazards comprise the next highest ranked hazards (Middle Tier), while wildfire, landslide, and volcano hazards comprise the lowest ranked hazards (Bottom Tier).

Table DA-6 Hazard Analysis Matrix – Dallas

Hazard	History	Probability	Vulnerability	Maximum Threat	Total Threat Score	Hazard Rank	
Flood - Riverine	14	70	30	80	194	# 1	<i>Top Tier</i>
Winter Storm	14	56	25	70	165	# 2	
Earthquake - Cascadia	2	21	40	100	163	# 3	
Windstorm	10	42	25	60	137	# 4	<i>Middle Tier</i>
Drought	6	28	20	80	134	# 5	
Earthquake - Crustal	4	14	25	70	113	# 6	
Wildfire (WUI)	4	14	5	40	63	# 7	<i>Bottom Tier</i>
Landslide	2	14	10	20	46	# 8	
Volcano	2	7	15	20	44	# 9	

Source: Dallas NHMP Steering Committee, 2017.

Table DA-7 categorizes the probability and vulnerability scores from the hazard analysis for the city and compares the results to the assessment completed by the Polk County NHMP Steering Committee (areas of differences are noted with **bold** text within the city ratings). The city ranked their vulnerability to Cascadia Subduction Zone earthquakes higher than the county.

Table DA-7 Probability and Vulnerability Comparison

Hazard	Dallas		County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Moderate	Moderate	Moderate
Earthquake (Cascadia)	Low	High	Moderate	Moderate
Earthquake (Crustal)	Low	Moderate	Moderate	Moderate
Flood	High	Moderate	High	Moderate
Landslide	Low	Low	High	Low
Volcano	Low	Low	Low	Moderate
Wildfire	Low	Low	Moderate	Moderate
Windstorm	Moderate	Moderate	High	High
Winter Storm	High	Moderate	High	High

Source: Dallas NHMP Steering Committee and Polk County NHMP Steering Committee, 2017.

Between 2010 and 2015 the City grew by 450 people (3%) and median household income decreased by 8% (see Appendix B). New development has complied with the standards of the [Oregon Building Code](#) and the city’s development code including their floodplain ordinance. During this period Whitworth Elementary School and the Dallas Fire Station

received Seismic Rehabilitation Grants for structural retrofits of their facilities. As such changes in population, demographics, and development have had a negligible impact upon vulnerability. However, decreased household income within the community may be a signal that segments of the community may have a difficult time recovering from a natural hazard. See specific hazard sections below for more information.

Community Asset Identification

This section provides information on city specific assets. For additional information on the characteristics of Dallas, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, *Community Profile*. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation.

Community Characteristics

Dallas is located in the mid-Willamette Valley near the foothills of the Coast Range and is located on Rickreall Creek covering an area of about 4.8 square miles. The climate of Dallas is moderate; the average monthly temperatures range from 49 – 82 degrees in July and August, and 33-46 degrees in December and January, and the city receives approximately 48 inches of rain each year¹. Monthly precipitation is about 6-9 inches during the wetter months of November – March, and average about 0.3-1.3 inches during the drier months of June - September. The city’s topography is relatively flat.

Economy

Dallas benefits from its location to Salem which is the State Capital and a regional center for industrial technology, engineering, research, commerce, and health care. Dallas has some manufacturing businesses, however, most employment is outside of the city.

Asset Inventory

Asset inventory is the first step of a vulnerability analysis. Assets that may be affected by hazard events include population, residential and nonresidential buildings, critical facilities, and infrastructure.

The asset inventory delineates the City’s existing building and infrastructure assets and insured values and are identified in detail in Table DA-8 and Map DA-1 (Attachment A).

Table DA-8 Dallas Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value ¹
Government	Dallas City Hall	187 SE Court	\$3.1 Million
	Dallas Public Works	820 SW Ash	\$1.2 Million
	Dallas Civic Center	Jefferson Street	In City Hall
	Dallas Public Library	950 Main Street	\$1.2 Million

¹ [Western Regional Climate Center, “Dallas 2 NE, OR \(352112\)”. Retrieved November 22, 2016.](#)

Facility Type	Name / Number	Address	Value ¹
	Polk County Courthouse	850 Main Street	Unknown
	Polk County Jail	883 SE Jefferson Street	Unknown
	County Maintenance Shop		Unknown
	City of Dallas Animal Shelter	350 Main Street	\$500,000
	Oregon Military Department & National Guard	817 SW Church	
Emergency Response	Dallas Fire Department	910 SE Shelton	\$1.82 Million
	Dallas Police Department	In City Hall	In City Hall
	Dallas Ambulance Service	SE Washington	\$469,000
	County Emergency Operations Center	850 Main Street	
Educational	School Administrative Offices	111 SW Ash Street	Unknown
	Dallas High School	901 SE Ash Street	Unknown
	LaCreole Middle School	701 SE La Creole	\$12,236,700
	Lyle Elementary School	185 SW Levens	District
	Oakdale Heights Elementary School	1375 SW Maple	\$6,109,810
Educational	Whitworth Elementary School	1151 SE Miller	\$7,030,250
	Morrison Campus Alternative School	1251 Main Street	Unknown
	Faith Christian School	2290 E Ellendale Ave	Unknown
	Luckiamute Valley Charter Schools	12975 Kings Valley Hwy	Unknown
	Chemeketa Community College (satellite campus)	1340 SE Holman Ave	Unknown
Care Facility	West Valley Hospital / Emergency Room	525 SE Washington Street	Unknown
	West Valley Physicians & Surgeons Clinic	555 SE Washington Street	Unknown
	Dallas Family Medicine	641 SE Miller Avenue	Unknown
	Flaming Medical Center	1000 SE Uglow Avenue	Unknown
	Polk County Family Planning	182 SW Academy Street # 302	Unknown
	Sable House (shelter)	289 E Ellendale Avenue # 701	\$ 350,000
	Dallas Senior Center	955 SE Jefferson Street	Unknown
	Dallas Retirement Village-Apartments/Townhouses	310 W. Ellendale Avenue	Unknown
	Dallas Retirement Village-Assisted Living	340 NW Brentwood Avenue	Unknown
	Dallas Retirement Village-Health Center	377 NW Jasper Street	Unknown
	Jefferson Manor Residential Care	664 SE Jefferson Street Dallas, OR 97338	Unknown
	Four Seasons Residential Care Facility	280 SE Uglow St	Unknown
	Ellendale Home	511 E Ellendale Avenue Dallas, OR 97338	Unknown
	Medical Arts Center	200 SE Washington Street	Unknown
	South View Medical Arts	531 SE Clay Street	Unknown
Valley Community Hospital	550 SE Clay Street	Unknown	
Community	Dallas Aquatic Center	1005 SE La Creole Drive	\$ 7.0 Million
	Dallas City Park		\$ 2.5 Million
	Birch Street Park		\$ 200,000
	Gala Park		\$ 350,000
	Kingsborough Park		\$ 300,000
	Rotary Park		\$150,000

Facility Type	Name / Number	Address	Value ¹
	Polk County Fairgrounds	520 N Pacific Hwy, Rickreall	Unknown
	Hunter Aboretum		\$500,000
	Dallas Cemetery	2065 SW Fairview Avenue	Unknown
	Guthrie Park Community Center	4320 Kings Valley Hwy	Unknown
	Historical Building List		Unknown
	Apostolic Faith Church	217 SW Court Street	\$412,910
	Berean Baptist Church	1156 SE Holman Avenue	Unknown
	Bridgeport Community Church	16930 Bridgeport Road	Unknown
	Christian & Mission Alliance		Unknown
	Church of Dallas		Unknown
	Church of Christ	691 NE Kings Valley Hwy	\$704,060
	Church of Christ of Latter Day Saints	1401 SW 13th Street	\$2,627,440
Community	Dallas Alliance Church	775 E Ellendale Avenue	Unknown
	Dallas Church of the Nazarene	1151 SE Miller Avenue	Unknown
	Dallas Evangelical Church	783 SW Church Street	\$286,520
	Evangelical Bible Church	1175 SE Howe Street	Unknown
	Faith Evangelical Free Church	2290 E Ellendale Avenue	\$3,043,040
	Falls City First Christian Church	233 S Main St, Falls City	
	First Baptist Church	245 SW Church Street	\$637,050
	First Presbyterian Church	879 SW Levens Street	\$974,100
	Grace Community Fellowship	598 E Ellendale Avenue	Unknown
	Kingdom Hall Jehovah's Witnesses	233 SE Dimick	Unknown
	Jesus Our Jubilee Ministries	174 SW River Drive	\$444,030
	Living Word Faith Fellowship	830 SE Shelton Street	\$427,800
	Mennonite Brethren Church of Dallas	976 SW Hayter Street	\$813,080
	Salt Creek Baptist Church	15075 Salt Creek Road	Unknown
	Seventh-Day Adventist	589 SW Birch Street	Unknown
	St. Thomas Episcopal Church	1486 SW Levens Street	Unknown
	Trinity Lutheran Church	450 SE Washington St	\$1,135,270
	United Methodist Church	565 SE Lacreole Drive	\$1,901,570
	Valley Life Center Assembly of God	1795 SE Miller Avenue	Unknown
	Dilbert Hunter Arboretum	187 SE Court Street	\$500,000
	Basket Slough Wildlife Refuge		Unknown
	Cross Creek Golf Course	13935 Highway 22	Unknown
Dallas Retirement Village	377 NW Jasper Street	Unknown	
Itemizer Observer Newspaper	147 SE Court Street	Unknown	
State and Federal Highways	State Hwy 222, (King's Valley Hwy)	3 miles within city	(3*\$2.2 Million/Mile)=\$6.6M
Railroads	Portland Western RR Company (Industrial use)	5 miles within city	Unknown
Bridges	LaCreole Bridge		\$1.2 Million
	Levens Street Bridge		\$ 1.3 Million
	Godsey Road Bridge		\$ 200,000
	Main Street & Jefferson Br.		\$ 3.0 Million
Transportation Facilities	Local Streets & Roads	54 miles in city	\$1.5 Million/Mile
	Transit Authority (Bus) Cherriot Bus Service-Salem		Unknown
	School Bus Facilities		Unknown

Facility Type	Name / Number	Address	Value ¹
Utilities	NW Natural Gas	3123 Broadway NE	Unknown
	Pacific Power (Electric)	583 SE Jefferson Street	Unknown
	Intake Station		\$ 3.2 Million
	Water Treatment Facility		\$12 Million
	Wastewater Treatment Facility	Bowersville Road	\$15 Million
	Wastewater Distribution System		\$ 32.6 Million
	Peters Fuel Company	1386 SE Uglow Avenue	Unknown
	Home Service Oil Company		Unknown
	Recycle Center	1845 SE Holman Avenue	Unknown
	Lift Stations(2)		\$500,000
	Treated Water Storage (4 sites)		\$ 7.25 Million
	Pacific Power		Unknown
	KPIE Radio station/tower		Unknown
Dams	Mercer Reservoir & Dam	West Rickreall Road	\$25 Million
	Reimer Dam		Unknown
	Morgan Brothers Dam		Unknown

Note: ¹Estimated and/or insured structural and/or Polk County Assessed value for critical facilities and estimated values for critical infrastructure in 2009 dollars

See hazard sections below and Section 2, *Risk Assessment*, for potential hazard vulnerabilities to these facilities.

Hazard Characteristics

Drought

The steering committee determined that the city's probability for drought is **moderate** (which is the same as the county's rating) and that their vulnerability to drought is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of drought hazards, as well as the location and extent of a potential event. Due to a cool, wet climate, past and present weather conditions have generally spared Polk County communities from the effects of drought; however, Polk County was included in a Governor declared drought declaration in 1992 and a Presidential drought declaration in 2015.

Dallas' primary water supply comes from the Rickreall Creek and the Rickreall Watershed (Mercer Reservoir is owned by the city and is the source of the city's water supply). The city has four (4) storage reservoir(s) for a total of 7.5 million gallons of treated water storage capacity. The city's water treatment plant has been operating since 1973 and was updated in 1994 and again in 2008. The city has a water master plan that is currently being updated and will be complete in 2018. In general, water supply is available and sufficient. Additional, drought-related community impacts are described within the county's Drought Hazard Annex. The city maintains a public facilities water map, click <http://www.ci.dallas.or.us/DocumentCenter/View/3394> to access the map.

Expansive Soils

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of drought hazards, as well as the location and extent of a potential event. The addition of moisture to any soil will cause a change in volume, which is referred to as a shrink-swell characteristic.²

According to the previous version of this plan the City of Dallas has critical facilities and infrastructure located within areas of low, moderate and high risk; see Map DA-2 (Attachment A).

Low risk areas contain approximately 3,490 residential structures (value \$414.6M) and 20 non-residential structures (value unknown).

Moderate risk areas contain approximately 3,733 residential structures (value \$443.5M), 29 non-residential structures (value unknown), six government facilities (value \$4.3M), four emergency response facilities (value \$2.3M), seven educational facilities (value \$7M), 13 care facilities (value \$350K), 14 community facilities (value \$7.1M), three bridges (value \$2.7M), one transportation facility (value unknown), five utility facilities (value \$15M) and two dams (value unknown).

High risk areas contain approximately 3,057 residential structures (value \$363.2M), 20 non-residential structures (value unknown), one government facility (value \$500K), three education facilities (value \$18.3M), eight care facilities (value \$350K), seven community facilities (value \$5.3M), three bridges (value \$5.5M), one transportation facility (value unknown) and two utility facilities (value unknown).

A comprehensive risk and vulnerability assessment is not available for the drought hazard. Statewide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks are present to humans and resources. Agriculture, fishing, and timber have historically been impacted, as well as local and regional economies.

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Earthquake

The steering committee determined that the city's probability for a Cascadia Subduction Zone (CSZ) Earthquake event is **low** (which is lower than the county's rating) and that their vulnerability to a Cascadia Earthquake event is **high** (which is higher than the county's rating). The steering committee determined that the city's probability for a Crustal Earthquake event is **low** (which is lower than the county's rating) and that their vulnerability to a Crustal Earthquake event is **moderate** (which is the same as the county's rating).

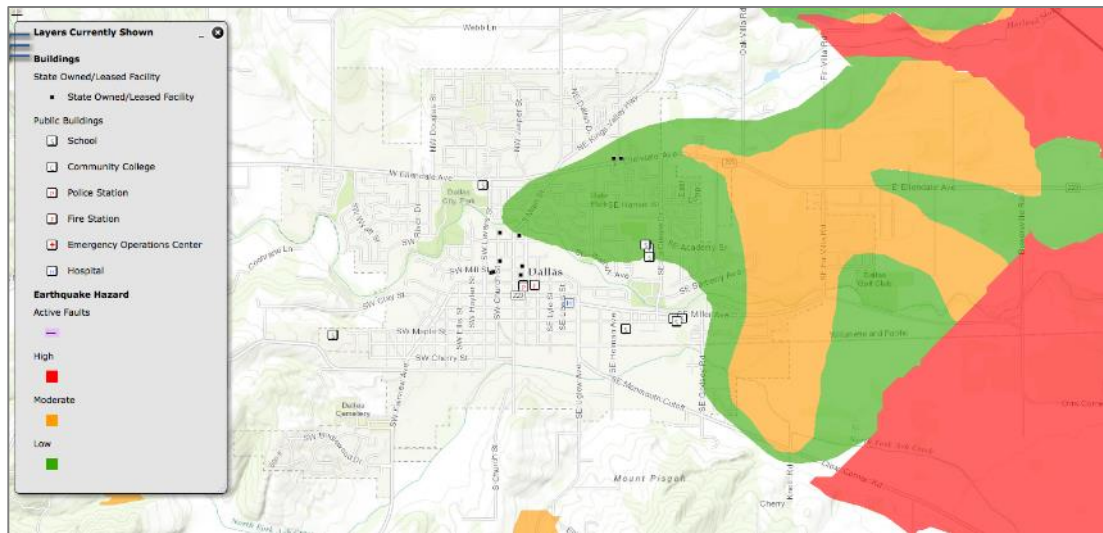
Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of earthquake hazards, history, as well as the location and extent of a potential event. Generally, an event that affects the county is likely to affect Dallas as well. The causes and characteristics of an

² US Department of Agriculture, Natural Resources Conservation Service (USDA NRCS). 2008. National Cooperative Soil Survey, Physical Soil Properties—Polk County, Oregon.

earthquake event are appropriately described within the county’s plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the county’s plan, and the community impacts described by the county would generally be the same for Dallas as well.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any particular site. In many major earthquakes, damages have primarily been caused by the behavior of the soil. Figure DA-2 displays relative liquefaction hazards. As shown, the area of greatest concern is just east of the Dallas city limits (darker areas) that are adjacent to Rickreall Creek where the concentration of soft soils is the highest.

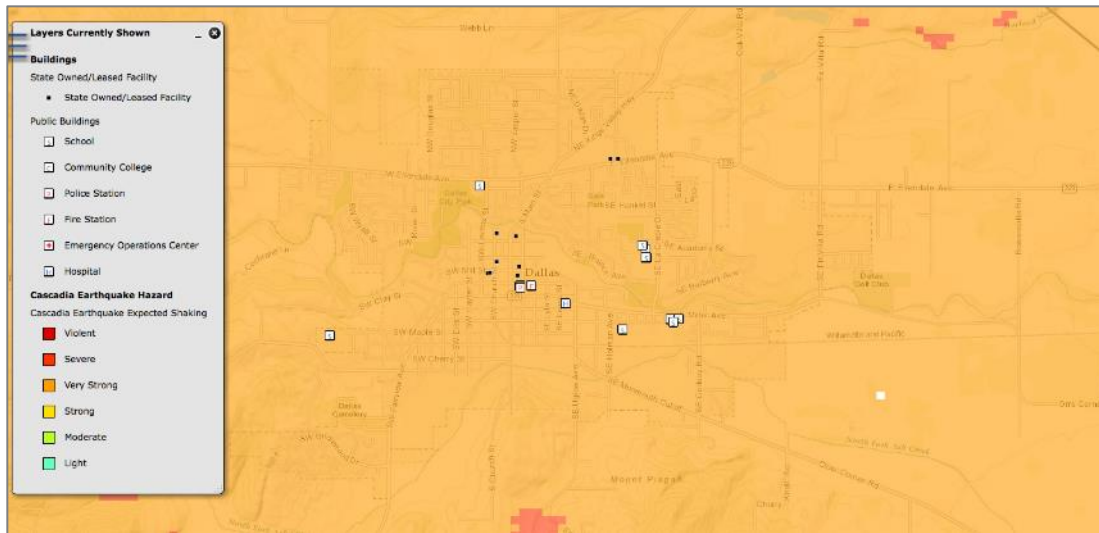
Figure DA-2 Active Faults and Soft Soils



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](https://www.oregon.gov/oha/ohaz/vu/Statewide_Geohazards_View.aspx)

Figure DA-3 below shows the expected shaking/ damage potential for Dallas because of a Cascadia Subduction Zone (CSZ) earthquake event. The figure shows that the city will experience “very strong” shaking that will last two to four minutes. The shaking will be extremely damaging to lifeline transportation routes including Highway 22, 99, and Interstate 5. For more information on expected losses due to a CSZ event see the [Oregon Resilience Plan](#).

Figure DA-3 Cascadia Subduction Zone Expected Shaking



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

As noted in the community profile approximately 57% of residential buildings were built prior to 1990, which increases the city’s vulnerability to the earthquake hazard. Information on specific public buildings’ (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table DA-9; each “X” represents one building within that ranking category. Of the facilities evaluated by DOGAMI using RVS, one (1) has a very high (100% chance) collapse potential, and eight (8) have a high (greater than 10% chance) collapse potential. Two facilities received [Seismic Rehabilitation Grant Programs](#) funds: Dallas Fire Station (2009-2010 grant award, \$887,725) and Whitworth Elementary School (Dallas; Phase One of 2015-2016 grant award, \$1,492,900) to retrofit their structures³.

In addition, the following structures have also had some structural and/ or non-structural seismic retrofitting:

- *Whitworth Elementary School (Dallas School District 2), brick flue was removed and a stainless-steel flue was installed, funded per 2009 local school bond (completed in August 2010).*
- *Lyle Elementary School (Dallas School District 2), brick flue was removed and a stainless-steel flue was installed, funded per 2009 local school bond (completed in August 2010).*
- *Dallas High School (Dallas School District 2), brick flue was removed and a stainless-steel flue was installed, funded per 2009 local school bond (completed in August 2010).*
- *Morrison Campus Alternative School (1251 Main St., Dallas School District 2), brick flue was removed and a stainless-steel flue was installed, stadium concrete foundation was installed, dry rot removed and structural upgrades to columns, press*

³ Additional information on seismic retrofits on the Whitworth School is found on the DOGAMI RVS webpage: http://www.oregongeology.org/sub/projects/rvs/activity-updates/2016/Dallas_SD2_SB1566Form2016.pdf

box support was engineered and upgraded; funded per 2009 local school bond (completed in August 2010, stadium upgrades in September 2011).

In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage.

Utility systems will be significantly damaged, including damaged buildings and damage to utility infrastructure, including water treatment plants and equipment at high voltage substations (especially 230 kV or higher which are more vulnerable than lower voltage substations). Buried pipe systems will suffer extensive damage with approximately one break per mile in soft soil areas. There would be much lower rate of pipe breaks in other areas. Restoration of utility services will require substantial mutual aid from utilities outside of the affected area.

Table DA-9 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (< 1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Dallas High (Dallas SD 2) (1250 Holman Ave)	Polk_sch02			X	
LaCreole Middle (Dallas SD 2) (701 SE La Creole Dr)	Polk_sch01	X		X,X	
Lyle Elementary (Dallas SD 2) (185 SW Levens St)	Polk_sch08			X	
Oakdale Heights Elementary (Dallas SD 2) (1275 SW Maple St)	Polk_sch11		X		
Whitworth Elementary (Dallas SD 2) (1151 SW Miller Ave)	Polk_sch12	Mitigated per 2015-2016 SRGP (Ph. I)			
Universities/ Colleges					
Chemeketa CC (Dallas Academy) (915 SE Ash)	Polk_sch02			X	
Public Safety					
Dallas Police Department (187 SE Court St)	Polk_pol02		X		X
Polk County Sheriff (850 Main St)	Polk_pol01		X		
Dallas Fire Station (915 SE Shelton St)	Polk_fir03	Mitigated per 2009-2010 SRGP			
Hospitals					
West Valley Community Hospital (Salem Health West Valley) (525 SE Washington St)	Polk_hos01	X			

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#)

“*” – Site ID is referenced on the [RVS Polk County Map](#)

A comprehensive risk and vulnerability assessment is not available. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. The Risk Report would provide a quantitative risk assessment

that informs communities of their risks related to certain natural hazards (including earthquake). If pursued, once complete the city can incorporate the risk assessment into their addendum to provide greater detail to sensitivity and exposure to the earthquake hazard.

According to the previous version of this plan approximately 4,906 residential structures (value \$583M), 38 non-residential structures (value unknown), nine government facilities (value \$6M), four emergency response facilities (value \$2.3M), ten educational facilities (value \$25M), 16 care facilities (value \$350K), 42 community facilities (value \$25M), two miles of highways (value \$8.1M), five rail segments (value unknown), four bridges (value \$5.7M), three transportation facilities (value \$81M), 13 utilities (value \$70M), and three dams (value \$25M) in the strong shaking hazard area.⁴

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

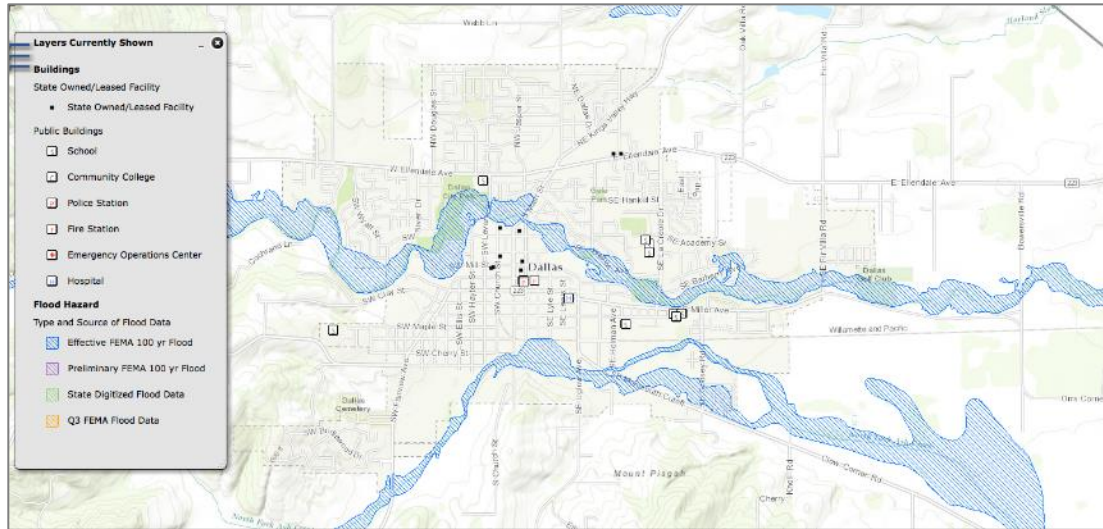
Flood

The steering committee determined that the city's probability for riverine flood is **high** (which is the same as the county's rating) and that their vulnerability to flood is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of flooding hazards within the region, as well as previous flooding occurrences. General flood-related community impacts are adequately described within the Flood Hazard Annex of Polk County's Natural Hazards Mitigation Plan. Portions of Dallas have areas of flood plains (special flood hazard areas). These include areas along Rickreall Creek and North Fork Ash Creek (see Figure DA-4 and Attachment A, Map DA-3). Furthermore, other portions of Dallas, outside of the mapped floodplains, are also subject to significant, repetitive flooding from local storm water drainage. In general, the 100-year floodplain delineates an area of high risk, while the 500-year floodplain delineates an area of moderate risk.

⁴ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

Figure DA-4 Special Flood Hazard Area



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

A comprehensive risk and vulnerability assessment is not available. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. The Risk Report would provide a quantitative risk assessment that informs communities of their risks related to certain natural hazards (including flood). If pursued, once complete the city can incorporate the risk assessment into their addendum to provide greater detail to sensitivity and exposure to the earthquake hazard.

Per the previous version of this plan approximately 1,736 residential structures (value \$206.2M), eight non-residential structures (value unknown), one government facility (value \$500K), one educational facility (value \$7.03M), three community facilities (value unknown), four bridges (value \$5.7M), one transportation facility (value unknown), three utility facilities (value \$15M), and one dam (value unknown). Within the 500-year floodplain, the City of Dallas has 1,690 residential structures (value \$200.8M), 7 non-residential structures (value unknown), and one care facility (value unknown).⁵

National Flood Insurance Program (NFIP)

FEMA modernized the Dallas Flood Insurance Rate Maps (FIRMs) in December 2006. Table DA-10 shows that as of September 2016, Dallas has 156 National Flood Insurance Program (NFIP) policies in force. Of those, 68 are for properties that were constructed before the initial FIRM. The last Community Assistance Visit (CAV) for Dallas was on June 3, 2004. Dallas is not a member of the Community Rating System (CRS). The table shows that most flood insurance policies are for residential structures, primarily single-family homes. There has been a total of nine (9) paid claims for \$103,826.

For more information on flood risk see the [Polk County Flood Insurance Study \(2006\)](#).

⁵ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

The Community Repetitive Loss record for Dallas identifies no Repetitive Loss Properties⁶ and no Severe Repetitive Loss Properties⁷.

Table DA-10 Flood Insurance Detail

Jurisdiction	Effective FIRM and FIS	Initial FIRM Date	Total Policies	Pre-FIRM Policies	Policies by Building Type				Minus Rated A Zone
					Single Family	2 to 4 Family	Other Residential	Non-Residential	
Polk County	-	-	428	183	334	27	25	42	28
Dallas	12/19/2006	4/5/1988	156	68	131	14	6	5	8

Jurisdiction	Insurance in Force	Total Paid Claims	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Paid Amount	Repetitive Loss Properties	Severe Repetitive Loss Properties	CRS Class Rating	Last CAV
Polk County	\$ 93,520,500	40	33	0	\$ 682,241	1	0	-	-
Dallas	\$ 33,852,300	9	8	0	\$ 103,826	0	0		6/3/2004

Source: Information compiled by Department of Land Conservation and Development, September 2016.

Riverine Erosion

Riverine erosion rarely causes death or injury. However, erosion causes significant destruction of property, development, and infrastructure. Erosion hazard data is not readily available; however, descriptions of several localized areas were identified during the development of this document and are identified only by location on Map DA-4 (Attachment A). Critical facilities that may be at risk of erosion were identified using a 300 foot-buffer in the areas identified as having historic erosion impacts to conservatively account for building footprints.

A comprehensive risk and vulnerability assessment is not available for the riverine erosion hazard. Per the previous version of this plan approximately 337 residential structures (value \$40M) and one community facility (value \$2.5M) were identified as being at risk.⁸

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

⁶ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

⁷ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000 and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

⁸ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

Landslide

The steering committee determined that the city's probability for landslide is **low** (which is lower than the county's rating) and that their vulnerability to landslide is **low** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. The potential for landslide in Dallas is low except for areas to the west near the Dallas Cemetery, to the south near Church Street, and in the hilly area to the north and in the areas immediately adjacent to stream channels.

Sedimentary rock underlies Dallas. Sedimentary rock is primarily conglomerate, claystone, and siltstone with some sandstone toward the west. Sedimentary rock is less resistant to stream action. Landslide susceptibility exposure for Dallas is shown in Figure DA-5 and Map DA-5 (Attachment A). Approximately 19% of Dallas has High, and approximately 13% Moderate, landslide susceptibility exposure⁹.

Figure DA-5 Landslide Susceptibility Exposure



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

Potential landslide-related impacts are adequately described within the county's plan, and include infrastructural damages, economic impacts (due to isolation and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides and debris flows can potentially occur during any winter in Polk County, and highway and other major roads beyond city limits are susceptible to obstruction as well.

A comprehensive risk and vulnerability assessment is not available. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. The Risk Report would provide a quantitative risk assessment

⁹ DOGAMI Open-File Report, O-16-02, Landslide Susceptibility Overview Map of Oregon (2016)

that informs communities of their risks related to certain natural hazards (including landslide). If pursued, once complete the city can incorporate the risk assessment into their addendum to provide greater detail to sensitivity and exposure to the earthquake hazard.

According to the previous version of this plan approximately 1,806 residential structures (value \$214.5M), 20 non-residential structures (value unknown), one government facility (value \$500K), two educational facilities (value \$13.15M), one care facility (value unknown), five community facilities (value \$637K), two bridges (value \$4.3M), three utility facilities (value \$15M), and three dams (value \$25M). There are 304 residential structures (value \$36.1M), one non-residential structures (value unknown), and no critical facilities located within high landslide risk areas.¹⁰

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Volcano

The steering committee determined that the city's probability for volcanic event is **low** (which is the same as the county's rating) and that their vulnerability to volcanic event is **low** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes Dallas' risk to volcanic events. Generally, an event that affects the county is likely to affect Dallas as well. The causes and characteristics of a volcanic event are appropriately described within the county's plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Dallas as well. Dallas is very unlikely to experience anything more than volcanic ash during a volcanic event. When Mt. Saint Helens erupted in 1980, the city was not impacted.

A comprehensive risk and vulnerability assessment is not available for the volcano hazard. Due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all residential and critical facilities and infrastructure within the City of Dallas are at risk.

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Wildfire

The steering committee determined that the city's probability for wildfire is **low** (which is lower than the county's rating) and that their vulnerability to wildfire is **low** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of wildfires, as well as the county and city's history of wildfire events. There are no known large wildfire events in Dallas. The location and extent of a wildfire vary depending on fuel,

¹⁰ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

topography, and weather conditions. Weather and urbanization conditions are primarily at cause for the hazard level.

The potential community impacts and vulnerabilities described in the county's plan are generally accurate for the city as well. Polk County developed a Community Wildfire Protection Plan (CWPP) in 2009, which mapped wildland urban interface areas and developed actions to mitigate wildfire risk (see Attachment A, Map DA-6). The city is a participant in the CWPP and will update the city's wildfire risk assessment if the CWPP presents better data during future updates. In general, wildfire conditions are greatest in the hilly area surrounding the water treatment plan, Mercer Reservoir (10 miles west of the city), and homes in the southeast portion of the city.

History:

- 1987 – 5,000 acre fire in the Rickreall Watershed caused sediment damage to the Mercer Reservoir which is the source for Dallas' drinking water supply.¹¹
- *August 17, 2013. 200-acre wildfire along Highway 22 burned near a winery close to Dallas. Firefighters from Dallas, Yamhill, Polk County, Sheridan, Willamina, McMinnville and Depoe Bay were utilized.*

Irrigated agricultural land surrounds much of Dallas, thereby reducing the risk to wildfire to the city.

A comprehensive risk and vulnerability assessment is not available. The Polk County CWPP provides some risk and vulnerability information related to Dallas that has been incorporated into this plan as applicable.

Per the previous version of this plan Dallas has critical facilities and infrastructure located within areas of moderate, high, very high and extreme risk.¹²

Moderate risk areas contain 4,754 residential structures (value \$564.8M), 38 non-residential structures (value unknown), eight government facilities (value \$6M), four emergency response facilities (value \$2.3M), 10 educational facilities (value \$25.3M), 16 care facilities (value

\$350K), 21 community facilities (value \$10M), four bridges (value \$5.7M), one transportation (value unknown), five utility facilities (value \$15M) and three dams (value \$25M).

High risk areas contain 3,498 residential structures (value \$415.6M), 20 non-residential structures (value unknown), one government facility (value \$500K), five educational facilities (value 13.1M), five care facilities (value unknown), nine community facilities (value \$3.7M), three bridges (value \$5.5M), one transportation facility (value unknown), three utility facilities (value \$15M) and three dams (value \$25M).

¹¹ Polk County Community Wildfire Protection Plan (2009)

¹² URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

Very high risk areas contain 615 residential structures (value \$73.1M), one educational facility (value unknown), one utility facility (value unknown), and one dam (value \$25M).

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Windstorm

The steering committee determined that the city's probability for windstorm is **moderate** (which is lower than the county's rating) and that their vulnerability to windstorm is **moderate** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of windstorms, as well as the location and extent of windstorm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

Polk County's plan adequately describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation and economic disruptions result as well.

A comprehensive risk and vulnerability assessment is not available for the windstorm hazard. Due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all residential and critical facilities and infrastructure within Dallas are at risk.

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Winter Storm (Snow/ Ice)

The steering committee determined that the city's probability for winter storm is **high** (which is the same as the county's rating) and that their vulnerability to winter storm is **low** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of winter storms, as well as the location and extent of winter storm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the city typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

Major winter storms can and have occurred in the Dallas area, and while they typically do not cause significant damage, they are frequent and have the potential to impact economic activity. Road closures on major roads due to winter weather are an uncommon occurrence, but can interrupt commuter and large truck traffic.

A comprehensive risk and vulnerability assessment is not available for the winter storm (snow/ice) hazard. Due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all residential and critical facilities and infrastructure within Dallas are at risk.

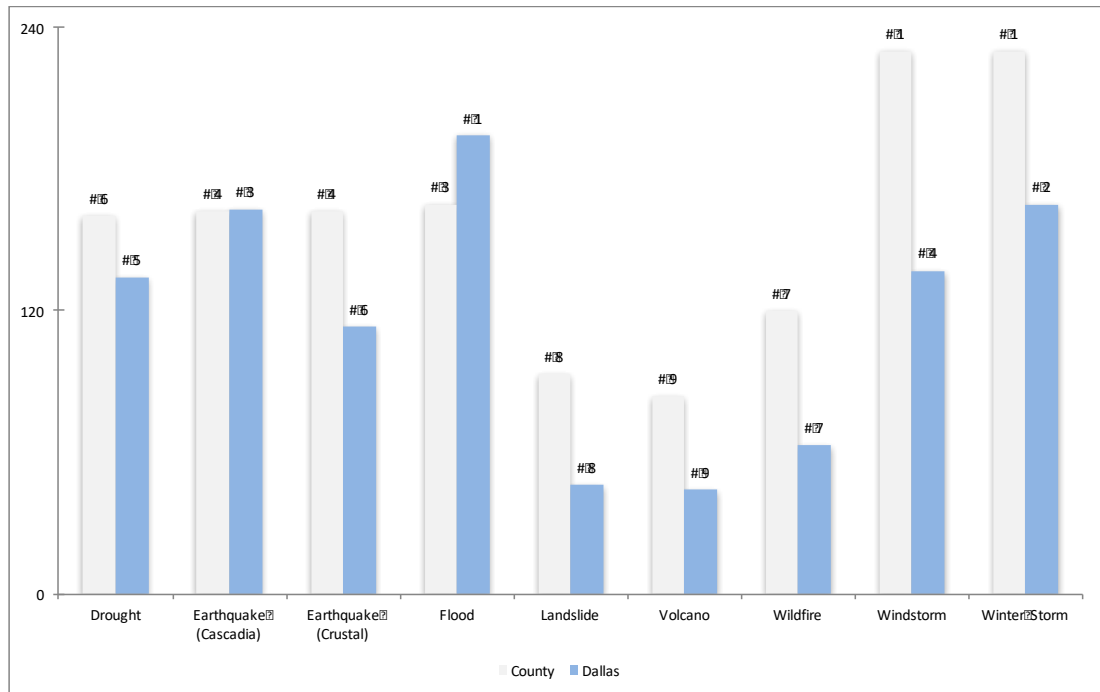
Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Summary

Figure DA-6 presents a summary of the hazard analysis for the City of Dallas and compares the results to the assessment completed by Polk County.

The city rated their threat to the Cascadia Subduction Zone earthquake and flood higher than the county. The top four hazards for the city are flood, winter storm, Cascadia Subduction Zone earthquake, and windstorm.

Figure DA-6 Overall Hazard Analysis Comparison –Polk County/ Dallas

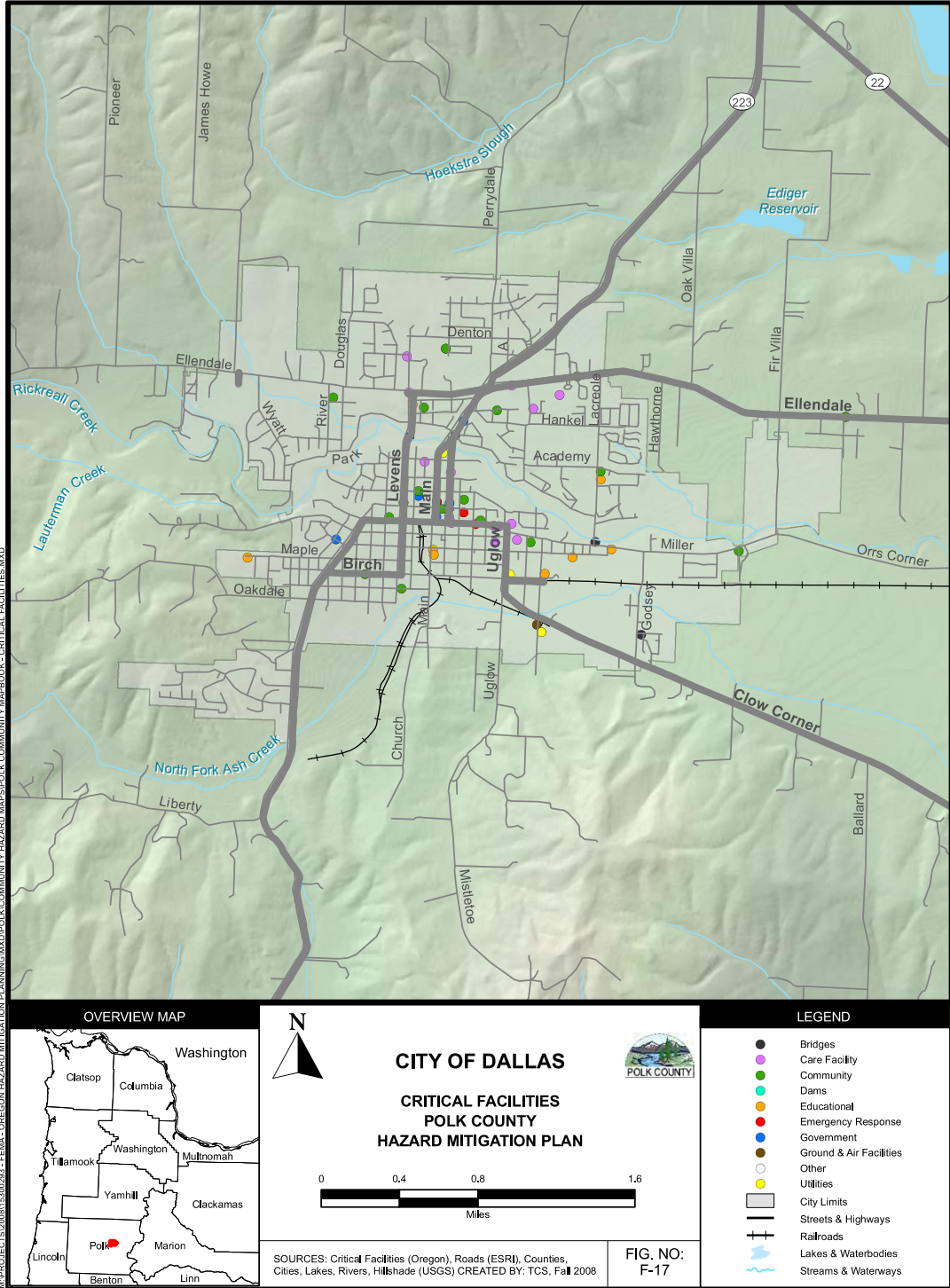


Source: City of Dallas NHMP Steering Committee and Polk County NHMP Steering Committee

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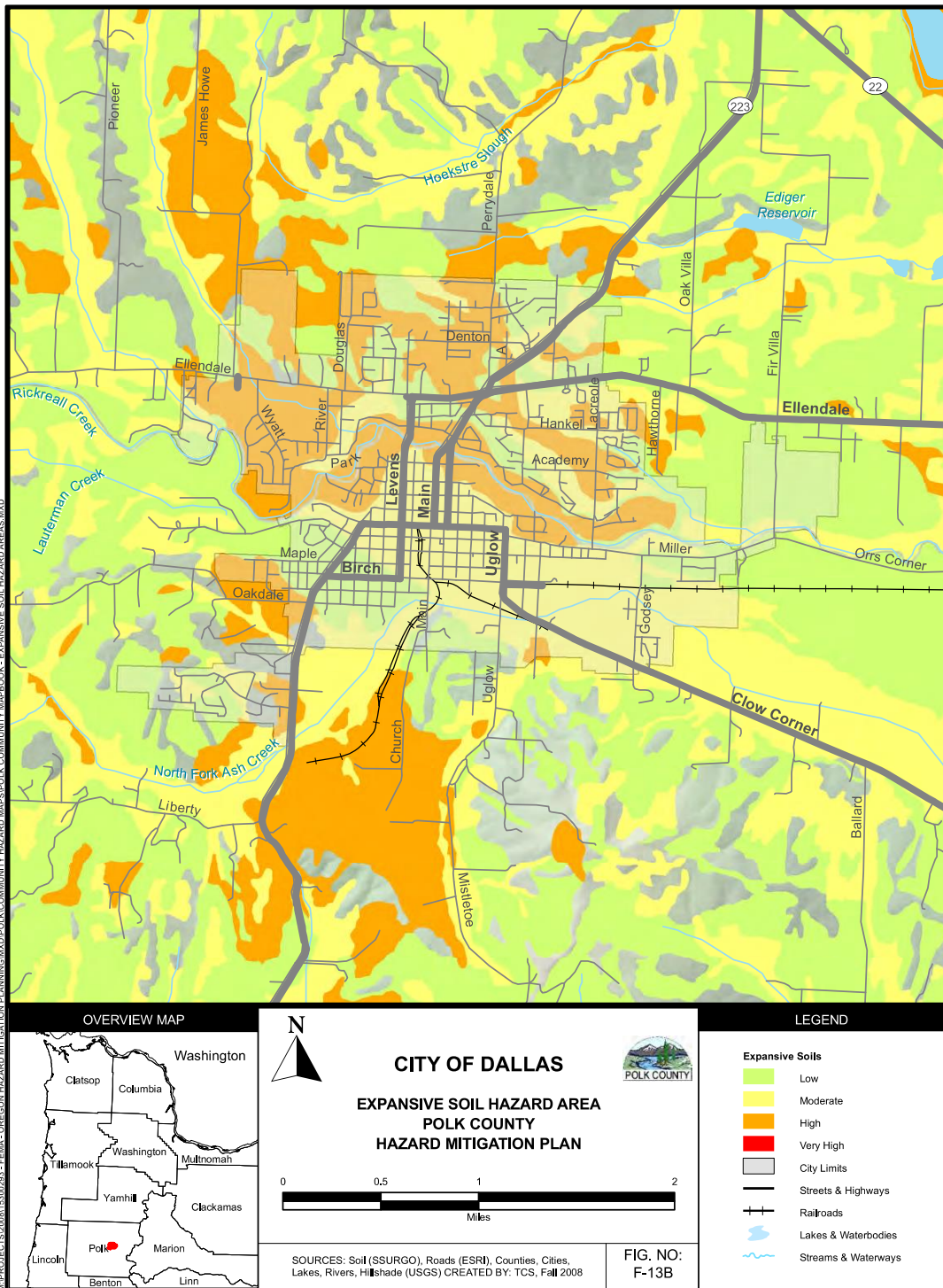
ATTACHMENT A - MAPS

Map DA-I Critical Facilities - Dallas



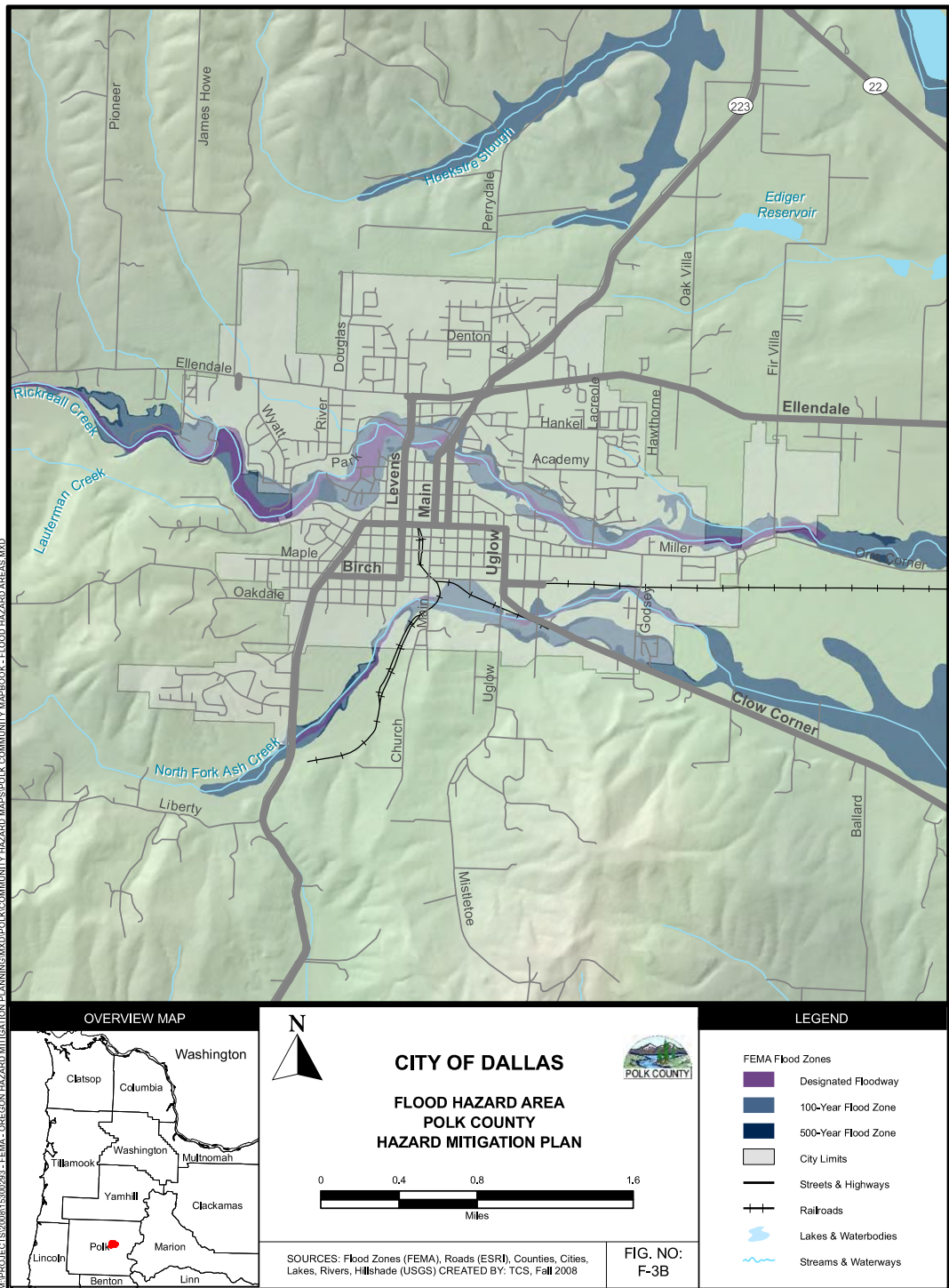
Source: Polk County NHMP (2009).

Map DA-2 Expansive Soils Hazard Area - Dallas



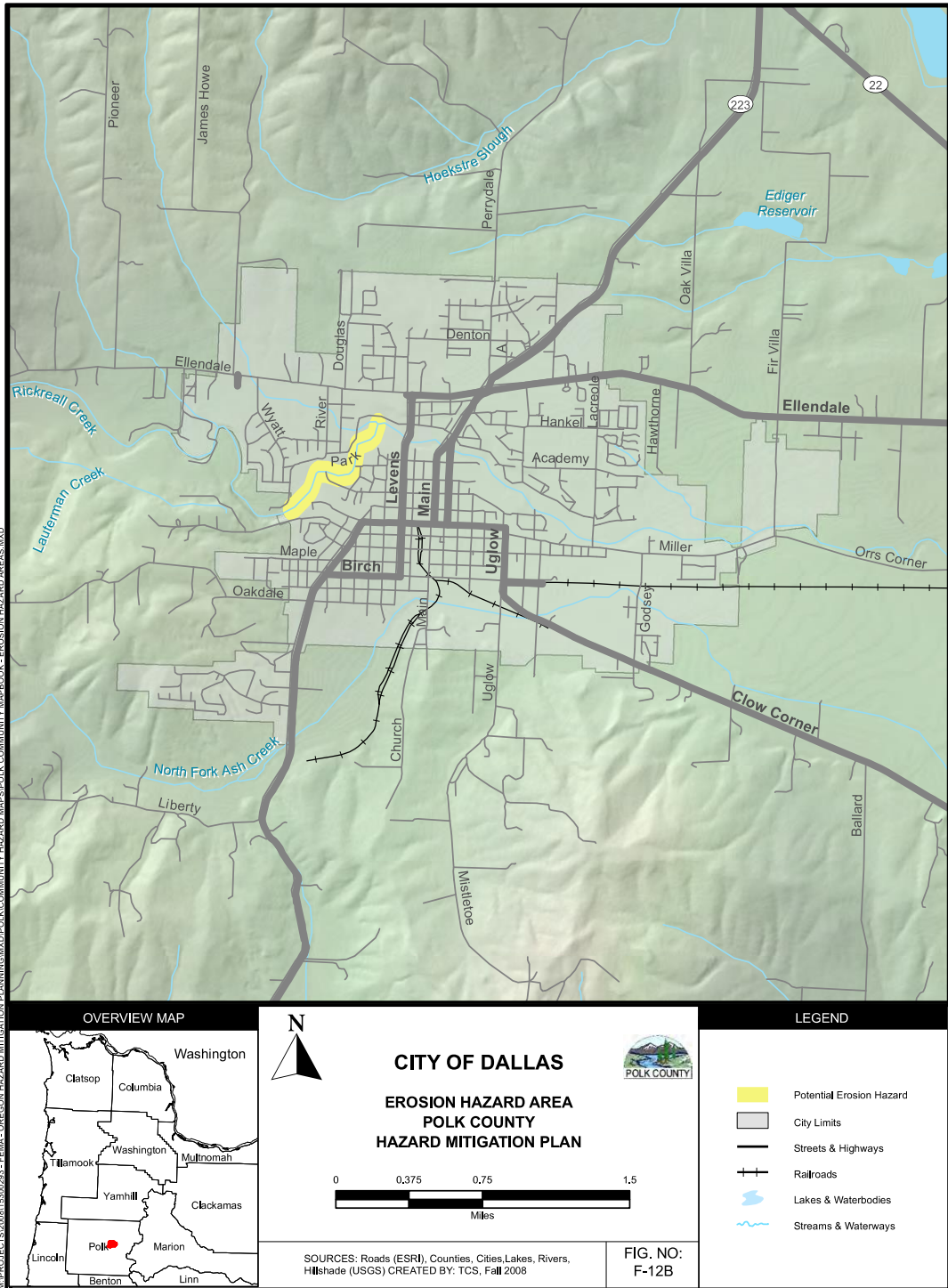
Source: Polk County NHMP (2009).

Map DA-3 Flood Hazard Area - Dallas



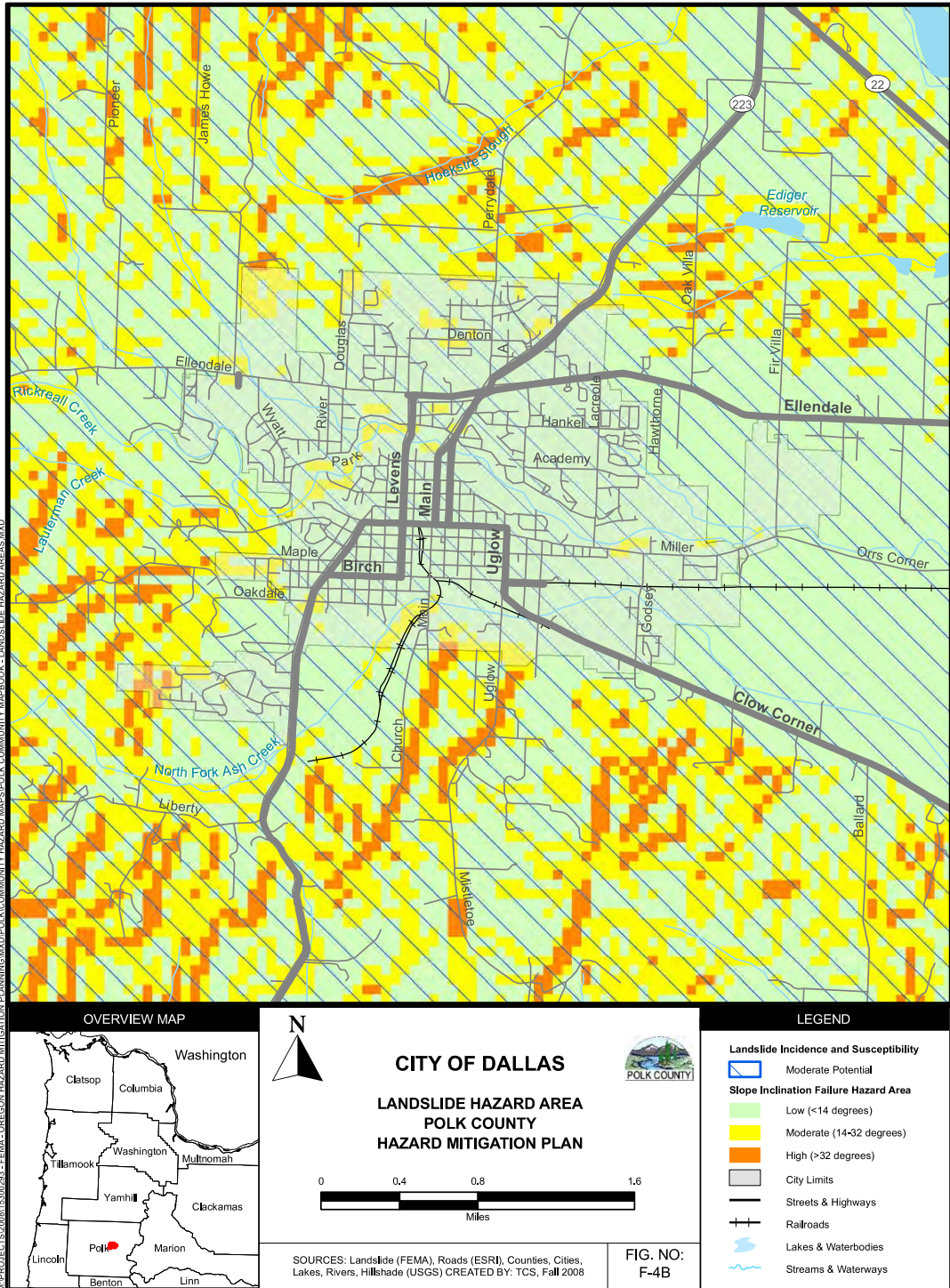
Source: Polk County NHMP (2009).

Map DA-4 Erosion Hazard Area - Dallas



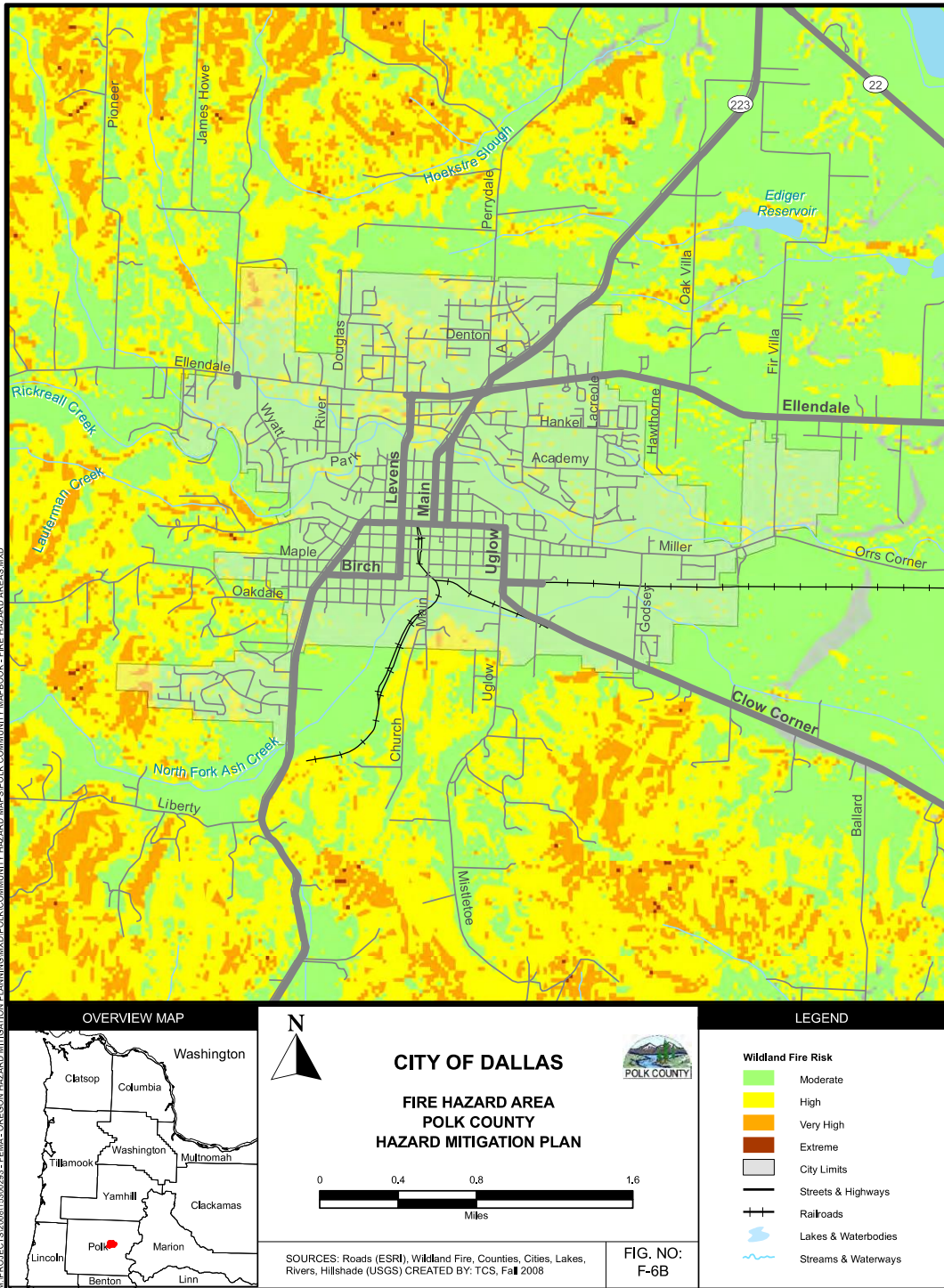
Source: Polk County NHMP (2009).

Map DA-5 Landslide Hazard Area - Dallas



Source: Polk County NHMP (2009).

Map DA-6 Wildfire Hazard Area - Dallas



Source: Polk County NHMP (2009).

CITY OF FALLS CITY ADDENDUM

Purpose

This document serves as the City of Falls City's Addendum to the Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan (MNHMP, NHMP). This addendum supplements information contained in Volume I (Basic Plan) of this NHMP, which serves as the foundation for this jurisdiction's addendum, and Volume III (Appendices), which provides additional information (particularly regarding participation and mitigation strategy). This addendum meets the following requirements:

- Multi-jurisdictional **Plan Adoption** §201.6(c)(5),
- Multi-jurisdictional **Participation** §201.6(a)(3),
- Multi-jurisdictional **Mitigation Strategy** §201.6(c)(3)(iv), and
- Multi-Jurisdictional **Risk Assessment** §201.6(c)(2)(iii).

Plan Process, Participation, and Adoption

This section of the NHMP addendum addresses 44 CFR 201.6(c)(5), *Plan Adoption*, and 44 CFR 201.6(a)(3), *Participation*.

In the Fall of 2016, the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center (CSC) partnered with the Oregon Military Department's Office of Emergency Management (OEM), and Polk County and cities, including Falls City, to update their NHMP, which expired October 14, 2014. This project is funded through the Federal Emergency Management Agency's (FEMA) FY14 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2014-002).

By developing this addendum to the Polk County NHMP, locally adopting it, and having it approved by FEMA, Falls City will regain eligibility for FEMA Hazard Mitigation, Pre-Disaster Mitigation, and Flood Mitigation Assistance grant program funds.

The Polk County NHMP, and Falls City addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. A project steering committee guided the process of developing the plan. For more information on the composition of the steering committee see the *Acknowledgements, Plan Summary, and Plan Process* (Volume III, Appendix A).

The City Manager of Falls City is the designated local convener and will take the lead in implementing, maintaining, and updating the addendum to the NHMP in collaboration with the designated convener of the Polk County NHMP (County Planning Department).

Representatives from the City of Falls City steering committee convened on the following occasions (see Appendix A for more information):

- July 27, 2016 - Polk County NHMP Kick-Off Meeting

- August 2016 – NHMP Project Agenda Report to City Council. Added an NHMP update project tab to City website and encouraged public participation.
- October 18, 2016 – Polk County NHMP Second Meeting

The city’s addendum reflects decisions decided upon at the plan update meeting and during subsequent work and communication with OPDR.

The Falls City Steering Committee was comprised of the following representatives:

- Convener, City Manager
- Domenica Protheroe , City Clerk
- Terry Ungricht. Mayor and City Manager
- Don Poe, Lead Public Works Worker
- Members of the City Council

Public participation was achieved with the establishment of the steering committee, which was comprised of city officials and special districts representing different organizations and sectors. In addition, public comments were solicited via the City Website (beginning in August 2016). The Steering Committee was closely involved throughout the development of the plan and served as the local oversight body for the plan’s development. In addition, community members outside of the steering committee were provided an opportunity for comment via the plan review process (see Appendix A for more information).

The Polk County NHMP was approved by FEMA on February 6, 2018 and the Falls City addendum was adopted via resolution on December 14, 2017. This NHMP is effective through February 5, 2023.

Mitigation Strategy

This section of the NHMP addendum addresses 44 CFR 201.6(c)(3)(iv), *Mitigation Strategy*.

During the 2016/2017 Polk County update process OPDR re-evaluated the Action Items with the county and local steering committees. Following the review actions were updated, noting what accomplishments had been made, and whether the actions were still relevant; any new action items were identified at this time (see Appendix A for more information). Each jurisdiction developed a list of priority actions any actions that were not prioritized were placed in an Action Item Pool and will be considered during the annual Implementation and Maintenance meetings.

Priority Actions

The city is listing a set of high priority actions in an effort to focus attention on an achievable set of high leverage activities over the next five-years. The city’s priority actions are listed below in Table FCA-1.

Action Item Pool

Table FCA-2 presents a pool of mitigation actions. This expanded list of actions is available for local consideration as resources, capacity, technical expertise and/or political will become available.

The majority of these actions carry forward from prior versions of this plan.

Table FCA-I Falls City Priority Action Items

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Priority Actions					
Multi-Hazard Action (MH)					
MH #1	Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities (particularly schools) susceptible to short term power disruption.	Falls City School District	Mid-Term (2-5 Years)	HMGP, School District Bond	BC: TBD TF: Yes
Earthquake Actions (EQ)					
EQ #1	Disseminate FEMA pamphlets to educate and encourage homeowners concerning seismic structural and non-structural retrofit benefits.	City Manager	Ongoing	General Fund, NEHRP, HMGP	BC: TBD TF: Yes
EQ #2	Repair Dayton Street Bridge	City Manager, Public Works	Mid-Term (2-5 Years)	OR-IFA, USDA, OPRD	BC: \$116,000 TF: Yes
Flood Action (FL) - including erosion					
FL #1	Develop an outreach program to educate public concerning NFIP participation benefits, floodplain development, land use regulation, and NFIP flood insurance availability to facilitate continued compliance with the NFIP.	MWVCOG Planning, City Manager, & Public Works	Short Term (0-2 Years)	General Fund	BC: TBD TF: Yes

Source: City of Falls City NHMP Steering Committee, 2016.

MH=Multi-Hazard, EQ=Earthquake, FL=Flood

Table FCA-2 Falls City Action Item Pool

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility
Action Item Pool					
Multi-Hazard Actions (MH)					
MH #2	Update Bulding Limitations Map and update Zoning and Development Code if required.	MWVCOG	Short Term (0-2 Years)	General Fund	BC: TBD TF: Yes
MH #3	Complete critical facility data collection to allow a more thorough vulnerability analysis for the City's infrastructure.	City Manager	Mid-Term (2-5 Years)	General Fund	BC: TBD TF: Yes
Drought Actions (DR) - including expansive soils					
<i>No specific actions identified; see multi-hazard actions.</i>					
Earthquake Actions (EQ)					
EQ #3	Identify high seismic hazard areas; develop a wood-frame residential building inventory and an outreach program to educate population concerning facilities particularly vulnerable to earthquake damage, such as pre-1940s homes and homes with cripple wall foundations.	MWVCOG	Mid-Term (2-5 Years)	General Fund	BC: TBD TF: Yes
EQ #4	Retrofit Bridge Street Vehilcular Bridge	City Manager, Public Works	Long Term (5+ Years)	OR-IFA, USDA, OPRD	BC: TBD TF: Yes
EQ #5	Retrofit important public facilities with significant seismic vulnerabilities (City Hall, etc.), such as unreinforced masonry construction. Consider structural and non-structural options.	City Manager Falls City School District	Long Term (5+ Years)	General Fund, NEHRP, HMGP, SRGP	BC: TBD TF: Yes
Flood Actions (FL) - including erosion					
FL #2	Southside drainage improvements.	City Manager, Polk County, Public Works	Ongoing	Street Fund, HMGP, HMA	BC: TBD TF: Yes
FL #3	Develop outreach program to educate residents concerning flood proofed well and sewer/septic installation.	Sewer: MWVCOG and City Manager Septic: Polk County	Ongoing	General Fund	BC: TBD TF: Yes
FL #4	Evaluate and implement preferred erosion protection initiatives to prevent or reduce riverine erosion damages to residential structures and road drainage systems.	MWVCOG Planning, City Manager, & Public Works	Ongoing	General Fund, NRCS, HMGP, HMA	BC: TBD TF: Yes

Source: City of Falls City NHMP Steering Committee, 2016
MH=Multi-Hazard, EQ=Earthquake, FL=Flood

Table FCA-2 Falls City Action Item Pool (continued)

2016 Action Item #	Description	Managing Department / Agency	OPDR Timeline	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
FL #5	Identify buildings that are at risk of being affected by erosion.	MWVCOG Planning, City Manager, & Public Works	Long Term (5+ Years)	General Fund, NRCS, HMPG, HMA	BC: TBD TF: Yes
FL #6	Conduct a water intake siting study and environmental impact study.	City Manager, Public Works	Long Term (5+ Years)	CDBG, USDA, OR-IFA	BC: \$25,000 TF: Yes
Landslide Actions (LS)					
LS #1	Develop, implement, and enforce property development landslide risk assessment procedures to identify potential facility vulnerability.	MWVCOG Planning & City Manager	Ongoing	General Fund	BC: TBD TF: Yes
LS #2	Create the storm water management plan to include regulations to control runoff, both for flood reduction and to minimize saturated soils on steep slopes that can cause landslides.	MWVCOG Planning & City Manager	Long Term (5+ Years)	General Fund	BC: TBD TF: Yes
Volcano Actions (VE)					
VE #1	Update emergency response planning and develop client focused outreach program for ash fall events affecting river, air, and highway transportation, and industrial facilities and operations.	MWVCOG, City Manager	Long Term (5+ Years)	General Fund, NOAA/ NWS	BC: TBD TF: Yes
VE #2	Evaluate capability of water treatment plant to deal with high turbidity from ash falls, update emergency response plans, and upgrade treatment facilities' physical plant to deal with ash falls.	City Engineer, City Manager & Public Works	Long Term (5+ Years)	General Fund, NOAA/ NWS	BC: TBD TF: Yes
Wildfire Actions (WF)					
WF #1	Develop outreach program to educate and encourage home landscape cleanup (defensible space) and define debris disposal programs.	DEQ, City Manager	Ongoing	General Fund, ODF, FMAP, HMGP	BC: TBD TF: Yes
WF #2	Participate in the maintenance, implementation, and update of the Polk County Community Wildfire Protection Plan (2009).	PC SW Rural Fire District Polk County & City Manager	Ongoing	General Fund	BC: TBD TF: Yes
WF #3	Identify, develop, implement, and enforce mitigation actions such as fuel breaks and reduction zones for potential wildland fire hazard areas.	Polk County, Oregon Department of Forestry, City Manager	Ongoing	General Fund	BC: TBD TF: Yes
WF #4	Identify critical facilities and vulnerable populations based on mapped high hazard areas.	City Manager	Mid-Term (2-5 Years)	General Fund, HMA	BC: TBD TF: Yes

Source: City of Falls City NHMP Steering Committee, 2016
 FL=Flood, LS=Landslide, VE=Volcano, WF=Wildfire

Table FCA-2 Falls City Action Item Pool (continued)

2016 Action Item #	Description	Managing Department / Agency	OPDR Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility
WF #5	Install new fire hydrants in locations where there is insufficient coverage as identified in Master Water Plan.	City Manager & Public Works	Long Term (5+ Years)	Water Fund, HMGP, PDM	BC: \$331,000 TF: Yes
Windstorm Action (WS)					
WD #1	Identify and prioritize critical facilities' overhead utilities that could be placed underground to reduce power disruption from windstorm / tree blow down damage.	City Manager & Pacific Power & Light	Mid-Term (2-5 Years)	General Fund, HMGP, HMA, Utility Co.	BC: TBD TF: Yes
Winter Storm Actions (WT)					
WT #1	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	Public Works	Ongoing	General Fund	BC: TBD TF: Yes
WT #2	Develop and implement strategies and educational outreach programs for debris management from severe winter storms.	MWVCOG Planning & City Manager & Public Works	Mid-Term (2-5 Years)	General Fund, PA	BC: TBD TF: Yes

Source: City of Falls City NHMP Steering Committee, 2016

WF=Wildfire, WD=Windstorm, WT=Winter Storm

Plan Implementation and Maintenance

The City Council will be responsible for adopting the City of Falls City addendum to the Polk County NHMP. This addendum designates a coordinating body and a convener to oversee the development and implementation of action items. Because the city addendum is part of the county's multi-jurisdictional NHMP, the city will look for opportunities to partner with the county. The city's steering committee will convene after re-adoption of the City of Falls City addendum on an annual schedule; the county is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The City Manager will serve as the convener and will be responsible for assembling the steering committee (coordinating body). The steering committee will be responsible for:

- identifying new risk assessment data,
- reviewing status of mitigation actions,
- identifying new actions, and
- seeking funding to implement the city's mitigation strategy (actions).

The convener will also remain active in the county's implementation and maintenance process (see Volume I, Section 4 for more information).

The city will utilize the same prioritization process as the county (See Volume I, Section 4: Plan Implementation and Maintenance and Volume III, Appendix C: Economic Analysis of Natural Hazard Mitigation Projects for more information).

Implementation through Existing Programs

Many of the Natural Hazards Mitigation Plan's recommendations are consistent with the goals and objectives of the city's existing plans and policies. Where possible, the City of Falls City will implement the NHMP'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, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented.

Falls City's acknowledged comprehensive plan is the Falls City Comprehensive Plan. The Oregon Land Conservation and Development Commission first acknowledged the plan in 1979. The City last amended the plan in July 2013. The City implements the plan through the Falls City Zoning and Development Code, which was amended in 2017.

Falls City currently has the following plans, programs, and policies that relate to natural hazard mitigation. For a complete list visit the city [website: www.fallscityoregon.gov](http://www.fallscityoregon.gov).

Table FCA-3 Legal and Regulatory Resources Available for Hazard Mitigation

Regulatory Tool	Name	Effects on Hazard Mitigation
Plans	Falls City Emergency Operations Plan (2014)	Identifies emergency planning, policies, procedures, and response to extraordinary emergency situations associated with natural disasters, technological incidents, and national security emergencies.
	Falls City Emergency Preparedness Plan (2015)	Provides resources for residents to be prepared in case of disaster.
	Falls City Comprehensive Plan (1979) Amended 2001, 2003, 2010, 2013	Defines governance, development, infrastructure, and responsibilities.
	Falls City Charter (2014)	Defines governance.
	Falls City Wastewater Facility Plan: Part A, Part B (2014)	Outline wastewater improvements.
	Falls City Water Master Plan (Underway 2017)	Outlines water system improvements.
	Transportation System Plan (2013)	To establish the City's goals, policies, and action strategies for development and improving the transportation system.
	Street Improvement Plan (2010)	Identifies needed street improvements.
	Park Master Plan (Underway 2017)	Outlines improvements and acquisitions for city parks.
Programs	National Flood Insurance Program (NFIP)	Makes affordable flood insurance available to homeowners, business owners, and renters in participating communities. In exchange, those communities must adopt and enforce minimum floodplain management regulations to reduce the risk of damage from future floods.
	CIS Flood Insurance	Falls City has a \$5M flood insurance policy with CIS.
Policies (Municipal Codes)	Falls City Municipal Code Chapter 151 Building Regulations	Adopts and enforces the Oregon Building Code.
	Falls City Municipal Code Chapter 150 Flood Damage Prevention	To minimize public and private losses due to flood conditions.
	Falls City Municipal Code Chapter 154 Zoning and Development Code	Adopts Falls City Zoning and Development Ordinance. Defines building requirements for the city, restricts building in hazard zones.

Table FCA-4 Administrative and Technical Resources for Hazard Mitigation

Staff/Personnel Resources	Department/Division Position
Planner(s) or engineer(s) with knowledge of land development and land management practices	City Engineer: Steve Ward, Westech Engineering, LLC City Planner Mid-Willamette Council of Governments (MWV COG)
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	City Engineer: Steve Ward, Westech Engineering, LLC
Planner(s) or engineer(s) with an understanding of manmade or natural hazards	City Engineer: Steve Ward, Westech Engineering, LLC City Planner City Planner Mid-Willamette Council of Governments (MWVCOG)
Floodplain manager	City Planner Mid-Willamette Council of Governments (MWVCOG)
Personnel skilled in GIS and/or HAZUS-MH	No capability in Falls City GIS accomplished by Mid-Willamette Council of Governments (MWVCOG) and Westech Engineering, LLC
Director of Emergency Services	City Manager
Finance (grant writers, purchasing)	City Manager
Public Information Officers	City Manager

Table FCA-5 Financial Resources for Hazard Mitigation

Financial Resources	Effect on Hazard Mitigation
General funds	Available for mitigation projects
Authority to levy taxes for specific purposes	(Measure 5 or Measure 50) w/ a cap w/ voter approval (cannot exceed cap)
Incur debt through general obligation bonds	Yes can increase city funding capability
Incur debt through special tax and revenue bonds	Yes
Incur debt through private activity bonds	No

Note: See Appendix D – Grant Programs for additional financial resources.

Continued Public Participation

Keeping the public informed of the city’s efforts to reduce the city’s risk to future natural hazards events is important for successful plan implementation and maintenance. The city is committed to involving the public in the plan review and updated process. See Volume I, Section 4, for more information.

Plan Maintenance

The Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan and city addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the county plan update process, the city will also review and update its addendum. The convener will be responsible for convening the steering committee to address the questions outlined below.

- 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?
- Have there been any significant changes in the community's demographics 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?

These questions will help the steering committee determine what components of the mitigation plan need updating. The steering committee will be responsible for updating any deficiencies found in the plan.

Risk Assessment

This section of the NHMP addendum addresses 44 CFR 201.6(b)(2) - Risk Assessment. In addition, this chapter can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards. Assessing natural hazard risk has three phases:

- **Phase 1:** Identify hazards that can impact the jurisdiction. This includes an evaluation of potential hazard impacts – type, location, extent, etc.
- **Phase 2:** Identify important community assets and system vulnerabilities. Example vulnerabilities include people, businesses, homes, roads, historic places and drinking water sources.
- **Phase 3:** Evaluate the extent to which the identified hazards overlap with, or have an impact on, the important assets identified by the community.

The local level rationale for the identified mitigation strategies (action items) is presented herein, and within Section 2, *Risk Assessment*, and Appendix B, *Community Profile*. The risk assessment process is graphically depicted in Figure FCA-1 below. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure FCA-I Understanding Risk



Hazard Analysis Methodology

This NHMP utilizes a hazard analysis methodology that was first developed by FEMA circa 1983, and gradually refined by the Oregon Military Department’s Office of Emergency Management over the years.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible). Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%.

This method provides the jurisdiction with a sense of hazard priorities, or relative risk. It doesn't predict the occurrence of a particular hazard, but it does "quantify" the risk of one hazard compared with another. By doing this analysis, planning can first be focused where the risk is greatest.

In this analysis, severity ratings, and weight factors, are applied to the four categories of history, vulnerability, maximum threat (worst-case scenario), and probability as shown in the table below. See Volume I, Section 2 (Risk Assessment) for more information.

Hazard Analysis

The Falls City steering committee developed their hazard vulnerability assessment (HVA), using the county’s HVA as a reference. Changes from the county’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Falls City, which are discussed throughout this addendum.

Table FCA-6 shows the HVA matrix for Falls City showing each hazard listed in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in

planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with sense of hazard priorities, but does not predict the occurrence of a particular hazard.

One catastrophic hazards (Cascadia Subduction Zone earthquake) and two chronic hazards (windstorm and landslide) rank as the top hazard threats to the city (Top Tier). The Wildfire, flood, and winter storm hazards comprise the next highest ranked hazards (Middle Tier), while drought, crustal earthquake, and volcano hazards comprise the lowest ranked hazards (Bottom Tier).

Table FCA-6 Hazard Analysis Matrix – Falls City

Hazard	History	Probability	Vulnerability	Maximum Threat	Total Threat Score	Hazard Rank	
Windstorm	16	56	35	100	207	# 1	<i>Top Tier</i>
Earthquake (Cascadia)	2	49	50	100	201	# 2	
Landslide	2	56	45	90	193	# 3	
Wildfire	4	56	40	70	170	# 4	<i>Middle Tier</i>
Flood	4	56	35	70	165	# 5	
Winter Storm	16	56	15	70	157	# 6	
Drought	6	42	20	80	148	# 7	<i>Bottom Tier</i>
Earthquake (Crustal)	2	7	15	30	54	# 8	
Volcano	2	7	25	10	44	# 9	

Source: Falls City NHMP Steering Committee, 2016.

Table FCA-7 categorizes the probability and vulnerability scores from the hazard analysis for the city and compares the results to the assessment completed by the Polk County NHMP Steering Committee (areas of differences are noted with **bold** text within the city ratings). The city ranked probability of landslide higher than the county and their vulnerability to Cascadia Subduction Zone earthquakes, landslide, and wildfire higher than the county.

Table FCA-7 Probability and Vulnerability Comparison

Hazard	Falls City		County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Moderate	Moderate	Moderate
Earthquake (Cascadia)	Moderate	High	Moderate	Moderate
Earthquake (Crustal)	Low	Low	Moderate	Moderate
Flood	High	Moderate	High	Moderate
Landslide	High	High	High	Low
Volcano	Low	Moderate	Low	Moderate
Wildfire	High	High	Moderate	Moderate
Windstorm	High	Moderate	High	High
Winter Storm	High	Low	High	High

Source: Falls City NHMP Steering Committee and Polk County NHMP Steering Committee, 2016.

Between 2010 and 2015 the City grew by approximately 5 people (<1%) and median household income decreased by 24% (see Appendix B). New development was placed outside of the floodplain per the city’s floodplain ordinance (see Table FCA-3) and complied with the seismic safety standards within the [Oregon State Building Code](#). As such changes in population, demographics, and development have had a negligible impact upon

vulnerability. However, decreased household income within the community may be a signal that segments of the community may have a difficult time recovering from a natural hazard. See specific hazard sections below for more information.

Community Asset Identification

This section provides information on city specific assets. For additional information on the characteristics of Falls City, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, *Community Profile*. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation.

Community Characteristics

Falls City is located in the mid-Willamette Valley nestled in the foothills of the Coast Range and is named for the Little Luckiamute Falls located in the center of town. The city is located on the Little Luckiamute River and covers an area of about 1.2 square miles. The climate of Falls City is moderate; the average monthly temperatures range from 48 – 80 degrees in July and August, and 31-46 degrees in December and January, and the city receives approximately 74 inches of rain each year. Monthly precipitation is about 9-13 inches during the wetter months of November – March, and average about 0.3-1.9 inches during the drier months of June - September. The city’s topography is both a mix of relatively flat areas and steeper sloped areas along the western and northern edges of the city.

Economy

Falls City benefits from its location to Salem which is the State Capital and a regional center for industrial technology, engineering, research, commerce, and health care. Top industries for employment include in Falls City include social assistance, educational services, construction, and retail; however, most employment is outside of the city.

Asset Inventory

Asset inventory is the first step of a vulnerability analysis. Assets that may be affected by hazard events include population, residential and nonresidential buildings, critical facilities, and infrastructure.

The asset inventory delineates the City’s existing building and infrastructure assets and insured values and are identified in detail in Table FCA-8 and Map FCA-1 (Attachment A).

Table FCA-8 Falls City Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value ¹
Government	US Post Office	123 Parry Street	\$408,290
	City Hall and Public Works Maintenance Shop	299 Mill Street	\$587,500
	City Maintenance Storage Bldg	120 Parry Rd	\$161,171
Emergency Response	Fire Station/Community Center	320 N Main Street	\$1,150,400
Educational	Falls City Elementary School K-8	177 Prospect Avenue	\$3,058,958

Facility Type	Name / Number	Address	Value ¹
	Falls City High School	111 N North Main Street	\$3,556,871
	Wagner Library	111 N Main Street	\$155,967
Community	George Kitchin Memorial Park	7 th Street	\$171,133 (restroom only)
	Michael Harding Memorial Park	Parry Road	Unknown
	Fay Wilson Memorial Park	S Main Street	\$10,510
	Lower Cemetery		Unknown
	Upper Cemetery		Unknown
	Grace Family Fellowship	401 Lombard Street	\$121,090
	United Methodist Church	242 N Main Street	\$73,940
	Seventh-Day Adventist Church	205 N Main Street	\$432,680
	First Christian Church	233 S Main St	\$168,460
	Mountain Gospel Fellowship	257 N Main St	\$79,350
State and Federal Highways	Hwy 223 N/S route		Unknown
Bridges	Little Luckiamute River Bridge	500 Main Street	\$1,820,000
	Steel Foot Bridge	299 Mill St	\$217,271
	Wood Foot Bridge	Dayton St	\$113,283
	Dutch Creek Crossing	Mitchell Street	
Utilities	Teal Creek Water Treatment Plant & water storage tank	6666 Teal Creek Rd	\$6,170,000
	Wastewater Treatment Plant with sand trap	111 N Main St	\$2,198,300
	Fair Oaks Pump Station	Fair Oaks Street	\$50,098

Note: ¹Estimated and/or insured structural and/or Polk County Assessed value for critical facilities and estimated values for critical infrastructure

See hazard sections below and Section 2, *Risk Assessment*, for potential hazard vulnerabilities to these facilities.

Hazard Characteristics

Drought

The steering committee determined that the city's probability for drought is **moderate** (which is the same as the county's rating) and that their vulnerability to drought is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of drought hazards, as well as the location and extent of a potential event. Due to a cool, wet climate, past and present weather conditions have generally spared Polk County communities from the effects of drought; however, Polk County was included in a Governor declared drought declaration in 1992 and a Presidential drought declaration in 2015.

Falls City's primary water supply comes from the Teal Creek and Glaze Creek drainages. The city has one (1) storage reservoir for a total of 600,000 gallons of treated water storage capacity. The city's water treatment plant has been operating since 1998. Oregon Health Authority (OHA) has approved the 2017 Water Master Plan and the City is awaiting approval from Oregon Water Resources Department (OWRD). In general, water supply is available

and sufficient. Additional, drought-related community impacts are described within the county's Drought Hazard Annex.

A comprehensive risk and vulnerability assessment is not available at this time. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities.

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

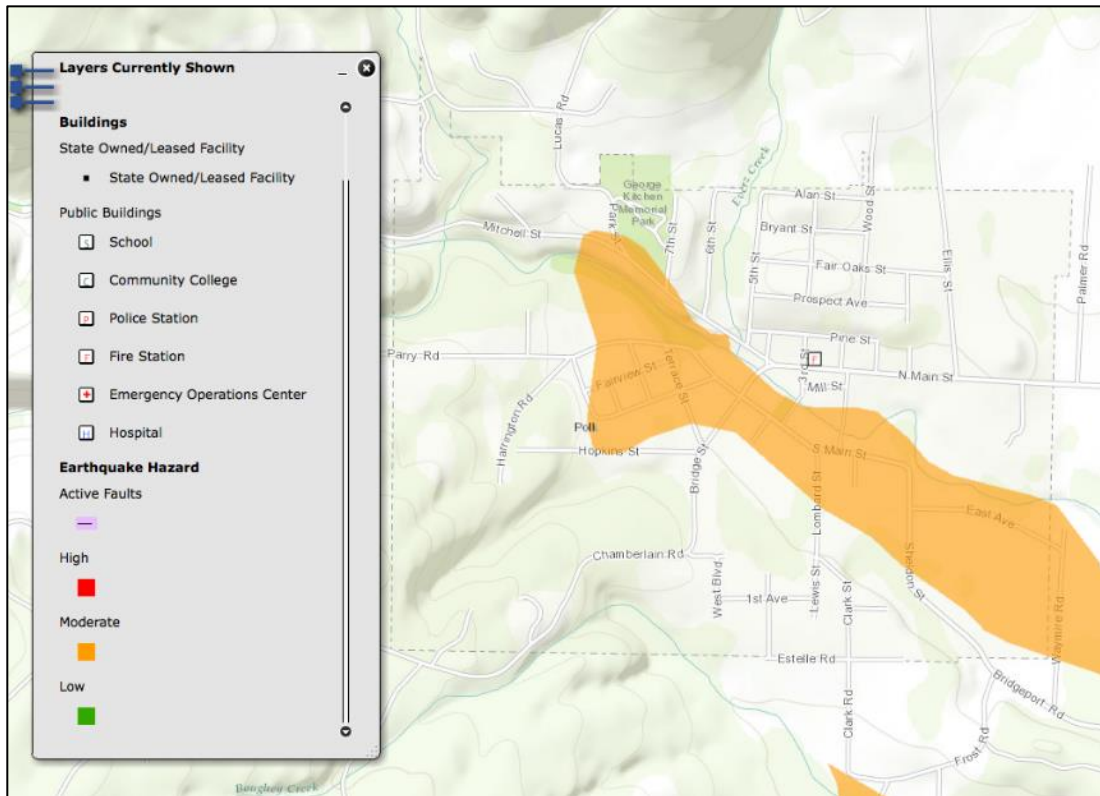
Earthquake

The steering committee determined that the city's probability for a Cascadia Subduction Zone (CSZ) Earthquake event is **moderate** (which is the same as the county's rating) and that their vulnerability to a Cascadia Earthquake event is **high** (which is higher than the county's rating). The steering committee determined that the city's probability for a Crustal Earthquake event is **low** (which is lower than the county's rating) and that their vulnerability to a Crustal Earthquake event is **low** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of earthquake hazards, history, as well as the location and extent of a potential event. Generally, an event that affects the county is likely to affect Falls City as well. The causes and characteristics of an earthquake event are appropriately described within the county's plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Falls City as well.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any particular site. In many major earthquakes, damages have primarily been caused by the behavior of the soil. Figure FCA-2 displays relative liquefaction hazards. As shown, the area of greatest concern within the city of Falls City (darker areas) is along the Little Luckiamute River where the concentration of soft soils is the highest.

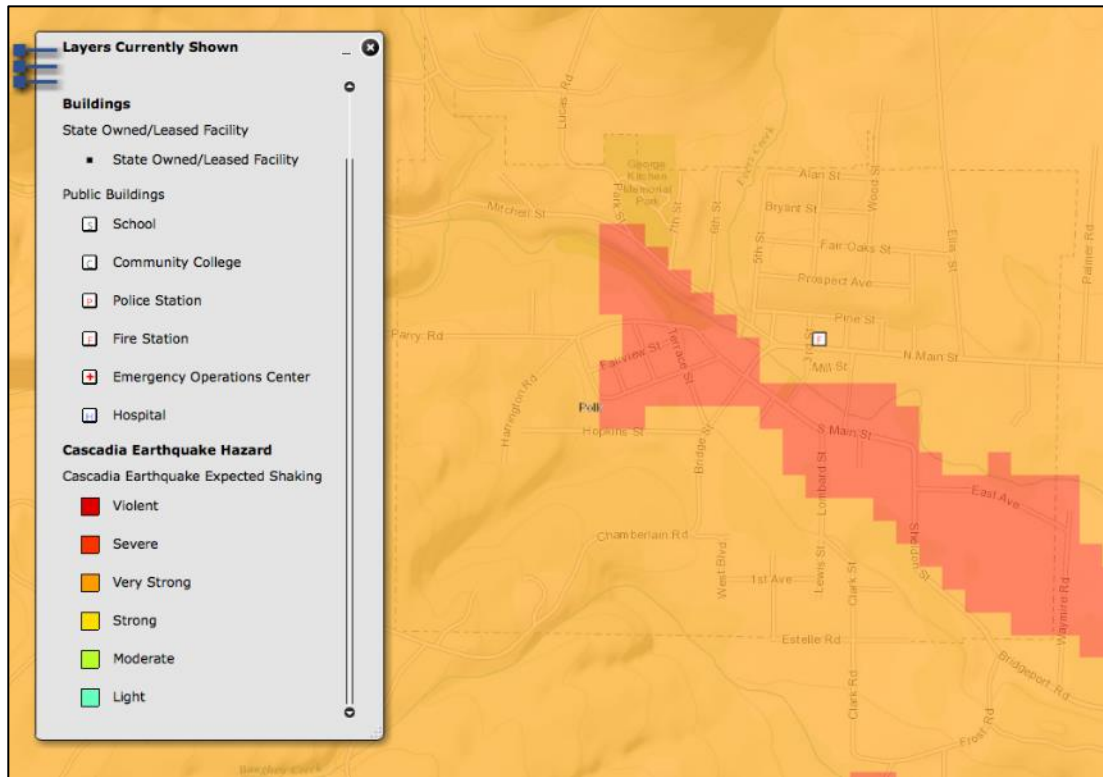
Figure FCA-2 Active Faults and Soft Soils



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

Figure FCA-3 shows the expected shaking/ damage potential for Falls City as a result of a Cascadia Subduction Zone (CSZ) earthquake event. The figure shows that the city will experience “strong” to “very strong” shaking that will last two to four minutes. The strong shaking will be extremely damaging to lifeline transportation routes including Highway 22, 99, and Interstate 5. For more information on expected losses due to a CSZ event see the [Oregon Resilience Plan](#).

Figure FCA-3 Cascadia Subduction Zone Expected Shaking



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

As noted in the community profile approximately 74% of residential buildings were built prior to 1990, which increases the city’s vulnerability to the earthquake hazard. Information on specific public buildings’ (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table FCA-9; each “X” represents one building within that ranking category. The one facility evaluated by DOGAMI using RVS, does not have a high (greater than 10% chance) or very high (100% chance) collapse potential.

Table FCA-9 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (< 1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Public Safety					
Falls City Fire Department (320 N Main St)	Polk_fir09	X			

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#)

“*” – Site ID is referenced on the [RVS Polk County Map](#)

In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage.

Utility systems will be significantly damaged, including damaged buildings and damage to utility infrastructure, including water treatment plants and equipment at high voltage substations (especially 230 kV or higher which are more vulnerable than lower voltage

substations). Buried pipe systems will suffer extensive damage with approximately one break per mile in soft soil areas. There would be much lower rate of pipe breaks in other areas. Restoration of utility services will require substantial mutual aid from utilities outside of the affected area.

A comprehensive risk and vulnerability assessment is not available at this time. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. According to the previous version of this plan approximately 440 residential structures (value \$43M), three government facilities (value \$1.2M), one emergency response facility (value \$1.2M), two educational facilities (value \$1.7M), ten community facilities (value \$866K), three bridges (value \$2.2M), and two utilities (value \$8.4M) which would be impacted by a strong shaking event.¹

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Flood

The steering committee determined that the city's probability for riverine flood is **high** (which is the same as the county's rating) and that their vulnerability to flood is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of flooding hazards within the region, as well as previous flooding occurrences. General flood-related community impacts are adequately described within the Flood Hazard Annex of Polk County's Natural Hazards Mitigation Plan. Portions of Falls City have areas of flood plains (special flood hazard areas). These include areas along the Little Luckiamute River (see Figure FCA-4 and Attachment A, Map FCA-2). Furthermore, other portions of Falls City, outside of the mapped floodplains, are also subject to significant, repetitive flooding from local storm water drainage.

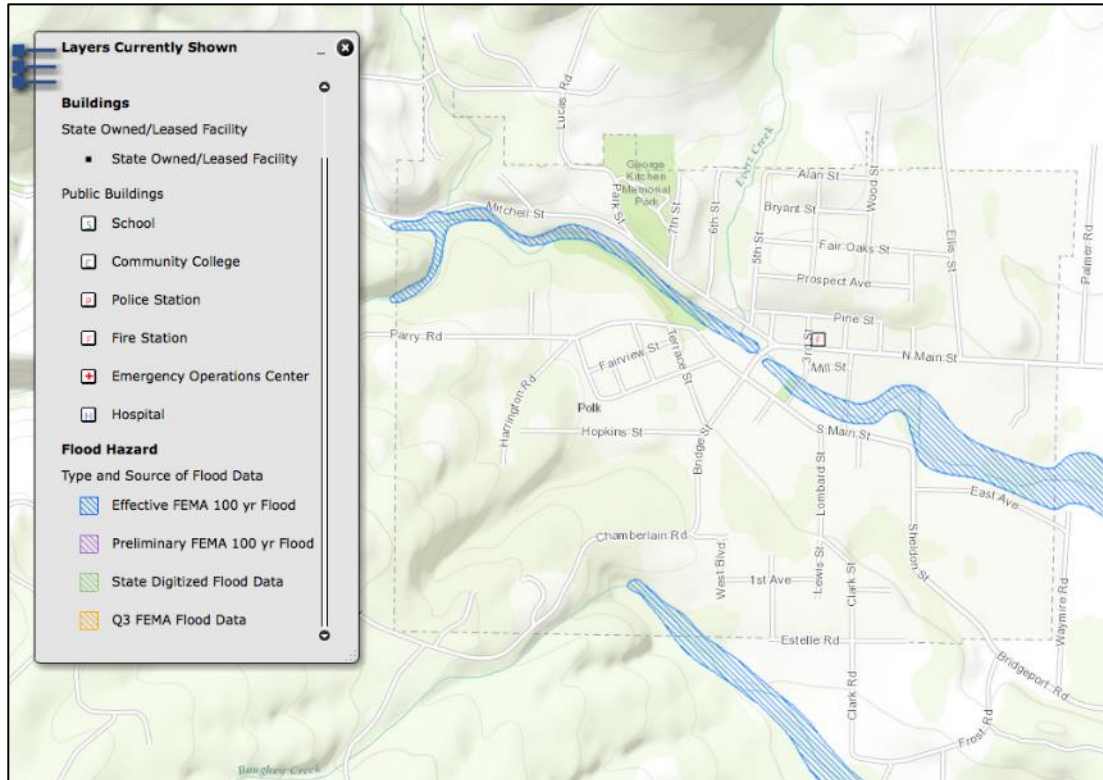
History:

The following incident has occurred since the previous plan:

- 12/07/2016 DR-4258: Flooding – culverts along Mitchell Road at GPS Location 44.869807 - 123.443991 was damaged by fast flowing floodwaters that overwhelmed this facility washing out the culverts and road at this site as a direct result of Sever Winter Storms, Straight-lines Winds, Flooding and Mud Slides.
- 1/17-21/2012: DR-4055: Flooding – severe winter storm and overland flooding inundated Falls City with record amounts of rainfall damaged 10 sites.

¹ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

Figure FCA-4 Special Flood Hazard Area



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

A comprehensive risk and vulnerability assessment is not available at this time. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. According to the previous version of this plan approximately 74 residential structures (value \$7.2M), two government facilities (value \$749K), three community facilities (value \$281K), and three bridges (value \$2.2M) are located within the 100-year floodplain.²

For more information on flood risk see the [Polk County Flood Insurance Study \(2006\)](#).

National Flood Insurance Program (NFIP)

FEMA modernized the Falls City Flood Insurance Rate Maps (FIRMs) in December 2006. Table FCA-10 shows that as of September 2016, Falls City has 0 National Flood Insurance Program (NFIP) policies in force. There has not been a Community Assistance Visit (CAV) for Falls City. Falls City is not a member of the Community Rating System (CRS).

² URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

The Community Repetitive Loss record for Falls City identifies no Repetitive Loss Properties³ and no Severe Repetitive Loss Properties⁴.

Table FCA-10 Flood Insurance Detail

Jurisdiction	Effective FIRM and FIS	Initial FIRM Date	Total Policies	Pre-FIRM Policies	Policies by Building Type				Minus Rated A Zone
					Single Family	2 to 4 Family	Other Residential	Non-Residential	
Polk County	-	-	428	183	334	27	25	42	28
Falls City	12/19/2006	7/7/1981	0	0	0	0	0	0	0

Jurisdiction	Insurance in Force	Total Paid Claims	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Paid Amount	Repetitive Loss Properties	Severe Repetitive Loss Properties	CRS Class Rating	Last CAV
Falls City	\$ -	0	0	0	\$ -	0	0	-	none

Source: Information compiled by Department of Land Conservation and Development, September 2016.

Riverine Erosion

Riverine erosion rarely causes death or injury. However, erosion causes significant destruction of property, development, and infrastructure. Erosion hazard data is not readily available; however, descriptions of several localized areas were identified during the development of this document and are identified only by location on Map FCA-3 (Attachment A). Critical facilities that may be at risk of erosion were identified using a 300 foot-buffer in the areas identified as having historic erosion impacts to conservatively account for building footprints.

A comprehensive risk and vulnerability assessment is not available at this time. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. According to the previous version of this plan approximately 101 residential structures (value \$9.8M), two government facilities (value \$749K), one emergency response facility (value \$1.2M), six community facilities (value \$414K), and three bridges (value \$2.2M) considered at risk.⁵

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

³ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

⁴ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000 and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

⁵ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

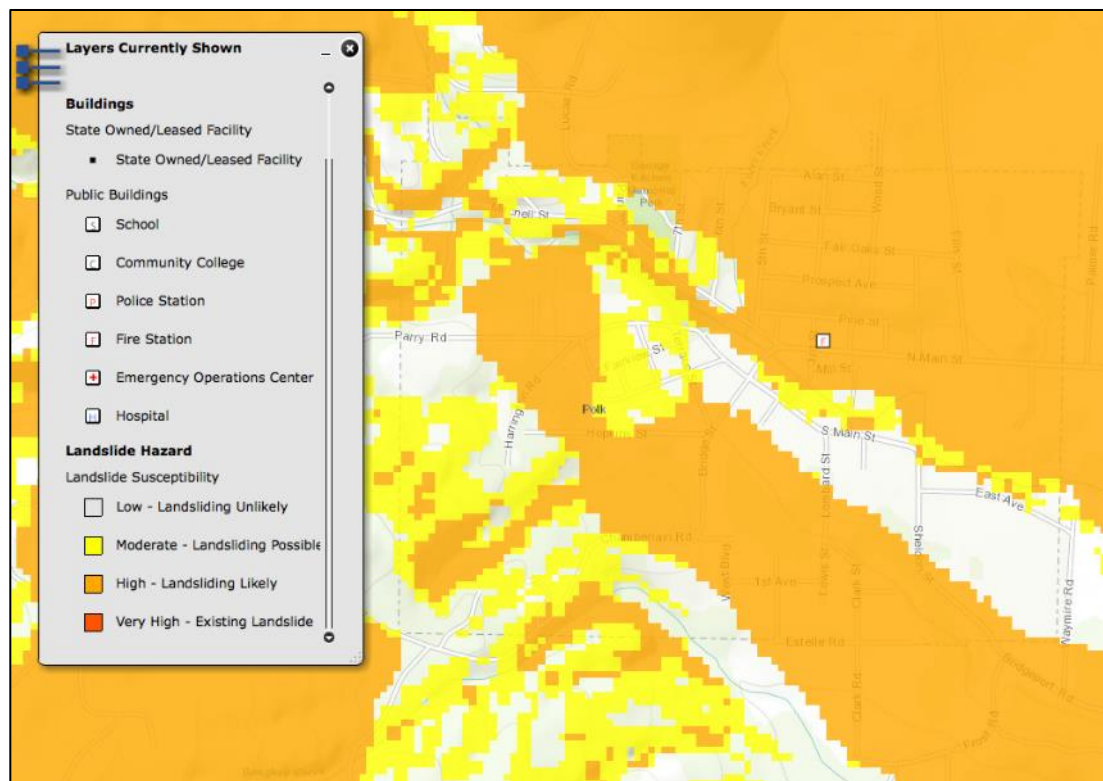
Landslide

The steering committee determined that the city's probability for landslide is **high** (which is the same as the county's rating) and that their vulnerability to landslide is **moderate** (which is higher than the county's rating).

Falls City is underlain by igneous and sedimentary rock. Igneous bedrocks (volcanic) origin is found primarily in the higher and steeper southwest portion of the city and along the Little Luckiamute River from the city's bridge upstream. Sedimentary rock is primarily siltstone with some sandstone and dip slightly toward the east. Sedimentary rock is less resistant to stream action than the igneous rock and when the sedimentary rock is eroded away the igneous rock is undermined causing large-scale block sliding.⁶ Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of landslides, and appropriately identifies previous landslide occurrences within the region.

Landslide susceptibility exposure for Falls City is shown in Figure FCA-5 and Map FCA-4 (Attachment A). Approximately 59% of Falls City has High, and approximately 16% Moderate, landslide susceptibility exposure⁷.

Figure FCA-5 Landslide Susceptibility Exposure



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

⁶ Falls City Comprehensive Plan (2013)

⁷ DOGAMI Open-File Report, O-16-02, Landslide Susceptibility Overview Map of Oregon (2016)

Potential landslide-related impacts are adequately described within the county's plan, and include infrastructural damages, economic impacts (due to isolation and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides and debris flows can potentially occur during any winter in Polk County, and highway and other major roads beyond city limits are susceptible to obstruction as well.

A comprehensive risk and vulnerability assessment is not available at this time. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. According to the previous version of this plan approximately 419 residential structures (value \$40.6M), three government facilities (value \$1.2M), one emergency response facility (value \$1.2M), two educational facilities (value \$1.7M), ten community facilities (value \$866K), three bridges (value \$2.2M), and two utility facilities (value \$8.4M) were located in moderate risk areas. There are 206 residential structures (value \$20M), one educational facility (value \$1M), and three community facilities (values unknown) located within high landslide risk areas.⁸

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Volcano

The steering committee determined that the city's probability for volcanic event is **low** (which is the same as the county's rating) and that their vulnerability to volcanic event is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes Falls City's risk to volcanic events. Generally, an event that affects the county is likely to affect Falls City as well. The causes and characteristics of a volcanic event are appropriately described within the county's plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Falls City as well. Falls City is very unlikely to experience anything more than volcanic ash during a volcanic event. When Mt. Saint Helens erupted in 1980, the city was not impacted.

A comprehensive risk and vulnerability assessment is not available at this time. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. According to the previous version of this plan approximately 395 residential structures (value \$47M), three government facilities (value \$1.2M), one emergency response facility (value \$1.2M), two educational facilities (value \$1.7M), ten community facilities (value \$866K), three bridges (value \$2.2M), and two utilities (value \$8.4M) which would be impacted by a volcanic ash event.⁹

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

⁸ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

⁹ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

Wildfire

The steering committee determined that the city's probability for wildfire is **high** (which is higher than the county's rating) and that their vulnerability to wildfire is **high** (which is higher than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of wildfires, as well as the county and city's history of wildfire events. There are no known large wildfire events in Falls City. The location and extent of a wildfire vary depending on fuel, topography, and weather conditions. Weather and urbanization conditions are primarily at cause for the hazard level.

The potential community impacts and vulnerabilities described in the county's plan are generally accurate for the city as well. Polk County developed a Community Wildfire Protection Plan (CWPP) in 2009, which mapped wildland urban interface areas and developed actions to mitigate wildfire risk (see Attachment A, Map FCA-5). The city is a participant in the CWPP and will update the city's wildfire risk assessment if the CWPP presents better data during future updates.

Forestland surrounds much of Falls City, particularly to the west. The city also includes a forestry zoning designation within the city.

A comprehensive risk and vulnerability assessment is not available at this time. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. According to the previous version of this plan Falls City has critical facilities and infrastructure located within areas of moderate, high, very high and extreme risk.¹⁰

Moderate risk areas contain 439 residential structures (value \$42.5M), three government facilities (value \$1.2M), one emergency response facility (value \$1.2M), two educational facilities (value \$1.7M), ten community facilities (value \$886K), three bridges (value \$2.2M), and one utility facility (value \$2.2M).

High risk areas contain 415 residential structures (value \$40.2M), three government facilities (value \$1.2M), one emergency response facility (value \$1.2M), two educational facilities (value \$1.7M), ten community facilities (value \$866K), three bridges (value \$2.2M), and one utility facility (value \$2.2M).

Very high risk areas contain 250 residential structures (value \$24.2M), one educational facility (value \$983K), four community facilities (values unknown), and one utility facility (value \$6.2M).

Extreme risk areas contain 23 residential structures (value \$2.2M) and one utility facility (value \$6.2M).

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

¹⁰ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

Windstorm

The steering committee determined that the city's probability for windstorm is **high** (which is the same as the county's rating) and that their vulnerability to windstorm is **moderate** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of windstorms, as well as the location and extent of windstorm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

History:

About once or twice per year the city will experience a windstorm event that will interrupt services, experience downed trees, and cause power outages. Since the previous plan the following incident has occurred:

- 01/17/2012-01/21/2012 DR-4055: High winds, heavy rains and flooding inundated Falls City, Oregon with record amounts of rainfall and damaged local streets.

Polk County's plan adequately describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation and economic disruptions result as well.

A comprehensive risk and vulnerability assessment is not available at this time. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. According to the previous version of this plan all areas within Falls City are at risk from a windstorm event. Including, approximately 395 residential structures (value \$47M), three government facilities (value \$1.2M), one emergency response facility (value \$1.2M), two educational facilities (value \$1.7M), ten community facilities (value \$886K), three bridges (value \$2.2M), and two utilities (value \$8.4M) are impacted by windstorms.¹¹

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Winter Storm (Snow/ Ice)

The steering committee determined that the city's probability for winter storm is **high** (which is the same as the county's rating) and that their vulnerability to winter storm is **low** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of winter storms, as well as the location and extent of winter storm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind.

¹¹ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the city typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

Major winter storms can and have occurred in the Falls City area, and while they typically do not cause significant damage, they are frequent and have the potential to impact economic activity. Road closures on major roads due to winter weather are an uncommon occurrence, but can interrupt commuter and large truck traffic.

A comprehensive risk and vulnerability assessment is not available at this time. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. According to the previous version of this plan all areas within Falls City are at risk from a winter storm event. Including, approximately 395 residential structures (value \$47M), three government facilities (value \$1.2M), one emergency response facility (value \$1.2M), two educational facilities (value \$1.7M), ten community facilities (value \$886K), three bridges (value \$2.2M), and two utilities (value \$8.4M) are impacted by winter storms.¹²

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

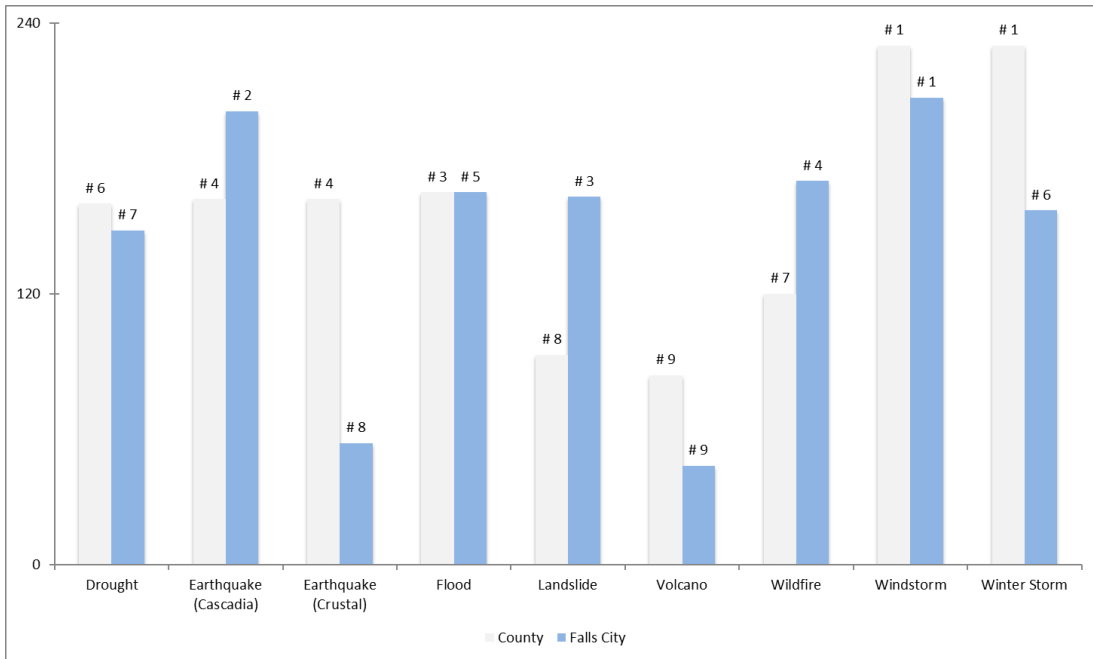
Summary

Figure FCA-6 presents a summary of the hazard analysis for the City of Falls City and compares the results to the assessment completed by Polk County.

The city rated their threat to the Cascadia Subduction Zone earthquake, landslide, and wildfire hazards higher than the county. The top four hazards for the city are windstorm, Cascadia Subduction Zone earthquake, wildfire, and flood.

¹² URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

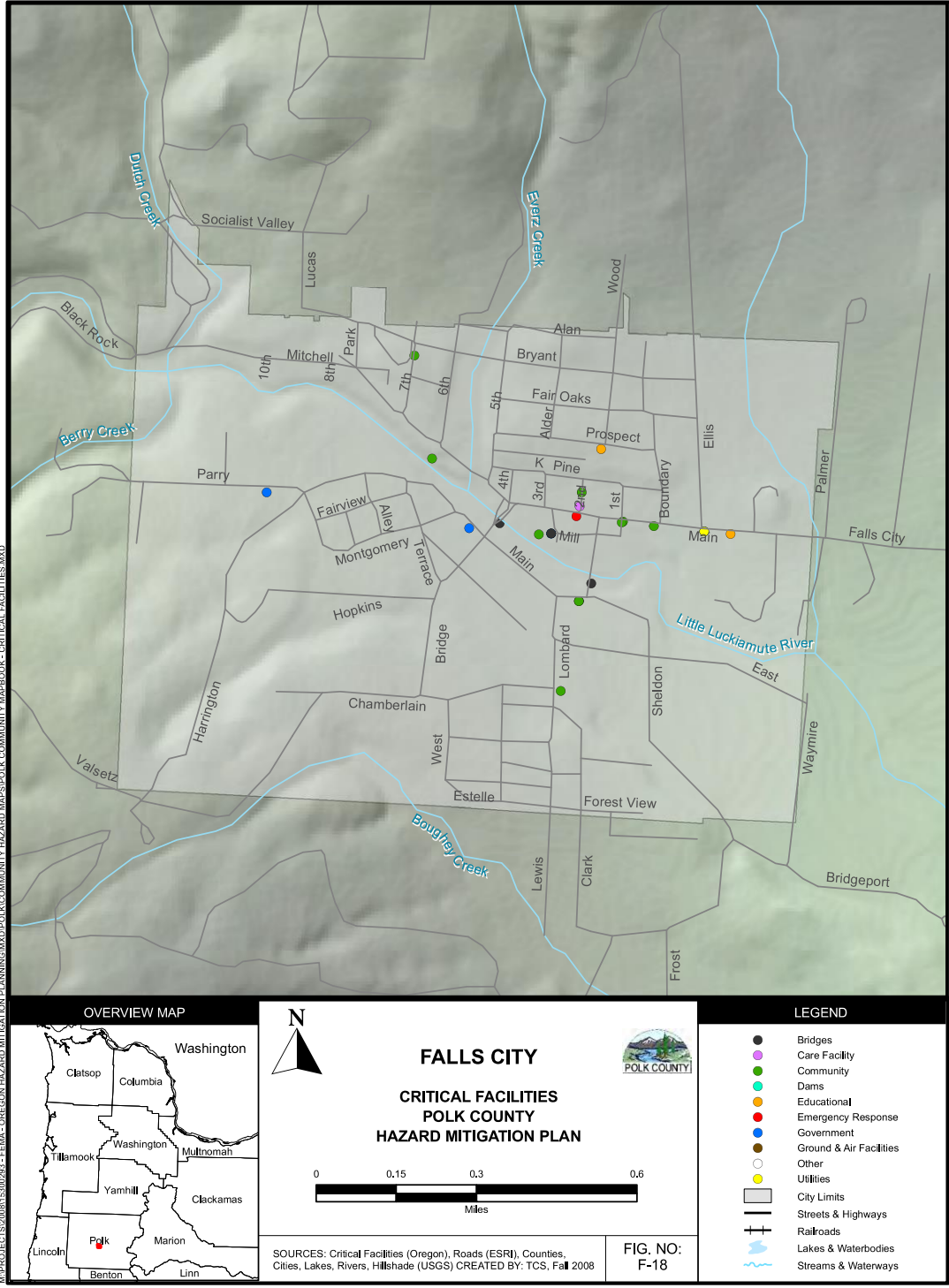
Figure FCA-6 Overall Hazard Analysis Comparison –Polk County/ Falls City



Source: City of Falls City NHMP Steering Committee and Polk County NHMP Steering Committee

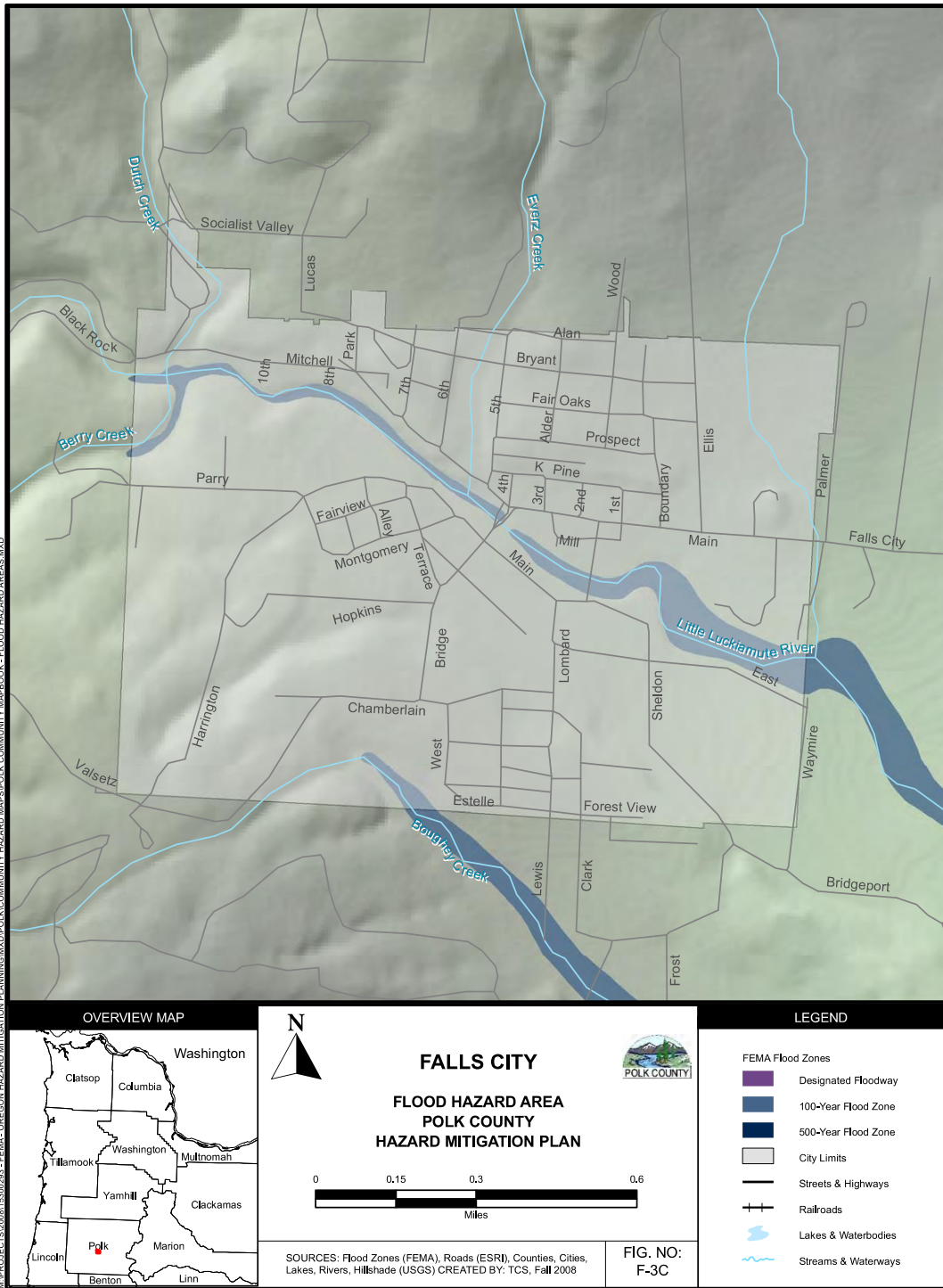
ATTACHMENT A - MAPS

Map FCA-I Critical Facilities - Falls City



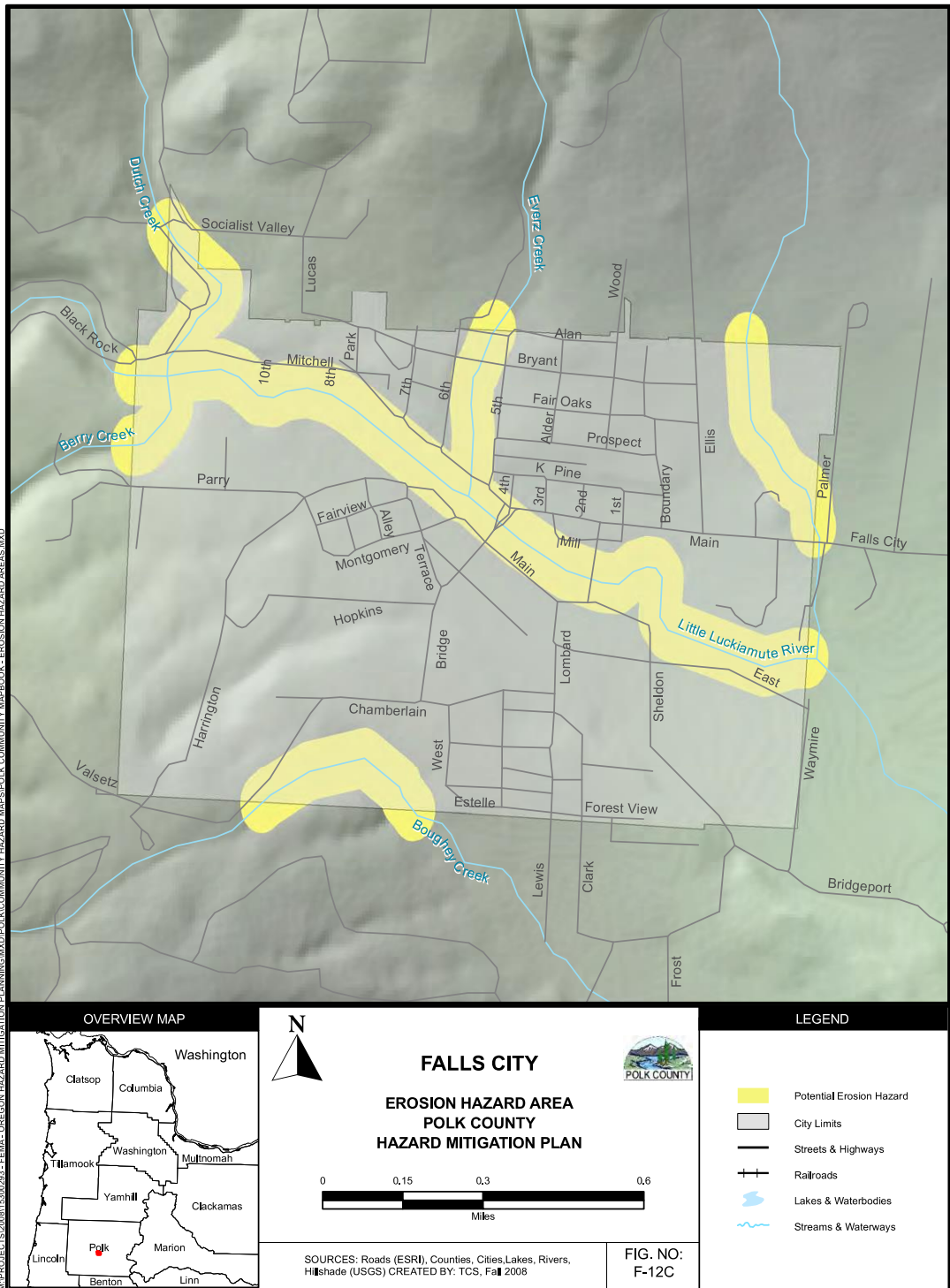
Source: Polk County NHMP (2009).

Map FCA-2 Flood Hazard Area - Falls City



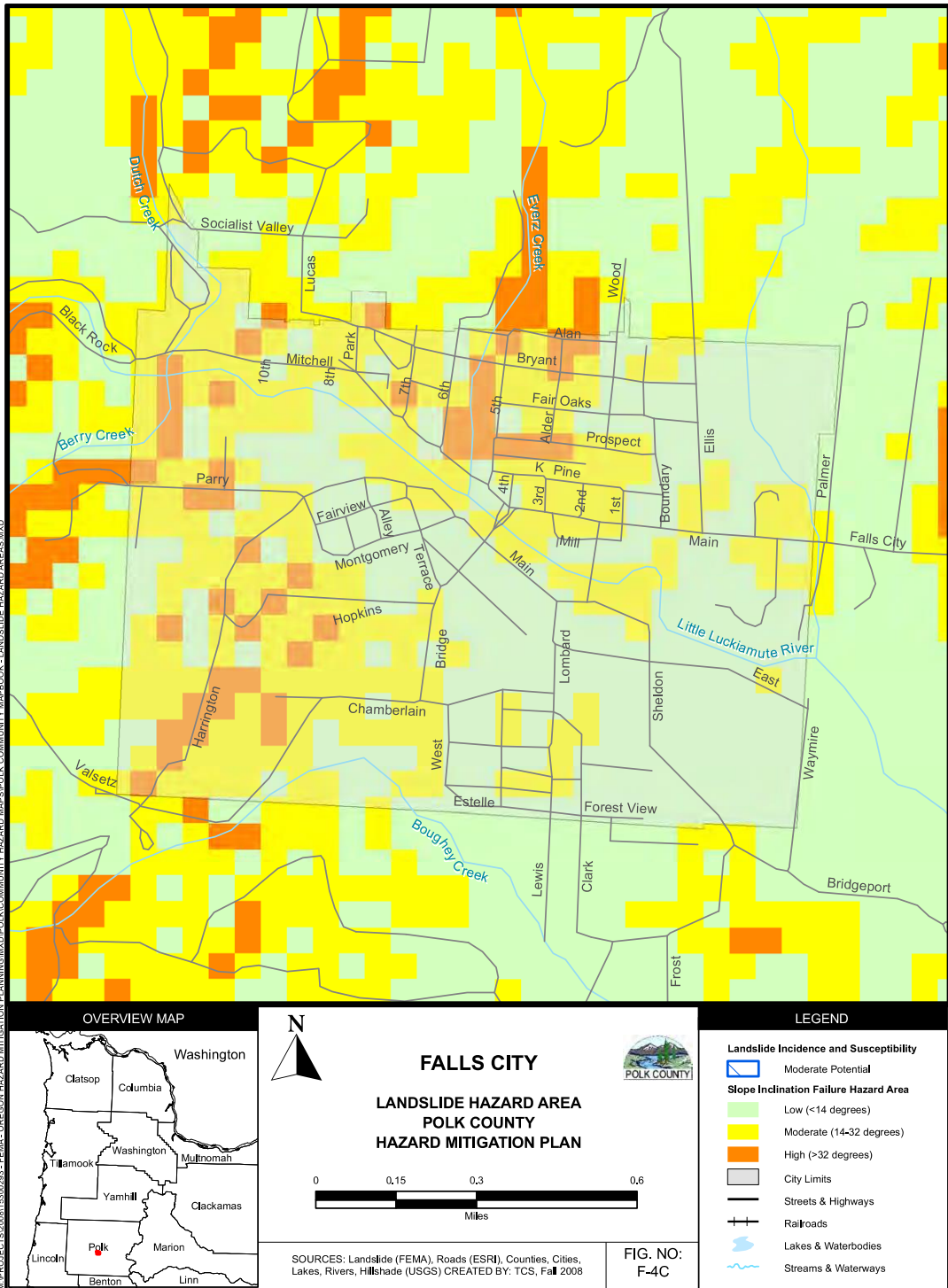
Source: Polk County NHMP (2009).

Map FCA-3 Erosion Hazard Area - Falls City



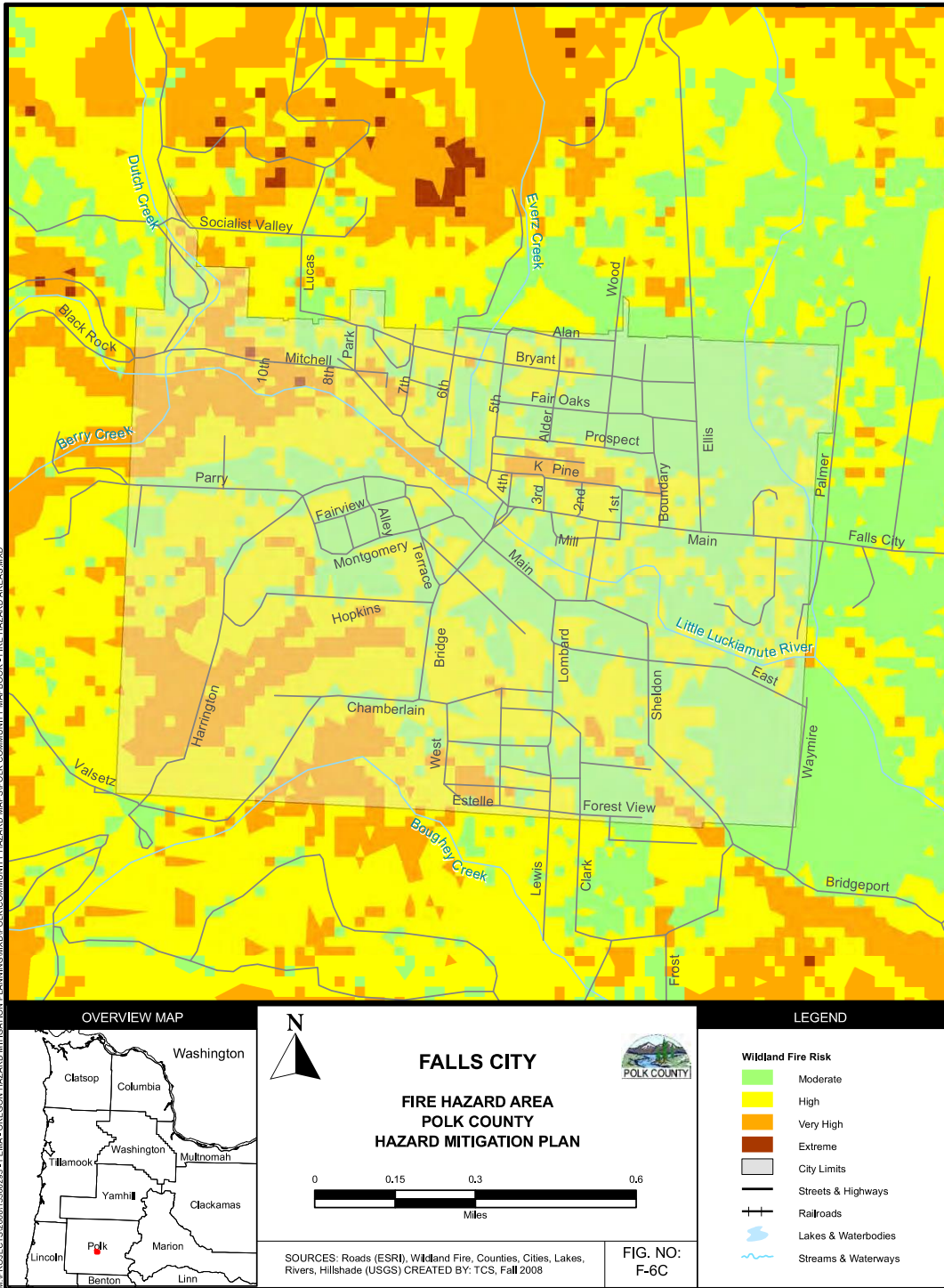
Source: Polk County NHMP (2009).

Map FCA-4 Landslide Hazard Area - Falls City



Source: Polk County NHMP (2009).

Map FCA-5 Wildfire Hazard Area – Falls City



Source: Polk County NHMP (2009).

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CITY OF INDEPENDENCE ADDENDUM

Purpose

This document serves as the City of Independence's Addendum to the Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan (MNHMP, NHMP). This addendum supplements information contained in Volume I (Basic Plan) of this NHMP, which serves as the foundation for this jurisdiction's addendum, and Volume III (Appendices), which provides additional information (particularly regarding participation and mitigation strategy). This addendum meets the following requirements:

- Multi-jurisdictional **Plan Adoption** §201.6(c)(5),
- Multi-jurisdictional **Participation** §201.6(a)(3),
- Multi-jurisdictional **Mitigation Strategy** §201.6(c)(3)(iv), and
- Multi-Jurisdictional **Risk Assessment** §201.6(c)(2)(iii).

Plan Process, Participation, and Adoption

This section of the NHMP addendum addresses 44 CFR 201.6(c)(5), *Plan Adoption*, and 44 CFR 201.6(a)(3), *Participation*.

In the Fall of 2016, the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center (CSC) partnered with the Oregon Military Department's Office of Emergency Management (OEM), and Polk County and cities, including Independence, to update their NHMP, which expired October 14, 2014. This project is funded through the Federal Emergency Management Agency's (FEMA) FY14 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2014-002).

By developing this addendum to the Polk County NHMP, locally adopting it, and having it approved by FEMA, Independence will regain eligibility for FEMA Hazard Mitigation, Pre-Disaster Mitigation, and Flood Mitigation Assistance grant program funds.

The Polk County NHMP, and Independence addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. A project steering committee guided the process of developing the plan. For more information on the composition of the steering committee see the *Acknowledgements*, *Plan Summary*, and *Plan Process* (Volume III, Appendix A).

The Economic Development Director of Independence is the designated local convener and will take the lead in implementing, maintaining, and updating the addendum to the NHMP in collaboration with the designated convener of the Polk County NHMP (County Planning Department).

Representatives from the City of Independence steering committee convened on the following occasions (see Appendix A for more information):

- July 27, 2016 - Polk County NHMP Kick-Off Meeting
- October 18, 2016 – Polk County NHMP Second Meeting
- November 1, 2016 – City Meeting concentrating on mitigation strategy
- Several follow-up conversations between steering committee members

The city’s addendum reflects decisions decided upon at the plan update meeting and during subsequent work and communication with OPDR.

The Independence Steering Committee was comprised of the following representatives:

- Convener, Shawn Irvine, Economic Development Director
- Robert Mason, Police Chief
- Michael Danko, Community Development Director
- Jason Kistler, Information Services Manager
- Matthew Carpenter, Public Works Lead Worker

Public participation was achieved with the establishment of the steering committee, which was comprised of city officials and special districts representing different organizations and sectors. The Steering Committee was closely involved throughout the development of the plan and served as the local oversight body for the plan’s development. In addition, community members outside of the steering committee were provided an opportunity for comment via the plan review process (see Appendix A for more information).

The Polk County NHMP was approved by FEMA on February 6, 2018 and the Independence addendum was adopted via resolution on February 27, 2018. This NHMP is effective through February 5, 2023.

Mitigation Strategy

This section of the NHMP addendum addresses 44 CFR 201.6(c)(3(iv), *Mitigation Strategy*.

During the 2016/2017 Polk County update process OPDR re-evaluated the Action Items with the county and local steering committees. Following the review actions were updated, noting what accomplishments had been made, and whether the actions were still relevant; any new action items were identified at this time (see Appendix A for more information). Each jurisdiction developed a list of priority actions any actions that were not prioritized were placed in an Action Item Pool and will be considered during the annual Implementation and Maintenance meetings.

Priority Actions

The city is listing a set of high priority actions in an effort to focus attention on an achievable set of high leverage activities over the next five-years. The city’s priority actions are listed below in Table IA-1.

Action Item Pool

Table IA-2 presents a pool of mitigation actions. This expanded list of actions is available for local consideration as resources, capacity, technical expertise and/or political will become available.

The majority of these actions carry forward from prior versions of this plan.

Table IA-I Independence Priority Action Items

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Priority Actions					
Multi-Hazard Action (MH)					
MH #1	Develop a secondary or backup communication link to the County EOC for assured communication during natural or manmade hazards.	Police Dept.	Short Term (0-2 Years)	Homeland Security Grants/ Partnerships	BC: TBD TF: Yes
Earthquake Actions (EQ)					
EQ #1	Inspect, prioritize, and retrofit any critical facility or public infrastructure that does not meet current Building Codes.	Community Development	Short Term (0-2 Years)	General Fund, HMGP, HMA, SRGP	BC: TBD TF: Yes
EQ #2	Structurally retrofit the historic buildings in the downtown core for earthquake survivability.	Historic Preservation Commission	Long Term (5+ Years)	URD/Property Owners	BC: TBD TF: Yes
Flood Actions (FL) - including erosion					
FL #1	Build a new Gun Club Road bridge to mitigate the flood and the resultant transportation hazard.	Community Development	Short Term (0-2 Years)	Transportation Fund/ General Fund/ Storm Fund	BC: TBD TF: Yes
FL #2	Identify and resolve areas of persistent stormwater flooding due to undersized, underperforming, stormwater infrastructure.	Public Works	Mid-Term (2-5 Years)	OWEB, General Fund, Grants, SDCs	BC: TBD TF: Yes
FL #3	Create access along Ash Creek to allow for early discovery of debris dams which causes backflow flooding and allow emergency removal of flood causing debris blockages.	Community Development	Short Term (0-2 Years)	State Parks/ Transportation Fund/ Watershed Enhancement grant	BC: TBD TF: Yes

Source: City of Independence NHMP Steering Committee, 2016.
MH=Multi-Hazard, EQ=Earthquake, FL=Flood

Table IA-2 Independence Action Item Pool

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Action Item Pool					
Multi-Hazard Actions (MH)					
MH #2	Develop outreach program to educate and encourage residents to maintain several days of emergency supplies for power outages or road closures.	Community Development/ Police Dept/ CERT	Short Term (0-2 Years)	General Fund	BC: TBD TF: Yes
MH #3	Enhance Public Works fuel storage capacity.	Public Works	Short Term (0-2 Years)	General Fund	BC: TBD TF: Yes
MH #4	Install electrical connection at private gas station so pumps can be run with a portable generator.	Public Works	Mid-Term (3-5 Years)	General Fund	BC: TBD TF: Yes
Drought Action (DR) - including expansive soils					
DR #1	Develop educational programs and implement initiatives related to water conservation and irrigation during drought periods.	Public Works/ Public Health	Short Term (0-2 Years)	Water Fund/ General Fund	BC: TBD TF: Yes
Earthquake Actions (EQ)					
<i>See priority action items.</i>					
Flood Actions (FL) - including erosion					
FL #4	Ash Creek clean up of major debris-log jams at the railroad trestle @ 2nd Street and install debris deflector. Would allow the water to flow without any blockage	ACWCD/ Public Works	Mid-Term (2-5 Years)	Ash Creek Water Control District/ Watershed Grants/ RR	BC: TBD TF: Yes
Landslide Actions (LS)					
<i>No specific actions identified; see multi-hazard actions.</i>					
Volcano Actions (VE)					
<i>No specific actions identified; see multi-hazard actions.</i>					

Source: City of Independence NHMP Steering Committee, 2016
 MH=Multi-Hazard, DR=Drought, FL=Flood

Table IA-2 Independence Action Item Pool (continued)

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility
Wildfire Action (WF)					
WF #1	Participate in the maintenance, implementation, and update of the Polk County Community Wildfire Protection Plan (2009).	PC SW Rural Fire District Polk County & City Manager	Ongoing	General Fund	BC: TBD TF: Yes
Windstorm Action (WS)					
WS #1	Identify and prioritize critical facilities' overhead utilities that could be placed underground to reduce power disruption from wind storm / tree blow down damage.	PP&L/ Public Works	Mid-Term (2-5 Years)	PP&L/School District/Fire District	BC: TBD TF: Yes
Winter Storm Actions (WT)					
WT #1	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	Public Works	Short Term (0-2 Years)	General Fund	BC: TBD TF: Yes
WT #2	Develop and maintain severe winter storm public outreach program defining mitigation activity benefits through educational outreach aimed at households and businesses while targeting special needs populations.	Police, Fire, Public Works	Short Term (0-2 Years)	General Fund, NOAA/ NWS, HMGP	BC: TBD TF: Yes

Source: City of Independence NHMP Steering Committee, 2016
 WF=Wildfire, WS=Windstorm, WT=Winter Storm

Plan Implementation and Maintenance

The City Council will be responsible for adopting the City of Independence addendum to the Polk County NHMP. This addendum designates a coordinating body and a convener to oversee the development and implementation of action items. Because the city addendum is part of the county's multi-jurisdictional NHMP, the city will look for opportunities to partner with the county. The city's steering committee will convene after re-adoption of the City of Independence addendum on an annual schedule; the county is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The Economic Development Director will serve as the convener and will be responsible for assembling the steering committee (coordinating body). The steering committee will be responsible for:

- identifying new risk assessment data,
- reviewing status of mitigation actions,
- identifying new actions, and
- seeking funding to implement the city's mitigation strategy (actions).

The convener will also remain active in the county's implementation and maintenance process (see Volume I, Section 4 for more information).

The city will utilize the same prioritization process as the county (See Volume I, Section 4: Plan Implementation and Maintenance and Volume III, Appendix C: Economic Analysis of Natural Hazard Mitigation Projects for more information).

Implementation through Existing Programs

Many of the Natural Hazards Mitigation Plan's recommendations are consistent with the goals and objectives of the city's existing plans and policies. Where possible, the City of Independence will implement the NHMP'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, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented.

Independence's acknowledged comprehensive plan is the Independence Comprehensive Plan. The Oregon Land Conservation and Development Commission first acknowledged the plan in 1979. The City last amended the plan in 2009. The City implements the plan through the Independence Zoning and Development Code, which was last amended in 2016.

Independence currently has the following plans, programs, and policies that relate to natural hazard mitigation. For a complete list visit the city [website](#):

Table IA-3 Legal and Regulatory Resources Available for Hazard Mitigation

Regulatory Tool	Name	Effects on Hazard Mitigation
Plans	Emergency Operations Plan (2003)	Identifies emergency planning, policies, procedures, and response to extraordinary emergency situations associated with natural and manmade disasters, technological incidents, and national security emergencies
	Standard Operating Procedures (2005)	To establish guidelines and procedures for the planning, response to, and control of unusual occurrences and disaster situations such as civil disturbances, hazardous materials and contaminant spills, fire coverage, etc.
	Comprehensive Plan (2009)	To establish Urban Growth Boundary and land use regulations.
	Southwest Independence Concept Plan (2012), Part 1 , Part 2	Establishes policies for 270-acre area in southwest Independence that was brought into the UGB in 2008 to provide for additional residential growth, including multifamily.
	Urban Renewal District Plan (2008)	Establishes goals and policies for the urban renewal area.
	Transportation System Plan (2007) Appendices	A component of the Capital Improvement Plan. To establish the City’s goals, policies, and action strategies for developing and improving the transportation system within the Independence Urban Growth Boundary.
	Parks & Open Space Master Plan (2015)	Provides guidance and recommendations on how to develop an interconnected and accessible park system.
	Water System Master Plan (1997) Updated in 2007, and 2015. Volume 1 Volume 2 Volume 3	A component of the Capital Improvement Plan. Outlines the water system improvements and expansion necessary to accommodate anticipated growth and current deficiencies. The time span of this study is 20 years outlining the projected needs of the water system from year 1997 to 2017, inclusive.
Wastewater Master Plan (2015)	A component of the Capital Improvement Plan. Includes summary, review and analysis of historic influent flows, biochemical and solids loading to the Water Treatment Facility and key pump stations. Identifies the collection system and WWTF deficiencies and	

		projected future improvements that will be required to accommodate growth and anticipated regulatory changes.
	Sanitary Sewerage System Facilities Plan (2015)	Provides information on existing conditions and future needs of the sanitary sewerage system and facilities
	Stormwater Master Plan (2015) Part 1 Part 2	A component of the Capital Improvement Plan. Provides analysis and recommendations through bull build out within the Urban Growth Boundary as well as recommendations for current and future needs of the stormwater conveyance system in Independence.
Programs	National Flood Insurance Program (NFIP)	Makes affordable flood insurance available to homeowners, business owners, and renters in participating communities. In exchange, those communities must adopt and enforce minimum floodplain management regulations to reduce the risk of damage from future floods.
	CIS Flood Insurance	Independence has a \$5M flood insurance policy with CIS Services.
	CRS Participant	No, the City of Independence is not a CRS participant but is seeking participation.
Policies (Municipal Codes)	Zoning Map (2017)	2017 Zoning Map
	Subchapter 51 - Flood Damage Prevention Ordinance	To minimize public and private losses due to flood conditions
	Subchapter 55 - Storm Water Management Requirements Code	For addition to or change in storm water, erosion, drainage or flooding
	Chapter 6: Buildings & Construction Ordinance	Adopts and enforces the Oregon Building Code (Oregon Structural Specialty Code)
	Property Maintenance	To protect the health, safety and welfare of Independence citizens, to prevent deterioration of existing structures and to contribute to vital neighborhoods.

Table IA-4 Administrative and Technical Resources for Hazard Mitigation

Staff/Personnel Resources	Department/Division Position
Planner(s) or engineer(s) with knowledge of land development and land management practices	Community Development Director: Shawn Irvine and a contract planner Economic Development Director: Shawn Irvine
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	Building Department Official: Jeff Kennedy
Planner(s) or engineer(s) with an understanding of manmade or natural hazards	Contract Services: Mid-Willamette Valley Council of Governments: Renata Wakely, Community Development Director
Floodplain manager	Economic Development Director: Shawn Irvine
Personnel skilled in GIS and/or HAZUS-MH	Polk County: Dan Anderson
Director of Emergency Services	City Manager: David Clyne
Finance (grant writers, purchasing)	Finance Director: Gloria Butsch
Public Information Officers	City Manager: David Clyne

Table IA-5 Financial Resources for Hazard Mitigation

Financial Resources	Effect on Hazard Mitigation
General funds	None
Authority to levy taxes for specific purposes	Special assessment-voted on by citizens.
Incur debt through general obligation bonds	Voted on by citizens.
Incur debt through special tax and revenue bonds	Special tax-voted on by citizens, Revenue bonds-voted on by City Council.
Incur debt through private activity bonds	Voted on by citizens if no general fund-otherwise vote by City Council.

Note: See Appendix D – Grant Programs for additional financial resources.

Continued Public Participation

Keeping the public informed of the city’s efforts to reduce the city’s risk to future natural hazards events is important for successful plan implementation and maintenance. The city is committed to involving the public in the plan review and updated process. See Volume I, Section 4, for more information.

Plan Maintenance

The Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan and city addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the county plan update process, the city will also review and

update its addendum. The convener will be responsible for convening the steering committee to address the questions outlined below.

- 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?
- Have there been any significant changes in the community's demographics 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?

These questions will help the steering committee determine what components of the mitigation plan need updating. The steering committee will be responsible for updating any deficiencies found in the plan.

Risk Assessment

This section of the NHMP addendum addresses 44 CFR 201.6(b)(2) - Risk Assessment. In addition, this chapter can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards. Assessing natural hazard risk has three phases:

- **Phase 1:** Identify hazards that can impact the jurisdiction. This includes an evaluation of potential hazard impacts – type, location, extent, etc.
- **Phase 2:** Identify important community assets and system vulnerabilities. Example vulnerabilities include people, businesses, homes, roads, historic places and drinking water sources.
- **Phase 3:** Evaluate the extent to which the identified hazards overlap with, or have an impact on, the important assets identified by the community.

The local level rationale for the identified mitigation strategies (action items) is presented herein, and within Section 2, *Risk Assessment*, and Appendix B, *Community Profile*. The risk assessment process is graphically depicted in Figure IA-1 below. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure IA-1 Understanding Risk



Hazard Analysis Methodology

This NHMP utilizes a hazard analysis methodology that was first developed by FEMA circa 1983, and gradually refined by the Oregon Military Department's Office of Emergency Management over the years.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible). Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%.

This method provides the jurisdiction with a sense of hazard priorities, or relative risk. It doesn't predict the occurrence of a particular hazard, but it does "quantify" the risk of one hazard compared with another. By doing this analysis, planning can first be focused where the risk is greatest.

In this analysis, severity ratings, and weight factors, are applied to the four categories of history, vulnerability, maximum threat (worst-case scenario), and probability as shown in the table below. See Volume I, Section 2 (Risk Assessment) for more information.

Hazard Analysis

The Independence steering committee developed their hazard vulnerability assessment (HVA), using the county's HVA as a reference. Changes from the county's HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Independence, which are discussed throughout this addendum.

Table IA-6 shows the HVA matrix for Independence showing each hazard listed in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step

in planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with sense of hazard priorities, but does not predict the occurrence of a particular hazard.

Three chronic hazards (winter storm, drought, and windstorm) and one catastrophic hazard (Cascadia Subduction Zone earthquake) rank as the top hazard threats to the city (Top Tier). The crustal earthquake, flood, and volcano hazards comprise the next highest ranked hazards (Middle Tier), while landslide and wildfire hazards comprise the lowest ranked hazards (Bottom Tier).

Table IA-6 Hazard Analysis Matrix – Independence

Hazard	History	Probability	Vulnerability	Maximum Threat	Total Threat Score	Hazard Rank	
Winter Storm	18	63	35	100	216	# 1	<i>Top Tier</i>
Earthquake - Cascadia	2	28	50	100	180	# 2	
Drought	10	35	25	100	170	# 3	
Windstorm	16	56	25	70	167	# 4	
Earthquake - Crustal	4	14	30	80	128	# 5	<i>Middle Tier</i>
Flood - Riverine	10	35	25	50	120	# 6	
Volcano	2	7	25	50	84	# 7	
Landslide	2	7	5	10	24	# 8	<i>Bottom Tier</i>
Wildfire (WUI)	2	7	5	10	24	# 8	

Source: Independence NHMP Steering Committee, 2016.

Table IA-7 categorizes the probability and vulnerability scores from the hazard analysis for the city and compares the results to the assessment completed by the Polk County NHMP Steering Committee (areas of differences are noted with **bold** text within the city ratings). Notably, the city ranked their vulnerability to Cascadia Subduction Zone earthquakes higher than the county.

Table IA-7 Probability and Vulnerability Comparison

Hazard	Independence		County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Moderate	Moderate	Moderate
Earthquake (Cascadia)	Moderate	High	Moderate	Moderate
Earthquake (Crustal)	Low	Moderate	Moderate	Moderate
Flood	Moderate	Moderate	High	Moderate
Landslide	Low	Low	High	Low
Volcano	Low	Moderate	Low	Moderate
Wildfire	Low	Low	Moderate	Moderate
Windstorm	High	Moderate	High	High
Winter Storm	High	Moderate	High	High

Source: Independence NHMP Steering Committee and Polk County NHMP Steering Committee, 2016.

Between 2010 and 2015 the City grew by 175 people (12%) and median household income decreased by 12% (see Appendix B). New development was placed outside of the floodplain per the city’s floodplain ordinance (see Table IA-3) and complied with the seismic safety standards within the [Oregon State Building Code](#). During this period Independence School

and Central High School were remodeled and upgraded. As such changes in population, demographics, and development have had a negligible impact upon vulnerability. However, decreased household income within the community may be a signal that segments of the community may have a difficult time recovering from a natural hazard. See specific hazard sections below for more information.

Community Asset Identification

This section provides information on city specific assets. For additional information on the characteristics of Independence, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, *Community Profile*. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation.

Community Characteristics

Independence is located in the mid-Willamette Valley near the foothills of the Coast Range and is located on the Willamette River covering an area of about 2.8 square miles. The climate of Independence is moderate; the average monthly temperatures range from 49 – 82 degrees in July through August, and 33-47 degrees in December and January, and the city receives approximately 40 inches of rain each year¹. Monthly precipitation is about 4-7 inches during the wetter months of November through March, and average about 0.5-1.5 inches during the drier months of June - September. The city's topography is relatively flat. The city abuts Monmouth to the west and is approximately 12 miles southwest of Salem.

Economy

Independence benefits from its location to Salem which is the State Capital and a regional center for industrial technology, engineering, research, commerce, and health care. Independence has some manufacturing businesses, however, most employment is outside of the city.

Asset Inventory

Asset inventory is the first step of a vulnerability analysis. Assets that may be affected by hazard events include population, residential and nonresidential buildings, critical facilities, and infrastructure.

The asset inventory delineates the City's existing building and infrastructure assets and insured values and are identified in detail in Table IA-8 and Map IA-1 (Attachment A).

¹ [Western Regional Climate Center, "Salem-McNary Field, Oregon \(357500\)". Retrieved November 22, 2016.](#)

Table IA-8 Independence Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value ¹
Government	City Hall/Courthouse/ Police Station	555 South Main Street	\$811,530
	Public Works	160 G Street	\$623,740
Emergency Response	Polk County Fire District #1	1800 Monmouth St.	\$4,065,380
	Independence Police Station	240 Monmouth St.	See Govt. Facility
Educational	District Office/Henry Hill Educational Services	750 S. 5th Street	\$4,678,060
	Independence Elementary	150 S. 4th Street	\$3,667,170
	Talmadge Middle School	51 16th Street	\$9,098,320
	Central High School	1530 Monmouth Street	\$23,779,130
	School Health Clinic and Resource Center	1610 Monmouth Street	\$551,200
Educational	Mid-Valley Christian Academy	1483 N 16th (Monmouth)	\$1,225,000
	OCDC	535 G Street	\$1,344,000
	Head Start	475 I Street	\$728,000
Care Facility	Evergreen Health & Rehabilitation	1525 Monmouth Street	\$2,538,720
	Four Seasons Residential Care	202 S. 9th Street	\$1,477,040
Community	Independence-Monmouth Family Medicine	1430 Monmouth Street	\$627,120
	Sterling Savings Bank	302 Main Street	\$709,170
	Vacant (was Taylor's Fountain)	296 Main Street	\$213,000
	San Miguel Bakery	286 Main Street	\$392,350
	Vacant (was Independence Appliances)	268 Main Street	\$345,710
	S. Main Antiques	250 Main Street	\$235,480
	JTE Floor Coverings	240 Main Street	\$194,460
	Main Street Little Mall	226 Main Street	\$622,280
	Cooper Building	206 Main Street	\$558,000
	Elks Lodge/Book Store/Beauty Shop	289 Main Street	\$1,506,480
	Dusty Spur Pizza	301 Main Street	\$317,470
	Central Martial Arts	265 Main Street	\$166,730
	Tildon's Barber Shop	259 Main Street	\$89,280
	Part of Andy's Café	235 Main Street	\$141,850
	Andy's Café	227 Main Street	\$111,350
	Linen Warehouse	223 Main Street	\$113,620
	Campos Boutique	215 Main Street	\$119,600
	2EZ Restaurant	211 Main Street	\$145,190
	Ash Creek Animal Clinic	194 Main Street	\$453,620
	River Gallery Antiques	184 Main Street	\$209,240
	Schooner's	174 Main Street	\$282,030
	Ragin River Steakhouse/Wine & Flowers	154 Main Street	\$279,740
	Main Street Antiques	144 Main Street	\$405,700
	J. Bella/Lenora's Ghost	104 Main Street	\$416,010
	Heritage Museum	112 S. 3rd Street, Street	\$407,070
	Riverview Park Amphitheater	50 C Street	\$4.5M estimate
	Independence City Shops	160 F Street (Public Works)	\$623,740
	Independence Library/ Arts Center	175 Monmouth Street	\$1,987,380

Facility Type	Name / Number	Address	Value ¹
	St. Patrick Catholic Church	1275 E Street	\$2,058,150
	First Baptist Church	1505 Monmouth Street	\$2,278,700
	Cornerstone Christian Center	4395 Independence Highway	\$241,690
State and Federal Highways	Highway 51		\$4.1M estimate 4 miles
Railroads	Portland-Western Railroad (runs through east end of town)		2 miles
Bridges	16th Street @ Talmadge School over Ash Creek		\$1,900,000
	Gun Club Road Bridge		\$1,900,000
	F Street, Bridge between 10th & 9th Street		\$1,500,000
	Monmouth Street Bridge between 8th & 7th St.		ODOT State Highway (estimate \$1,500,000)
	River Road Bridge @ River Road & Main St.		County Bridge (Marion & Polk) (estimate \$75-100M)
	Main Street Bridge between B & A St.		ODOT State Highway (estimate \$30M)
	Ash Street No. of Albert		\$2,400,000
Transportation Facilities	Independence Airport		\$2,685,330
	Bus Maintenance Buidling (Central SD)		\$575.160
Utilities	Sewer Lagoon & Pump Station		\$3,891,260
	Sewer Lift Station		\$239,000
	Mt. Fir Sewer Lift Station		\$250,000
	Briar Sewer Lift Station		\$243,000
	North Sewer Lift Station		\$244,000
	Stryker Sewer Lift Station		\$244,000
	13th St. Sewer Lift Station		\$244,500
	9th St, Sewer Lift Station		\$250,500
	Riverview Lift Station		\$500,000
	Oak Sewer Lift Station		\$250,550
	Williams Sewer Lift Station		\$255,500
	Albert Sewer Lift Station		\$243,900
	Water well fields, east end of Polk Street @ River Road (4 wells-1 @ River Drive Well & 3 @ Polk St)		\$400,000
	Water Storage Tanks (2) plus Reservoir, River Oak Rd (3 wells)		\$2,750,000
	Qwest		Unknown
Pacific Power & Light Sub Station		PPL has their own HMP	
Monmouth Street Water Tower		\$1,500,000	

Facility Type	Name / Number	Address	Value ¹
	(Reservoir)		
	New River Wells (2) on Corvallis Road		\$50K each
	NW Natural-high pressure gas regulators @ Hoffman and Stryker		Unknown
	NW Natural-High pressure gas regulator @ D and 2nd Streets		Unknown
	Polk Water Reservoir		\$1,500,000
	Above-ground Fuel Station at City Shops site		\$10K estimate
	Monmouth Water Treatment and Storage Facility	4th Street	\$1,000,000
Other	Simplot Soil Builders		\$385,800
	Marquis Spas		\$1,193,970

Note: ¹Estimated and/or insured structural and/or Polk County Assessed value for critical facilities and estimated values for critical infrastructure in 2009 dollars. Items in **bold** have been revised to 2017 dollars.

See hazard sections below and Section 2, *Risk Assessment*, for potential hazard vulnerabilities to these facilities.

Hazard Characteristics

Drought

The steering committee determined that the city’s probability for drought is **moderate** (which is the same as the county’s rating) and that their vulnerability to drought is **moderate** (which is the same as the county’s rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of drought hazards, as well as the location and extent of a potential event. Due to a cool, wet climate, past and present weather conditions have generally spared Polk County communities from the effects of drought; however, Polk County was included in a Governor declared drought declaration in 1992 and a Presidential drought declaration in 2015.

Independence’s primary water supply comes from nine individual groundwater wells (two are inactive) located at the South Well Field (5 wells – 2 inactive – produce a maximum yield of 500 GPM) and the Polk Street Well Field (4 wells produce a maximum yield of 1,000 GPM).² The city has additional water rights from the Willamette River (up to 2,000 GPM).³ The city has four (4) storage reservoir(s) for a total of 3.75 million gallons of treated water storage capacity.⁴ Based on projections current water storage will be satisfied by the year 2025, however, an planned 1.25 million gallon reservoir adjacent South Reservoir is anticipated to accommodate future needs through 2035.⁵ The city has been providing water

² Water System Master Plan Update (2015), Independence, OR. 4B Engineering and Consulting, LLC

³ Ibid.

⁴ Ibid.

⁵ Ibid.

service since the 1950's. The water supply comes from underground aquifers which is treated at the wellhead with chorine and fluoride before it is pumped to the storage reservoirs. The city has a water master plan (2015, [Part 1](#), [Part 2](#), [Part 3](#)), In general, water supply is available and sufficient. Additional, drought-related community impacts are described within the county's Drought Hazard section (Volume I, Section 2).

Expansive Soils

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of drought hazards, as well as the location and extent of a potential event. The addition of moisture to any soil will cause a change in volume, which is referred to as a shrink-swell characteristic.⁶

Per the previous version of this plan the City of Independence has critical facilities and infrastructure located within areas of low, moderate and high risk; see Map IA-2 (Attachment A).

Low risk areas contain 1,901 residential structures (value \$191.8M) and 15 non-residential structures (value unknown). Moderate risk areas contain 684 residential structures (value \$69M), three non-residential structures (value unknown), one emergency response facility (value \$4.1M), one care facility (value \$1.5M), 23 community facilities (value \$7M), five bridges (value \$37.7M), and nine utility facilities (value \$8M).

A comprehensive risk and vulnerability assessment is not available for the drought hazard. Statewide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks are present to humans and resources. Agriculture, fishing, and timber have historically been impacted, as well as local and regional economies.

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Earthquake

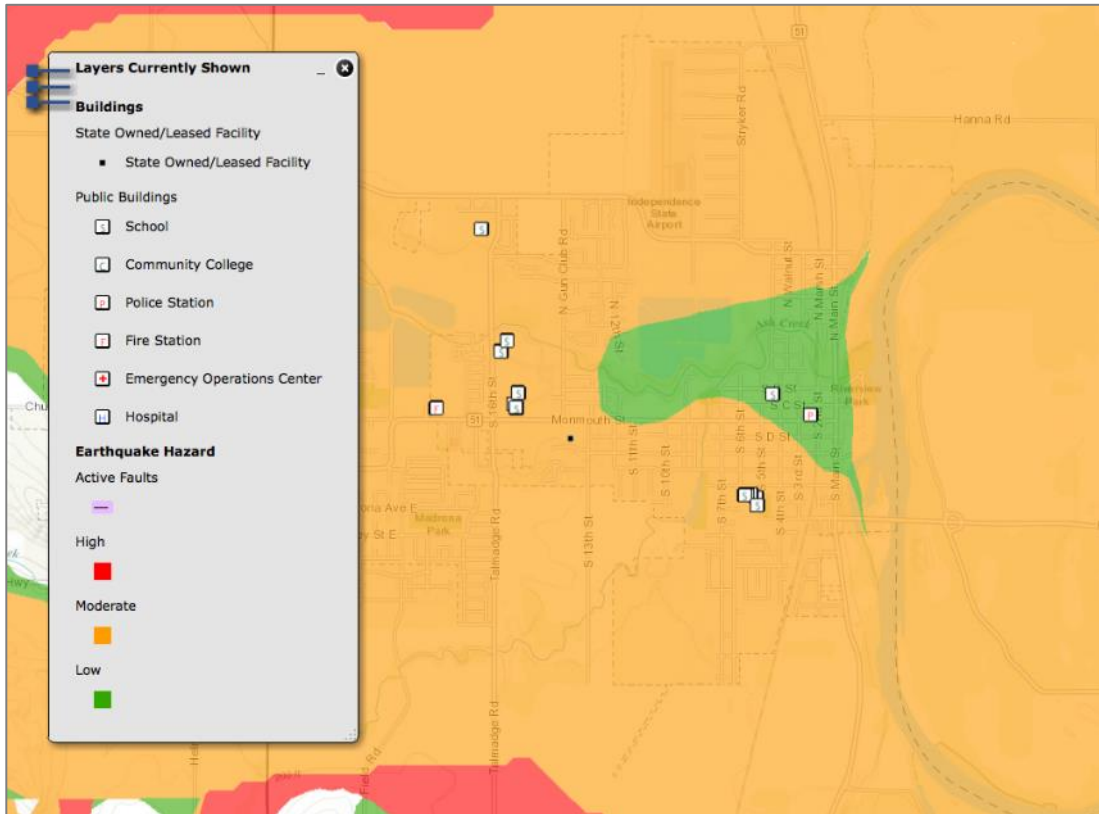
The steering committee determined that the city's probability for a Cascadia Subduction Zone (CSZ) Earthquake event is **moderate** (which is the same as the county's rating) and that their vulnerability to a Cascadia Earthquake event is **high** (which is higher than the county's rating). The steering committee determined that the city's probability for a Crustal Earthquake event is **low** (which is lower than the county's rating) and that their vulnerability to a Crustal Earthquake event is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of earthquake hazards, history, as well as the location and extent of a potential event. Generally, an event that affects the county is likely to affect Independence as well. The causes and characteristics of an earthquake event are appropriately described within the county's plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Independence as well.

⁶ US Department of Agriculture, Natural Resources Conservation Service (USDA NRCS). 2008. National Cooperative Soil Survey, Physical Soil Properties—Polk County, Oregon.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any particular site. In many major earthquakes, damages have primarily been caused by the behavior of the soil. Figure IA-2 displays relative liquefaction hazards. As shown, the areas of greatest concern are just outside of the city limits to the north and south (darker areas) and also the area that are adjacent to the Willamette River where the concentration of soft soils is the highest.

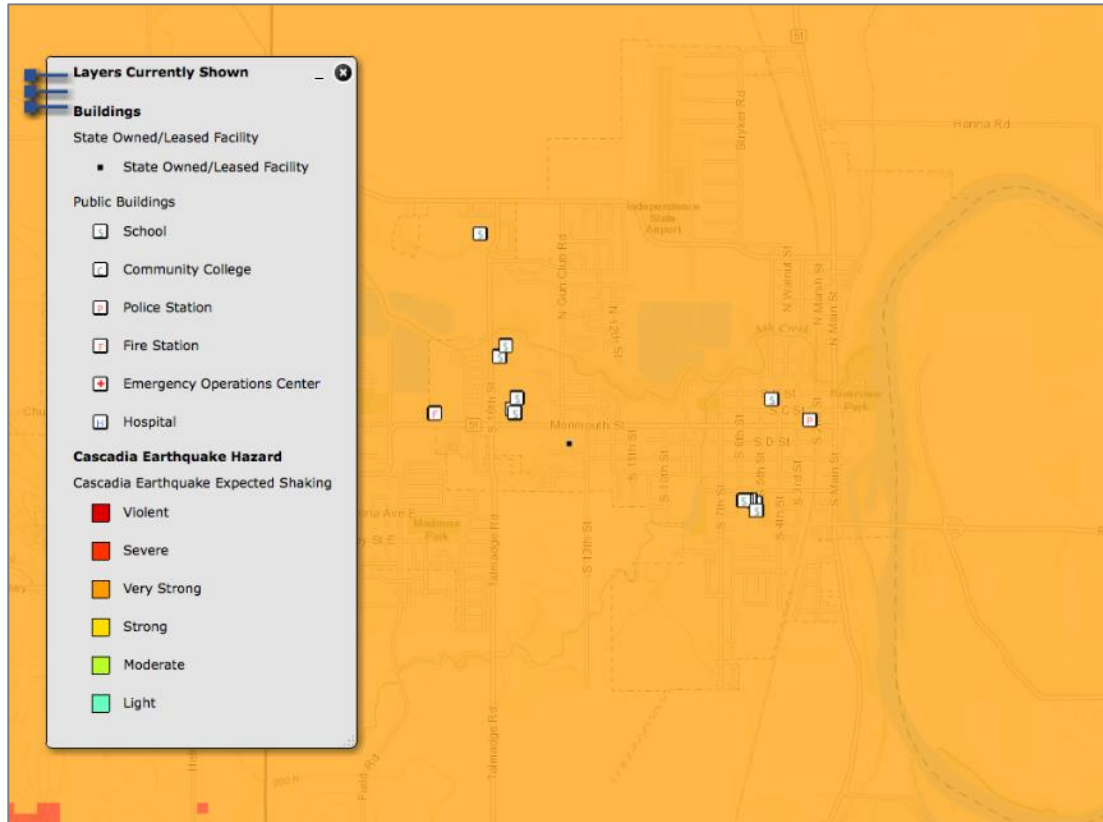
Figure IA-2 Active Faults and Soft Soils



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

Figure IA-3 below shows the expected shaking/ damage potential for Independence because of a Cascadia Subduction Zone (CSZ) earthquake event. The figure shows that the city will experience “very strong” shaking that will last two to four minutes. The shaking will be extremely damaging to lifeline transportation routes including Highway 99 and Interstate 5. For more information on expected losses due to a CSZ event see the [Oregon Resilience Plan](#).

Figure IA-3 Cascadia Subduction Zone Expected Shaking



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

As noted in the community profile approximately 45% of residential buildings were built prior to 1990, which increases the city's vulnerability to the earthquake hazard. Information on specific public buildings' (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table IA-9; each "X" represents one building within that ranking category. Of the facilities evaluated by DOGAMI using RVS, two (2) have very high (100% chance) collapse potential, and eight (8) have a high (greater than 10% chance) collapse potential. Note: Henry Hill Elementary School is now the home of the Central School District Educational Services.

The following structures have also had some structural and/ or non-structural seismic retrofitting:

- *Independence Elementary School remodeled.*⁷
- *Central High School significant upgrade.*⁸

In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage.

⁷ Polk County Itemizer-Observer, *Will they Stand or Fall: Are Polk County governments ready for the 'big one'?*, September 9, 2015, <http://www.polkio.com/news/2015/sep/09/will-they-stand-or-fall/>

⁸ Ibid.

Utility systems will be significantly damaged, including damaged buildings and damage to utility infrastructure, including water treatment plants and equipment at high voltage substations (especially 230 kV or higher which are more vulnerable than lower voltage substations). Buried pipe systems will suffer extensive damage with approximately one break per mile in soft soil areas. There would be much lower rate of pipe breaks in other areas. Restoration of utility services will require substantial mutual aid from utilities outside of the affected area.

Table IA-9 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (< 1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Henry Hill Elementary (Central SD 13J) (750 5th St)	Polk_sch03	X, X		X, X	X
Independence Elementary (Central SD 13J) (150 S 4th St)	Polk_sch09				X
Talmadge Middle (Central SD 13J) (51 16th St)	Polk_sch05		X	X	
Central High (Central SD 13J) (1530 Monmouth St)	Polk_sch06			X, X, X	
Public Safety					
Independence Police Department (240 Monmouth St)	Polk_pol03			X	
Polk County Fire District 1 (1800 Monmouth St)	Polk_fir01			X	

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#) "*" – Site ID is referenced on the [RVS Polk County Map](#)

A comprehensive risk and vulnerability assessment is not available. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. The Risk Report would provide a quantitative risk assessment that informs communities of their risks related to certain natural hazards (including earthquake). If pursued, once complete the city can incorporate the risk assessment into their addendum to provide greater detail to sensitivity and exposure to the earthquake hazard.

According to the previous version of this plan approximately 2,066 residential structures (value \$ 208M), 15 non-residential structures (value unknown), two government facilities (value \$1.4M), two emergency response facilities (value \$4.1M), five educational facilities (value \$41.8M), two care facilities (value \$3.9M), 31 community facilities (value \$16M), four miles of highways (value \$4.1M), two rail segments (value unknown), seven bridges (value \$40M), two transportation facilities (value \$3.3M), 23 utilities (value \$13M), and two "other" facilities (value \$1.6M) which would be impacted by such an event.⁹

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

⁹ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

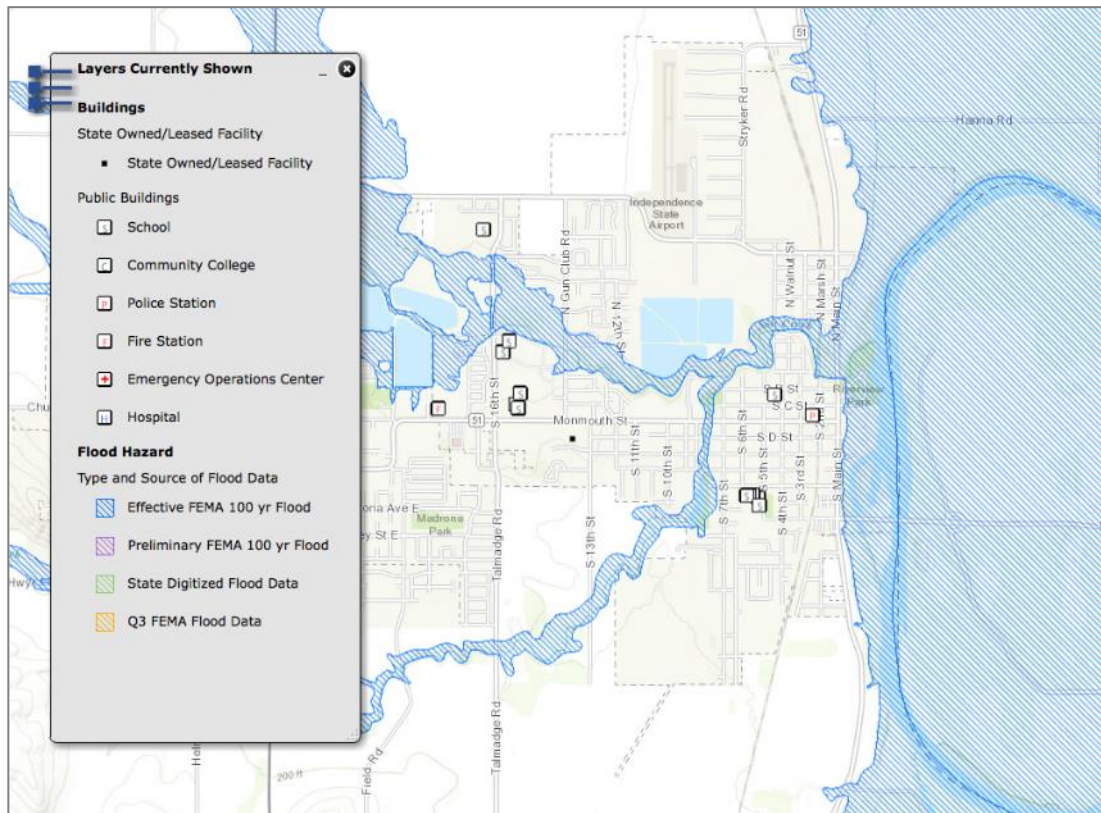
Flood

The steering committee determined that the city’s probability for riverine flood is **moderate** (which is lower than the county’s rating) and that their vulnerability to flood is **moderate** (which is the same as the county’s rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of flooding hazards within the region, as well as previous flooding occurrences. General flood-related community impacts are adequately described within the Flood Hazard Annex of Polk County’s Natural Hazards Mitigation Plan. Portions of Independence have areas of flood plains (special flood hazard areas). These include areas along the Willamette River, Ash Creek, and South Fork Ash Creek (see Figure IA-4 and Attachment A, Map IA-3).

Furthermore, other portions of Independence, outside of the mapped floodplains, are also subject to significant, repetitive flooding from local storm water drainage. In general, the 100-year floodplain delineates an area of high risk, while the 500-year floodplain delineates an area of moderate risk.

Figure IA-4 Special Flood Hazard Area



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

A comprehensive risk and vulnerability assessment is not available. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. The Risk Report would provide a quantitative risk assessment that informs communities of their risks related to certain natural hazards (including flood). If

pursued, once complete the city can incorporate the risk assessment into their addendum to provide greater detail to sensitivity and exposure to the earthquake hazard.

Per the previous version of this plan approximately 726 residential structures (value \$73.3M), seven non-residential structures (value unknown), 25 community facilities (value \$8.2M), seven bridges (value \$7.7M), and nine utilities (value \$2.1M). Within the 500-year floodplain, the City of Independence has 781 residential structures (value \$78.8M), seven non-residential structures (value unknown), one government facility (value \$625K), and one care facility (value \$1.5M).¹⁰

For more information on flood risk see the [Polk County Flood Insurance Study \(2006\)](#).

National Flood Insurance Program (NFIP)

FEMA modernized the Independence Flood Insurance Rate Maps (FIRMs) in December 2006. Table IA-10 shows that as of September 2016, Independence has 61 National Flood Insurance Program (NFIP) policies in force. Of those, 16 are for properties that were constructed before the initial FIRM. The last Community Assistance Visit (CAV) for Independence was on April 20, 2004. Independence is not a member of the Community Rating System (CRS). The table shows that most flood insurance policies are for residential structures, primarily single-family homes. There have been zero paid claims.

The Community Repetitive Loss record for Independence identifies no Repetitive Loss Properties¹¹ and no Severe Repetitive Loss Properties¹².

Table IA-10 Flood Insurance Detail

Jurisdiction	Effective FIRM and FIS	Initial FIRM Date	Total Policies	Pre-FIRM Policies	Policies by Building Type				Minus Rated A Zone
					Single Family	2 to 4 Family	Other Residential	Non-Residential	
Polk County	-	-	428	183	334	27	25	42	28
Independence	12/19/2006	4/5/1988	61	16	38	0	19	4	3

Jurisdiction	Insurance in Force	Total Paid Claims	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Paid Amount	Repetitive Loss Properties	Severe Repetitive Loss Properties	CRS Class Rating	Last CAV
Polk County	\$ 93,520,500	40	33	0	\$ 682,241	1	0	-	-
Independence	\$ 16,665,200	0	0	0	\$ -	0	0	-	4/20/2004

Source: Information compiled by Department of Land Conservation and Development, September 2016.

¹⁰ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

¹¹ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

¹² A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000 and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

Riverine Erosion

Riverine erosion rarely causes death or injury. However, erosion causes significant destruction of property, development, and infrastructure. Erosion hazard data is not readily available; however, descriptions of several localized areas were identified during the development of this document and are identified only by location on Map IA-4 (Attachment A). Critical facilities that may be at risk of erosion were identified using a 300 foot-buffer in the areas identified as having historic erosion impacts to conservatively account for building footprints.

A comprehensive risk and vulnerability assessment is not available for the riverine erosion hazard. Per the previous version of this plan there is a minor erosion threat to the City of Independence principally occurring where the Willamette River is slowly consuming the embankment along the East side of Riverview Park. This could eventually threaten the Amphitheater.¹³

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Landslide

The steering committee determined that the city's probability for landslide is **low** (which is lower than the county's rating) and that their vulnerability to landslide is **low** (which is the same as the county's rating).

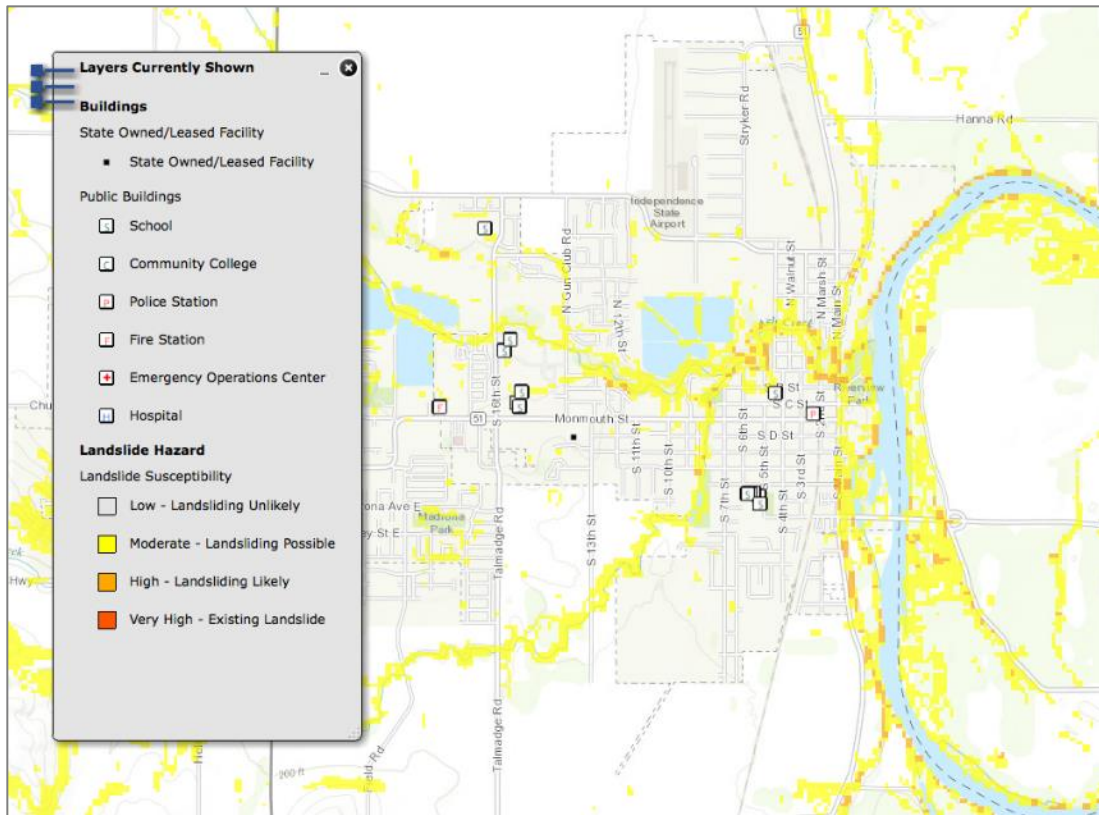
Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Independence has a flat topography and the potential for landslide is low except for areas immediately adjacent to Ash Creek, South Fork Ash Creek, and the Willamette River.

Sedimentary rock underlies Independence. Sedimentary rock is primarily conglomerate, claystone, and siltstone with some sandstone toward the west. Sedimentary rock is less resistant to stream action. Landslide susceptibility exposure for Independence is shown in Figure IA-5 and Map IA-5 (Attachment A). Approximately 2% of Independence has High, and approximately 10% Moderate, landslide susceptibility exposure¹⁴.

¹³ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

¹⁴ DOGAMI Open-File Report, O-16-02, Landslide Susceptibility Overview Map of Oregon (2016)

Figure IA-5 Landslide Susceptibility Exposure



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

Potential landslide-related impacts are adequately described within the county’s plan, and include infrastructural damages, economic impacts (due to isolation and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides and debris flows can potentially occur during any winter in Polk County, and highway and other major roads beyond city limits are susceptible to obstruction as well.

A comprehensive risk and vulnerability assessment is not available. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. The Risk Report would provide a quantitative risk assessment that informs communities of their risks related to certain natural hazards (including landslide). If pursued, once complete the city can incorporate the risk assessment into their addendum to provide greater detail to sensitivity and exposure to the landslide hazard.

According to the previous version of this plan approximately 547 residential structures (value \$55.2M), six non-residential structures (value unknown), one government facility (value \$625K), one care facility (value \$1.5M), two community facilities (value \$865K), three bridges (value \$2.4M), six utility facilities value (\$1.3M) and one “other” facility (value

\$385K) were located in areas of moderate risk while no facilities were located within areas of high risk.¹⁵

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Volcano

The steering committee determined that the city's probability for volcanic event is **low** (which is the same as the county's rating) and that their vulnerability to volcanic event is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes Independence's risk to volcanic events. Generally, an event that affects the county is likely to affect Independence as well. The causes and characteristics of a volcanic event are appropriately described within the county's plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Independence as well. Independence is very unlikely to experience anything more than volcanic ash during a volcanic event. When Mt. Saint Helens erupted in 1980, the city was not impacted.

A comprehensive risk and vulnerability assessment is not available for the volcano hazard. Due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all residential and critical facilities and infrastructure within the City of Independence are at risk.

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Wildfire

The steering committee determined that the city's probability for wildfire is **low** (which is lower than the county's rating) and that their vulnerability to wildfire is **low** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of wildfires, as well as the county and city's history of wildfire events. There are no known large wildfire events in Independence. The location and extent of a wildfire vary depending on fuel, topography, and weather conditions. Weather and urbanization conditions are primarily at cause for the hazard level.

The potential community impacts and vulnerabilities described in the county's plan are generally accurate for the city as well. Polk County developed a Community Wildfire Protection Plan (CWPP) in 2009, which mapped wildland urban interface areas and developed actions to mitigate wildfire risk (see Attachment A, Map IA-6). The city is a participant in the CWPP and will update the city's wildfire risk assessment if the CWPP

¹⁵ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

presents better data during future updates. In general, wildfire conditions are greatest in the populated areas adjacent to the interface area.

Irrigated agricultural land surrounds much of Independence, thereby reducing the risk to wildfire to the city.

A comprehensive risk and vulnerability assessment is not available. The Polk County CWPP provides some risk and vulnerability information related to Independence that has been incorporated into this plan as applicable.

Per the previous version of this plan Independence has critical facilities and infrastructure located within areas of moderate, high, and very high risk.¹⁶

Moderate risk areas contain 1,904 residential structures (value \$192.1M), 15 non-residential structures (value unknown), two government facilities (value \$1.4M), two emergency response facilities (value \$4.1M), five education facilities (value \$41.8M), two care facilities (value \$3.9M), 31 community facilities (value \$16M), seven bridges (value \$7.7M), two transportation facilities (value \$3.3M), 23 utility facilities (value \$12.7M) and two “other” facilities (value \$1.6M).

High risk areas contain 854 residential structures (value \$86.2M), seven non-residential structures (value unknown), one care facility (value \$1.5M), 14 community facilities (value \$6M), seven bridges (value \$7.7M), and 12 utilities facilities (value \$7.7M).

Very high risk areas contain 221 residential structures (value \$22.3M) and one bridge (value \$2.4M).

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Windstorm

The steering committee determined that the city’s probability for windstorm is **high** (which is the same as the county’s rating) and that their vulnerability to windstorm is **moderate** (which is lower than the county’s rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of windstorms, as well as the location and extent of windstorm hazards. The region’s (and city’s) history of events is adequately described within the county’s plan as well. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

Polk County’s plan adequately describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation and economic disruptions result as well.

A comprehensive risk and vulnerability assessment is not available for the windstorm hazard. Due to the nature of the hazard, it is impossible to predict the location or extent of

¹⁶ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

future events with any probability, although it can be assumed that all residential and critical facilities and infrastructure within Independence are at risk.

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Winter Storm (Snow/ Ice)

The steering committee determined that the city's probability for winter storm is **high** (which is the same as the county's rating) and that their vulnerability to winter storm is **moderate** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of winter storms, as well as the location and extent of winter storm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the city typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

Major winter storms can and have occurred in the Independence area, and while they typically do not cause significant damage, they are frequent and have the potential to impact economic activity. Road closures on major roads due to winter weather are an uncommon occurrence, but can interrupt commuter and large truck traffic.

A comprehensive risk and vulnerability assessment is not available for the winter storm (snow/ice) hazard. Due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all residential and critical facilities and infrastructure within Independence are at risk.

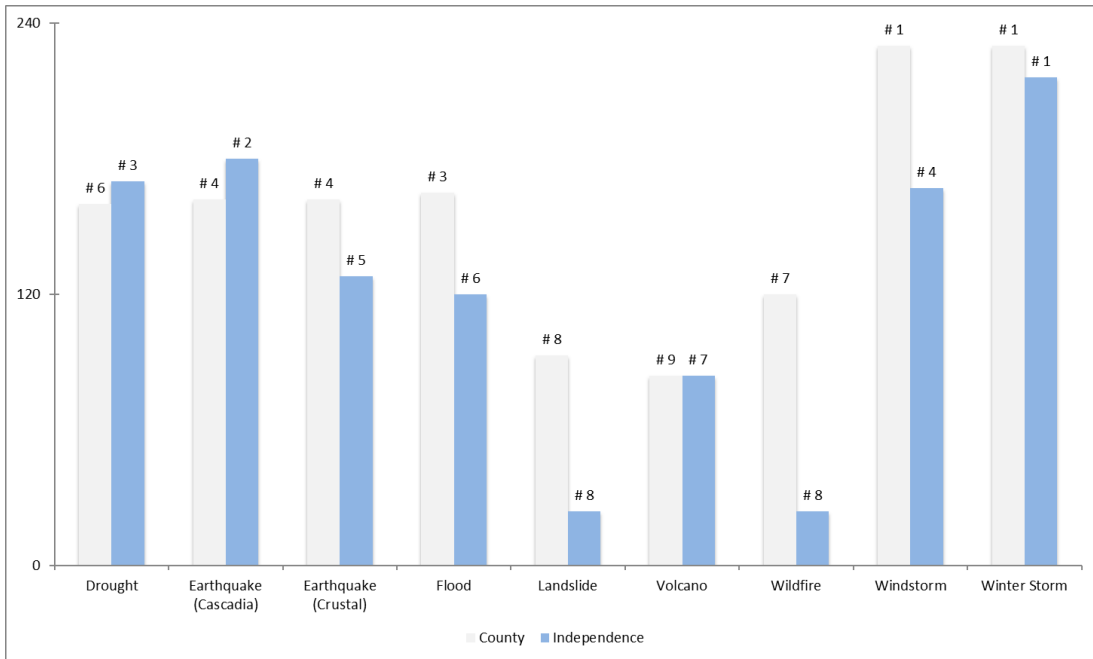
Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Summary

Figure IA-6 presents a summary of the hazard analysis for the City of Independence and compares the results to the assessment completed by Polk County.

The city rated their threat to the Drought and Cascadia Subduction Zone earthquake higher than the county. The top four hazards for the city are winter storm, Cascadia Subduction Zone earthquake, drought, and windstorm.

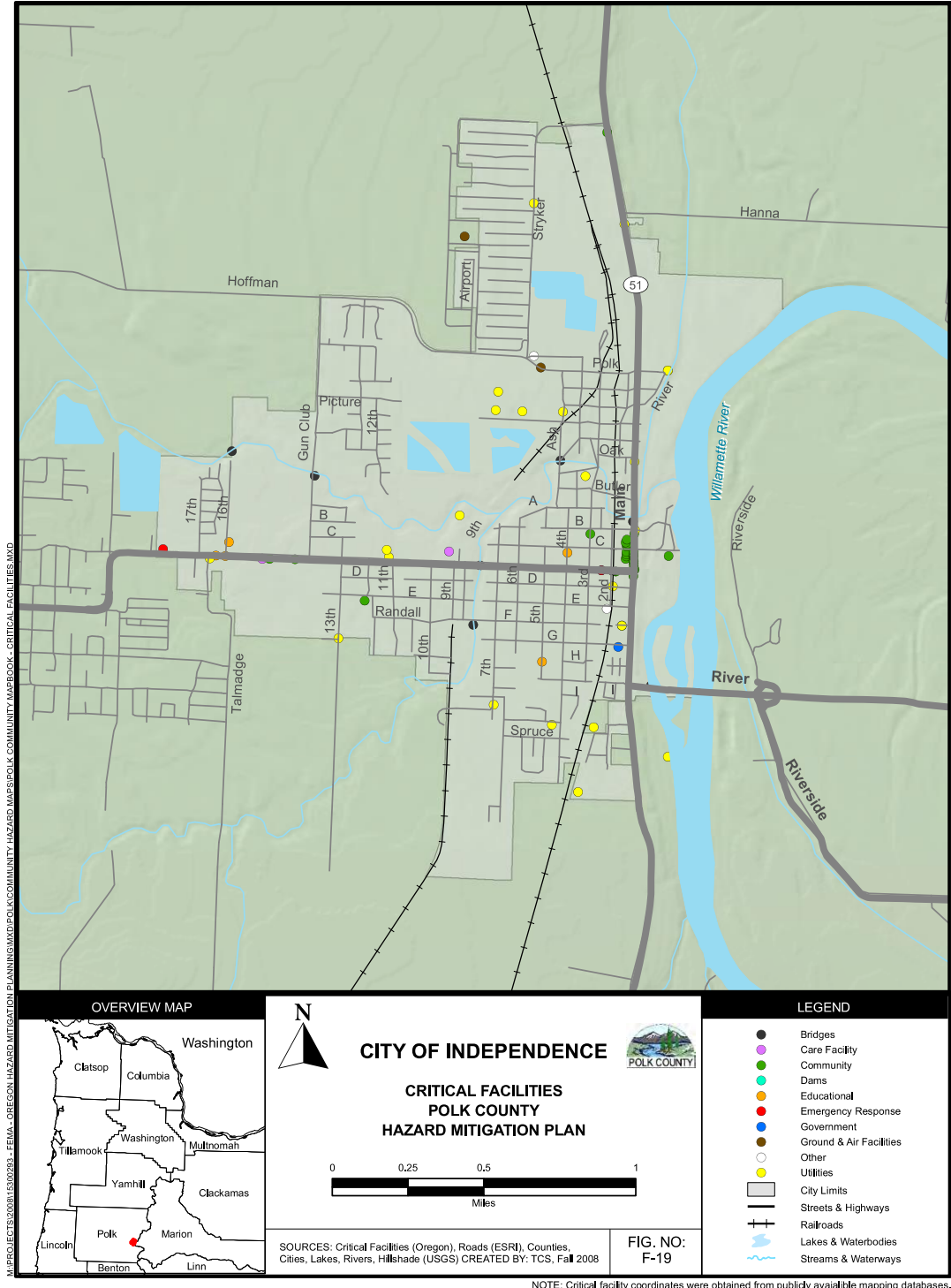
Figure IA-6 Overall Hazard Analysis Comparison –Polk County/ Independence



Source: City of Independence NHMP Steering Committee and Polk County NHMP Steering Committee

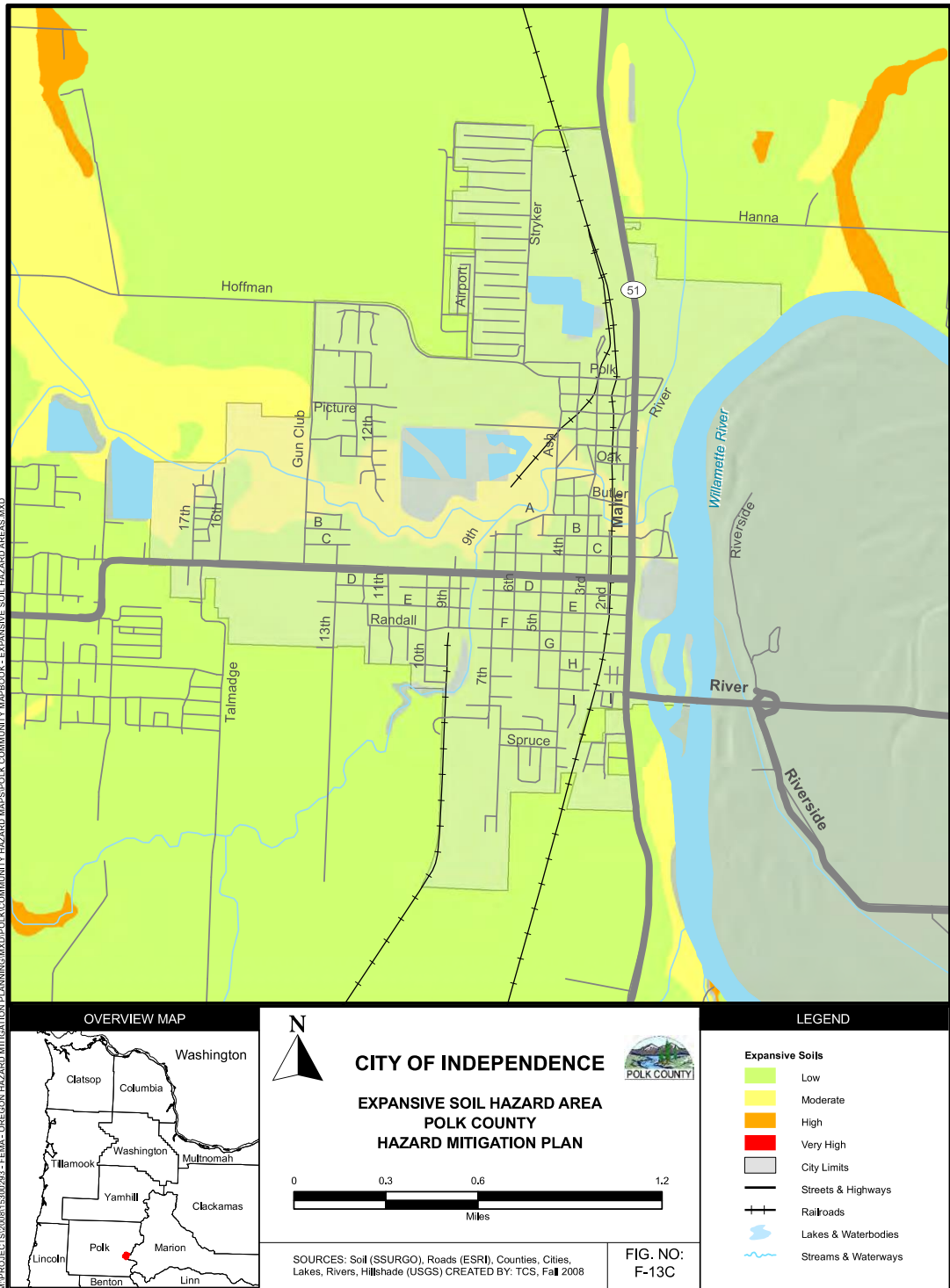
ATTACHMENT A - MAPS

Map IA-I Critical Facilities - Independence



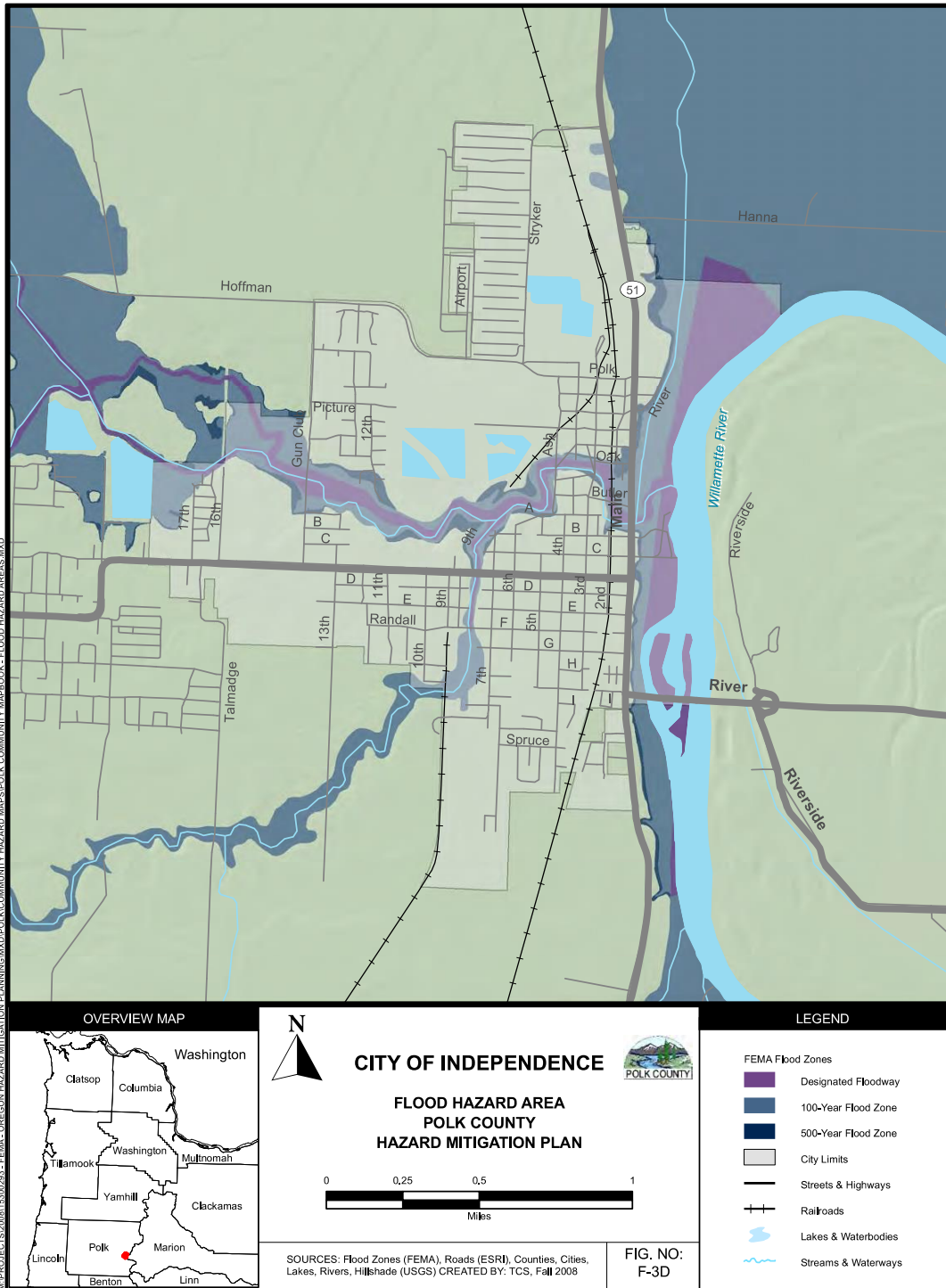
Source: Polk County NHMP (2009).

Map IA-2 Expansive Soils Hazard Area - Independence



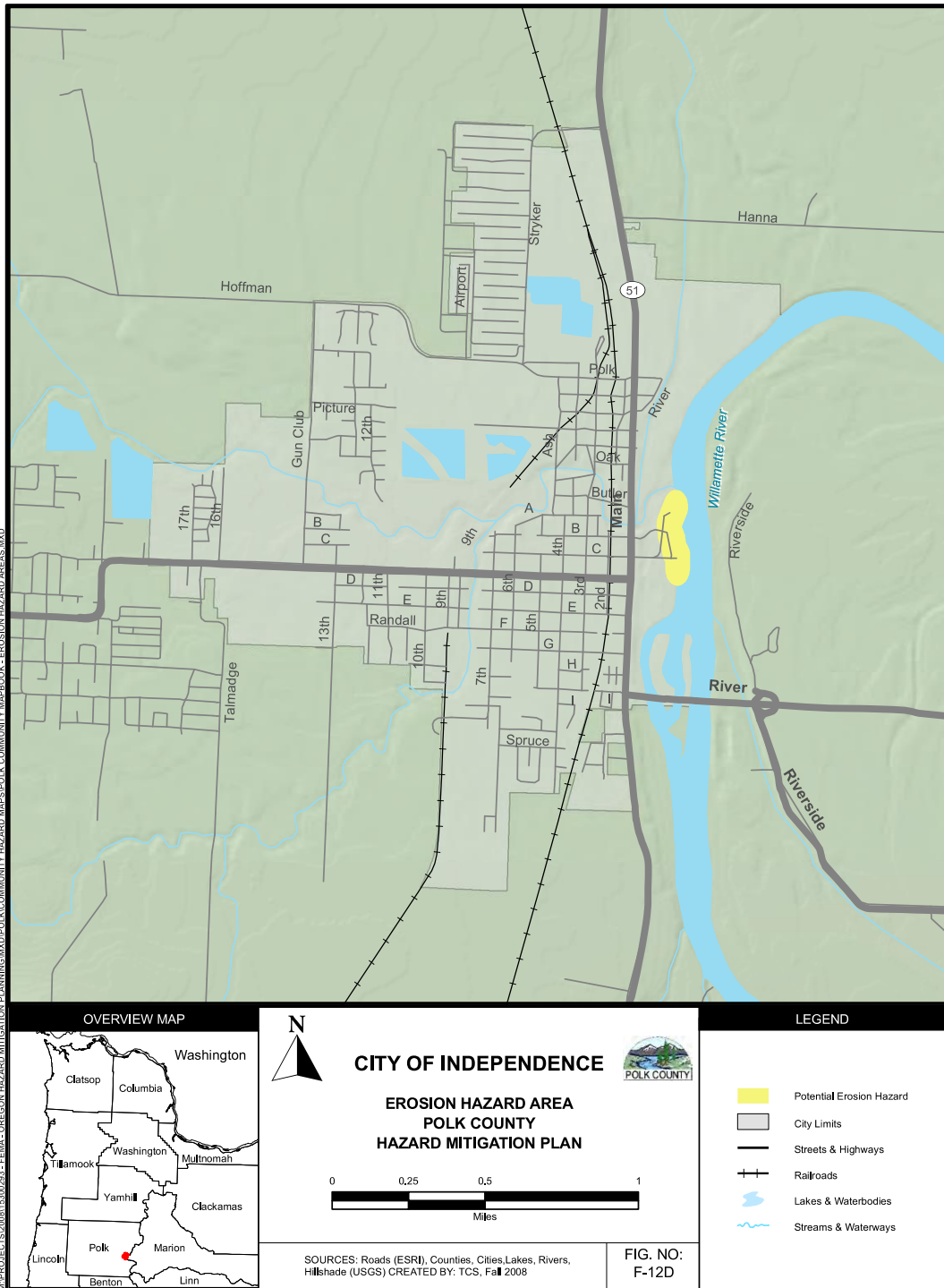
Source: Polk County NHMP (2009).

Map IA-3 Flood Hazard Area - Independence



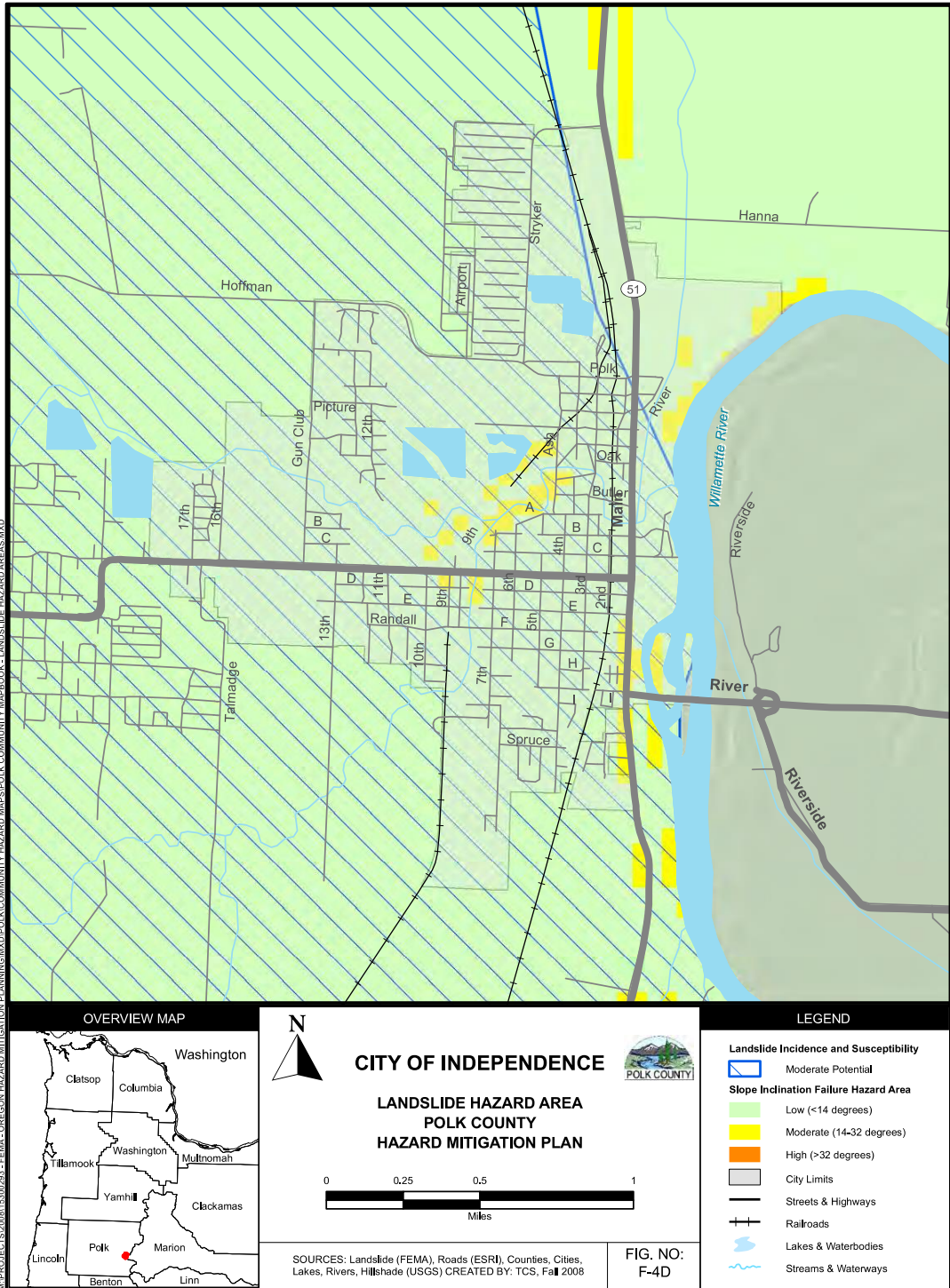
Source: Polk County NHMP (2009).

Map IA-4 Erosion Hazard Area - Independence



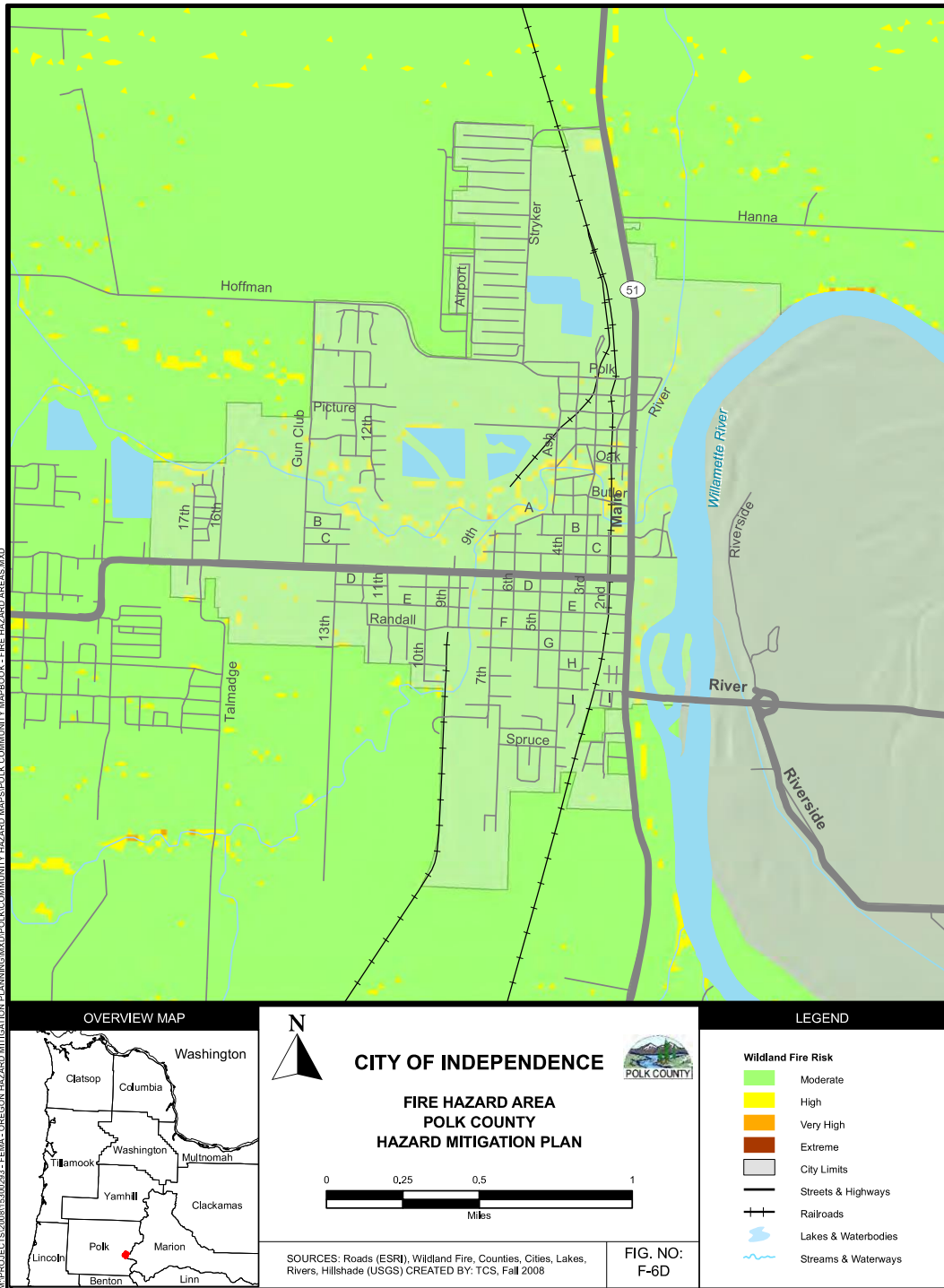
Source: Polk County NHMP (2009).

Map IA-5 Landslide Hazard Area - Independence



Source: Polk County NHMP (2009).

Map IA-6 Wildfire Hazard Area - Independence



Source: Polk County NHMP (2009).

CITY OF MONMOUTH ADDENDUM

Purpose

This document serves as the City of Monmouth's Addendum to the Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan (MNHMP, NHMP). This addendum supplements information contained in Volume I (Basic Plan) of this NHMP, which serves as the foundation for this jurisdiction's addendum, and Volume III (Appendices), which provides additional information (particularly regarding participation and mitigation strategy). This addendum meets the following requirements:

- Multi-jurisdictional **Plan Adoption** §201.6(c)(5),
- Multi-jurisdictional **Participation** §201.6(a)(3),
- Multi-jurisdictional **Mitigation Strategy** §201.6(c)(3)(iv), and
- Multi-Jurisdictional **Risk Assessment** §201.6(c)(2)(iii).

Plan Process, Participation, and Adoption

This section of the NHMP addendum addresses 44 CFR 201.6(c)(5), *Plan Adoption*, and 44 CFR 201.6(a)(3), *Participation*.

In the Fall of 2016, the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center (CSC) partnered with the Oregon Military Department's Office of Emergency Management (OEM), and Polk County and cities, including Monmouth, to update their NHMP, which expired October 14, 2014. This project is funded through the Federal Emergency Management Agency's (FEMA) FY14 Pre-Disaster Mitigation Competitive Grant Program (PDMC-PL-10-OR-2014-002).

By developing this addendum to the Polk County NHMP, locally adopting it, and having it approved by FEMA, Monmouth will regain eligibility for FEMA Hazard Mitigation, Pre-Disaster Mitigation, and Flood Mitigation Assistance grant program funds.

The Polk County NHMP, and Monmouth addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. A project steering committee guided the process of developing the plan. For more information on the composition of the steering committee see the *Acknowledgements*, *Plan Summary*, and *Plan Process* (Volume III, Appendix A).

The Community Development Director of Monmouth is the designated local convener and will take the lead in implementing, maintaining, and updating the addendum to the NHMP in collaboration with the designated convener of the Polk County NHMP (County Planning Department).

Representatives from the City of Monmouth steering committee convened on the following occasions (see Appendix A for more information):

- July 27, 2016 - Polk County NHMP Kick-Off Meeting

- October 18, 2016 – Polk County NHMP Second Meeting
- April 3, 2017 – Review Draft Monmouth Addendum

The city’s addendum reflects decisions decided upon at the plan update meeting and during subsequent work and communication with OPDR.

The Monmouth Steering Committee was comprised of the following representatives:

- Convener, Mark Fancey, Community Development Director
- Russ Cooper, Monmouth Public Works Director
- Scott McClure, Monmouth City Manager
- Allen Risen, Western Oregon University Public Safety
- Michael Smith – Director Western Oregon University Facilities
- Ben Stange, Fire Chief, Polk County Fire District No. 1
- Darrell Tallen, Monmouth Chief of Police
- Chuck Thurman, Monmouth Power & Light Superintendent

Public participation was achieved with the establishment of the steering committee, which was comprised of city officials and special districts representing different organizations and sectors. The Steering Committee was closely involved throughout the development of the plan and served as the local oversight body for the plan’s development. In addition, community members outside of the steering committee were provided an opportunity for comment via the plan review process (see Appendix A for more information).

The Polk County NHMP was approved by FEMA on February 6, 2018 and the Monmouth addendum was adopted via resolution on January 16, 2018. This NHMP is effective through February 5, 2023.

Mitigation Strategy

This section of the NHMP addendum addresses 44 CFR 201.6(c)(3)(iv), *Mitigation Strategy*.

During the 2016/2017 Polk County update process OPDR re-evaluated the Action Items with the county and local steering committees. Following the review actions were updated, noting what accomplishments had been made, and whether the actions were still relevant; any new action items were identified at this time (see Appendix A for more information). Each jurisdiction developed a list of priority actions any actions that were not prioritized were placed in an Action Item Pool and will be considered during the annual Implementation and Maintenance meetings.

Priority Actions

The city is listing a set of high priority actions in an effort to focus attention on an achievable set of high leverage activities over the next five-years. The city’s priority actions are listed below in Table MA-1.

Action Item Pool

Table MA-2 presents a pool of mitigation actions. This expanded list of actions is available for local consideration as resources, capacity, technical expertise and/or political will become available.

The majority of these actions carry forward from prior versions of this plan.

Table MA-I Monmouth Priority Action Items

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Priority Actions					
Multi-Hazard Actions (MH)					
MH #1	Develop and incorporate city ordinances commensurate with building and fire codes to reflect survivability from wind, seismic, fire, and other hazards to ensure life safety.	Community Development Department, Building Department, Fire District	Ongoing	General Fund	BC: TBD TF: Yes
MH #2	Review ordinances and develop outreach programs to assure propane tanks are properly anchored and hazardous materials are properly stored and protected from known natural hazards such as seismic or flooding events.	Building Department, Fire District	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes
Earthquake Actions (EQ)					
EQ #1	Update the City Code to adopt, implement, and enforce current State of Oregon Building Codes.	Building Department	Ongoing	General Fund	BC: TBD TF: Yes
EQ #2	Retrofit important public facilities with significant seismic vulnerabilities (City Hall, etc.), such as unreinforced masonry construction. Consider structural and non-structural options.	City Manager, Central School District	Long Term (5+ Years)	General Fund, NEHRP, HMGP, SRGP	BC: TBD TF: Yes
Flood Actions (FL) - including erosion					
FL #1	Develop, or revise, adopt, and enforce storm water ordinances and regulations to manage run-off from new development, including buffers and retention basins.	Community Development Department, Public Works Department	Ongoing	General Fund, HMA	BC: TBD TF: Yes
FL #2	Identify and resolve areas of persistent stormwater flooding due to undersized, underperforming, stormwater infrastructure.	Public Works	Mid-Term (2-5 Years)	OWEB, General Fund, Grants, SDCs	BC: TBD TF: Yes
Winter Storm Actions (WT)					
WT #1	Implement and enforce the most current Uniform International, and State, Building Codes to ensure structures can withstand winter storm hazards such as high winds, rain, water, and snow.	Building Department	Short Term (0-2 Years)	General Fund	BC: TBD TF: Yes
WT #2	Develop and implement tree clearing mitigation programs to keep trees from threatening lives, property, and public infrastructure from severe weather events.	Public Works Department, Monmouth Power & Light	Short Term (0-2 Years)	General Fund, HMGP, HMA	BC: TBD TF: Yes

Source: City of Monmouth NHMP Steering Committee, 2017.

MH=Multi-Hazard, EQ=Earthquake, FL=Flood, WT=Winter Storm

Table MA-2 Monmouth Action Item Pool

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Action Item Pool					
Drought Action (DR) - including expansive soils					
DR #1	Review construction codes to require non-absorbent fill soils that slope away from foundations for a minimum of five feet to prevent ponding and water retention.	Building Department	Short Term (0-2 Years)	General Fund	BC: TBD TF: Yes
Earthquake Actions (EQ)					
EQ #3	Encourage utility companies to evaluate and harden vulnerable infrastructure elements for sustainability.	Public Works Department Monmouth Power & Light	Mid-Term (2-5 Years)	General Fund, HMGP, Utility Co	BC: TBD TF: Yes
EQ #4	Disseminate FEMA pamphlets to educate and encourage homeowners concerning seismic structural and non-structural retrofit benefits.	Building Department	Short Term (0-2 Years)	General Fund, HMGP, NEHRP	BC: TBD TF: Yes
Flood Actions (FL) - including erosion					
FL #3	Develop and maintain GIS mapped inventory, and develop prioritized list of mitigation projects for residential and commercial buildings within 100-year floodplains.	Community Development Department	Mid-Term (2-5 Years)	General Fund, HMGP, HMA	BC: TBD TF: Yes
FL #4	Develop and maintain GIS mapped critical facility inventory for all structures located within 100-year floodplains.	Community Development Department	Short Term (0-2 Years)	General Fund, HMGP, HMA	BC: TBD TF: Yes
FL #5	Maintain and update erosion hazard locations, identify critical facilities potentially impacted, and develop mitigation initiatives such as bank stabilization or facility relocation to prevent or reduce the threat.	Community Development Department Public Works Department	Mid-Term (2-5 Years)	General Fund, HMGP, HMA, NRCS	BC: TBD TF: Yes
FL #6	Develop and provide information to all residents on riverbank erosion and methods to prevent it in an easily distributed format.	Public Works Department	Mid-Term (2-5 Years)	General Fund, NRCS, HMGP	BC: TBD TF: Yes
Landslide Actions (LS)					
<i>No specific actions identified; see multi-hazard actions.</i>					
Volcano Actions (VE)					
<i>No specific actions identified; see multi-hazard actions.</i>					

Source: City of Monmouth NHMP Steering Committee, 2017

DR=Drought, EQ=Earthquake, FL=Flood,

Table MA-2 Monmouth Action Item Pool (continued)

Action Item #	Description	Managing Department / Agency	Timeline	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Action Item Pool					
Wildfire Action (WF)					
WF #1	Participate in the maintenance, implementation, and update of the Polk County Community Wildfire Protection Plan (2009).	PC SW Rural Fire District Polk County & City Manager	Ongoing	General Fund	BC: TBD TF: Yes
Windstorm Actions (WS)					
WS #1	Identify and prioritize critical facilities' overhead utilities that could be placed underground to reduce power disruption from wind storm / tree blow down damage.	Monmouth Power & Light	Short Term (0-2 Years)	General Fund, Utility Co	BC: TBD TF: Yes
WS #2	Enforce requirements to place utilities underground to reduce power disruption from windstorm / tree blow down damage when upgrading or during new development.	Community Development Department Building Department Monmouth Power & Light	Ongoing	General Fund	BC: TBD TF: Yes
Winter Storm Actions (WT)					
WT #3	Update or develop, implement, and maintain jurisdictional debris management plans.	Public Works Department Monmouth Power & Light	Mid-Term (2-5 Years)	General Fund, HMGP, HSGP	BC: TBD TF: Yes
WT #4	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	Public Works Department Monmouth Power & Light	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes
WT #5	Develop, implement, and maintain partnership program with electrical utilities to use underground utility placement methods where possible to reduce or eliminate power outages from severe winter storms.	Community Development Department Building Department Monmouth Power & Light	Ongoing	General Fund, Utility Co	BC: TBD TF: Yes
WT #6	Educate public regarding weather patterns associated with El Niño / La Niña.	Community Development Department	Short Term (0-2 Years)	General Fund, NOAA/ NWS, HMGP	BC: TBD TF: Yes

Source: City of Monmouth NHMP Steering Committee, 2017

WF=Wildfire, WS=Windstorm, WT=Winter Storm

Plan Implementation and Maintenance

The City Council will be responsible for adopting the City of Monmouth addendum to the Polk County NHMP. This addendum designates a coordinating body and a convener to oversee the development and implementation of action items. Because the city addendum is part of the county's multi-jurisdictional NHMP, the city will look for opportunities to partner with the county. The city's steering committee will convene after re-adoption of the City of Monmouth addendum on an annual schedule; the county meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The Community Development Director will serve as the convener and will be responsible for assembling the steering committee (coordinating body). The steering committee will be responsible for:

- identifying new risk assessment data,
- reviewing status of mitigation actions,
- identifying new actions, and
- seeking funding to implement the city's mitigation strategy (actions).

The convener will also remain active in the county's implementation and maintenance process (see Volume I, Section 4 for more information).

The city will utilize the same prioritization process as the county (See Volume I, Section 4: Plan Implementation and Maintenance and Volume III, Appendix C: Economic Analysis of Natural Hazard Mitigation Projects for more information).

Implementation through Existing Programs

Many of the Natural Hazards Mitigation Plan's recommendations are consistent with the goals and objectives of the city's existing plans and policies. Where possible, the City of Monmouth will implement the NHMP'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, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented.

Monmouth's acknowledged comprehensive plan is the [Monmouth Comprehensive Plan](#). The Oregon Land Conservation and Development Commission first acknowledged the plan in 1978. The City last amended the plan in 2010. The City implements the plan through the [Monmouth City Code](#), which was last amended in 2017.

Monmouth currently has the following plans, programs, and policies that relate to natural hazard mitigation. For a complete list visit the city [website](#):

Table MA-3 Legal and Regulatory Resources Available for Hazard Mitigation

Regulatory Tool	Name	Effects on Hazard Mitigation
Plans	Emergency Operations Plan (2010)	Identifies emergency planning, policies, procedures, and response to extraordinary emergency situations associated with natural disasters, technological incidents, and national security emergencies.
	Comprehensive Plan (2010) Natural Hazards Element Map	Provides background and inventory information as well as policy direction.
	Urban Renewal Plan (2005) District Map	This plan may be used to identify Capitol Improvement projects that would mitigate future disaster damages.
	Building Inspection Program Operations Plan	Outlines Building Department procedures including plan review and inspections.
	Water Master Plan	Provides a description and analysis of water system and outlines planned improvements.
	Sewer Master Plan	Provides a description and analysis of sewer system and outlines planned improvements.
	Storm Drainage Master Plan	Provides a description and analysis of storm drainage system and outlines planned improvements.
	Transportation System Plan (2009)	Establishes the City's goals, policies, and action strategies for developing and improving the transportation system within the Urban Growth Boundary.
Parks System Master Plan (2008)	Provides guidance and recommendations on how to develop an interconnected and accessible park system.	
Programs	National Flood Insurance Program (NFIP)	Makes affordable flood insurance available to homeowners, business owners, and renters in participating communities. In exchange, those communities must adopt and enforce minimum floodplain management regulations to reduce the risk of damage from future floods.
Policies (Municipal Codes)	Monmouth City Code Title 15: Building and Construction	Adopts and enforces the Oregon Building Code.
	Housing Code	Provides health and safety standards for rental properties.
	Monmouth City Charter	No effect.

Regulatory Tool	Name	Effects on Hazard Mitigation
	Monmouth Sign Code	No effect.
	Monmouth City Code Title 18: Zoning Chapter 18.125: Floodplain Zone	Uses the FEMA Model Ordinance to regulate floodplain development and provide guidance for safe building location, practices, and review requirements.

Table MA-4 Administrative and Technical Resources for Hazard Mitigation

Staff/Personnel Resources	Department/Division Position
Planner(s) or engineer(s) with knowledge of land development and land management practices	Community Development Director: Mark Fancey
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	Building Official: Larry Thornton
Planner(s) or engineer(s) with an understanding of manmade or natural hazards	Community Development Director: Mark Fancey
Floodplain manager	Community Development Director: Mark Fancey
Personnel skilled in GIS and/or HAZUS-MH	Community Development Director: Mark Fancey
Grant Writer	Community Development Director: Mark Fancey
Director of Emergency Services	EOC / Depends on hazard
Finance (grant writers, purchasing)	City Finance Director
Public Information Officers	EOC / Depends on hazard

Table MA-5 Financial Resources for Hazard Mitigation

Financial Resources	Effect on Hazard Mitigation
General funds	Yes
Authority to levy taxes for specific purposes	(measure 5) w/ a cap w/ voter approval (cannot exceed cap)
Incur debt through general obligation bonds	No
Incur debt through special tax and revenue bonds	Yes
Incur debt through private activity bonds	Yes

Note: See Appendix D – Grant Programs for additional financial resources.

Continued Public Participation

Keeping the public informed of the city's efforts to reduce the city's risk to future natural hazards events is important for successful plan implementation and maintenance. The city is committed to involving the public in the plan review and updated process. See Volume I, Section 4, for more information.

Plan Maintenance

The Polk County Multi-Jurisdictional Natural Hazards Mitigation Plan and city addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the county plan update process, the city will also review and update its addendum. The convener will be responsible for convening the steering committee to address the questions outlined below.

- 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?
- Have there been any significant changes in the community's demographics 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?

These questions will help the steering committee determine what components of the mitigation plan need updating. The steering committee will be responsible for updating any deficiencies found in the plan.

Risk Assessment

This section of the NHMP addendum addresses 44 CFR 201.6(b)(2) - Risk Assessment. In addition, this chapter can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards. Assessing natural hazard risk has three phases:

- **Phase 1:** Identify hazards that can impact the jurisdiction. This includes an evaluation of potential hazard impacts – type, location, extent, etc.
- **Phase 2:** Identify important community assets and system vulnerabilities. Example vulnerabilities include people, businesses, homes, roads, historic places and drinking water sources.
- **Phase 3:** Evaluate the extent to which the identified hazards overlap with, or have an impact on, the important assets identified by the community.

The local level rationale for the identified mitigation strategies (action items) is presented herein, and within Section 2, *Risk Assessment*, and Appendix B, *Community Profile*. The risk assessment process is graphically depicted in Figure MA-1 below. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure MA-1 Understanding Risk



Hazard Analysis Methodology

This NHMP utilizes a hazard analysis methodology that was first developed by FEMA circa 1983, and gradually refined by the Oregon Military Department's Office of Emergency Management over the years.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible). Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%.

This method provides the jurisdiction with a sense of hazard priorities, or relative risk. It doesn't predict the occurrence of a particular hazard, but it does "quantify" the risk of one hazard compared with another. By doing this analysis, planning can first be focused where the risk is greatest.

In this analysis, severity ratings, and weight factors, are applied to the four categories of history, vulnerability, maximum threat (worst-case scenario), and probability as shown in the table below. See Volume I, Section 2 (Risk Assessment) for more information.

Hazard Analysis

The Monmouth steering committee developed their hazard vulnerability assessment (HVA), using the county’s HVA as a reference. Changes from the county’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Monmouth, which are discussed throughout this addendum.

Table MA-6 shows the HVA matrix for Monmouth showing each hazard listed in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with sense of hazard priorities, but does not predict the occurrence of a particular hazard.

One catastrophic hazard (Cascadia Subduction Zone earthquake) and two chronic hazards (winter storm and flood) rank as the top hazard threats to the city (Top Tier). The crustal earthquake, windstorm, and drought hazards comprise the next highest ranked hazards (Middle Tier), while wildfire, landslide, and volcano hazards comprise the lowest ranked hazards (Bottom Tier).

Table MA-6 Hazard Analysis Matrix – Monmouth

Hazard	History	Probability	Vulnerability	Maximum Threat	Total Threat Score	Hazard Rank	
Earthquake - Cascadia	2	49	50	100	201	# 1	<i>Top Tier</i>
Winter Storm	8	56	25	60	149	# 2	
Flood - Riverine	4	28	20	70	122	# 3	
Earthquake - Crustal	2	7	20	80	109	# 4	<i>Middle Tier</i>
Windstorm	6	28	20	50	104	# 5	
Drought	2	7	5	80	94	# 6	
Wildfire (WUI)	4	7	5	10	26	# 7	<i>Bottom Tier</i>
Landslide	2	7	5	10	24	# 8	
Volcano	2	7	5	10	24	# 8	

Source: Monmouth NHMP Steering Committee, 2017.

Table MA-7 categorizes the probability and vulnerability scores from the hazard analysis for the city and compares the results to the assessment completed by the Polk County NHMP Steering Committee (areas of differences are noted with **bold** text within the city ratings). Notably, the city ranked their vulnerability to Cascadia Subduction Zone earthquakes higher than the county.

Table MA-7 Probability and Vulnerability Comparison

Hazard	Monmouth		County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Low	Low	Moderate	Moderate
Earthquake (Cascadia)	Moderate	High	Moderate	Moderate
Earthquake (Crustal)	Low	Moderate	Moderate	Moderate
Flood	Moderate	Moderate	High	Moderate
Landslide	Low	Low	High	Low
Volcano	Low	Low	Low	Moderate
Wildfire	Low	Low	Moderate	Moderate
Windstorm	Moderate	Moderate	High	High
Winter Storm	High	Moderate	High	High

Source: Monmouth NHMP Steering Committee and Polk County NHMP Steering Committee, 2017.

Between 2010 and 2015 the City grew by 95 people (1%) and median household income decreased by 19% (see Appendix B). New development was placed outside of the floodplain per the city’s floodplain ordinance (see Table MA-3) and complied with the seismic safety standards within the [Oregon State Building Code](#). As such changes in population, demographics, and development have had a negligible impact upon vulnerability. However, decreased household income within the community may be a signal that segments of the community may have a difficult time recovering from a natural hazard. See specific hazard sections below for more information.

Community Asset Identification

This section provides information on city specific assets. For additional information on the characteristics of Monmouth, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume III, Appendix B, *Community Profile*. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation. Considering the city specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation.

Community Characteristics

Monmouth is located in the mid-Willamette Valley near the foothills of the Coast Range and is located on the Willamette River covering an area of about 2.2 square miles. The climate of Monmouth is moderate; the average monthly temperatures range from 49 – 82 degrees in July through August, and 33-47 degrees in December and January, and the city receives approximately 40 inches of rain each year¹. Monthly precipitation is about 4-7 inches during the wetter months of November through March, and average about 0.5-1.5 inches during the drier months of June - September. The city’s topography is relatively flat. The city abuts Independence to the east and is approximately 15 miles southwest of Salem.

¹ [Western Regional Climate Center, “Salem-McNary Field, Oregon \(357500\)”. Retrieved November 22, 2016.](#)

Economy

Monmouth benefits from its location to Salem which is the State Capital and a regional center for industrial technology, engineering, research, commerce, and health care. Monmouth has some manufacturing businesses, however, most employment is outside of the city.

Asset Inventory

Asset inventory is the first step of a vulnerability analysis. Assets that may be affected by hazard events include population, residential and nonresidential buildings, critical facilities, and infrastructure.

The asset inventory delineates the City's existing building and infrastructure assets and insured values and are identified in detail in Table MA-8 and Map MA-1 (Attachment A).

Table MA-8 Monmouth Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value ¹
Government	Monmouth City Hall	151 W Main St	\$851,810
	Monmouth Library	168 Ecols St S	\$2,001,290
	Monmouth Post Office	437 Clay St E	\$367,600
	City shop #1	401 Hogan Rd	\$734,890
	Storage building #2	401 Hogan Rd	\$22,791
	Gas tanks	401 Hogan Rd	\$7,349
	Office trailer	401 Hogan Rd	\$10,300
	City Hall storage building	144 S Warren Street	\$190,550
	Volunteer Hall	144 S Warren Street	\$519,120
	Community Building		\$462,470
Educational	Monmouth Elementary School	958 E Church	\$3,256,780
	Ash Creek Intermediate School	1360 N 16 th St	\$10,137,690
	Western Oregon University	345 N Monmouth	\$185,943,598
Care Facility	Monmouth Senior Center	180 Warren St S	\$513,970
	Medical Center	512 Main Street	\$723,800
	Heron Pointe Assisted Living Center	504 Gwinn St E	\$5,432,430
	Total Health Care Center	180 Atwater Street N	\$269,530
Community	Southgate Park	Southgate Drive & Josephine Street	Unknown
	Whitesell Park	Catherine Court	Unknown
	Winegar Park	Ecols Street N. & Suzanna Avenue	\$2,440
	Cherry Lane Park	Cherry Lane	Unknown
	Gentle Woods Park Restrooms	Olive Way & High Street N.	\$19,410
	Gentle Woods Park picnic shelter	Olive Way & High Street N.	\$77,250
	Le Mesa Park	Heffley Street S. & Bentley Street E.	Unknown
	Madrona Park restrooms	Madrona Street E. & Edwards Road	\$30,098
	Main Street Park restrooms	Main Street W. & Warren Street S.	57,680
Main Street Park Splash Fountain	Main Street W. & Warren Street S.	\$210,000	

Facility Type	Name / Number	Address	Value ¹
	Main Street Park Amphitheater	Main Street W. & Warren Street S.	\$1,300,000
	Marr Park	Jackson Street W. & Marr Court	Unknown
	Monmouth Recreational Park	Hogan Road & Highway 51	\$83,640
	Baseball fields/skate park	540 Ridge Rd	\$235,870
	Baseball fields restroom	541 Ridge Rd	\$84,460
Emergency Response	Monmouth Police Department	450 Pacific Highway N	\$3,764,977
State and Federal Highways	US Route 99W	Traverses the entire community from north to south	\$1.93 miles
	US Route 51	Traverses the entire community from east to west	\$1.80 miles
Utilities	NE lift station	401 Hogan Road	208,160
	Chlorine building	401 Hogan Road	44,290
	Generator	401 Hogan Road	65,920
	S. Warren lift station		193,460
	NW lift station		145,230
	SE Teton lift station		124,630
	Fencing	Hogan Road	153,470
	WIMPEG Channel 17		76,220
	Communications Tower	Cupids Knoll	Unknown
	Water Tank #1	Cupids Knoll	475,860
	Water Tank #2	Cupids Knoll	1,492,470
	Water Tank #3	Cupids Knoll	\$1,114,460
	Water Tank #4	4th St (Independence)	\$999,698
	Sewer effluent pump	Riddell Road	\$168,920
	Effluent pump station	Riddell Road	\$26,780
	Sewer effluent pump	Hogan Road	\$439,810
	Sewer Plant pump building		\$296,640
	River Road pump house #1*		\$337,840
	River Road pump house #2*		\$491,870
	Pumphouse #1		\$33,990
	Pumphouse #2		\$36,050
Pumphouse #3		\$41,200	
Pumphouse #4	4 th St (Independence)	\$50,473	
North switch station		\$335,780	
South switch station		\$49,423	

Note: ¹Estimated and/or insured structural and/or Polk County Assessed value for critical facilities and estimated values for critical infrastructure in 2009 dollars. Items in **bold** have been revised to 2017 dollars.

* - River Road pump house facilities are located in Marion County.

See hazard sections below and Section 2, *Risk Assessment*, for potential hazard vulnerabilities to these facilities.

Hazard Characteristics

Drought

The steering committee determined that the city's probability for drought is **low** (which is lower than the county's rating) and that their vulnerability to drought is **low** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of drought hazards, as well as the location and extent of a potential event. Due to a cool, wet climate, past and present weather conditions have generally spared Polk County communities from the effects of drought; however, Polk County was included in a Governor declared drought declaration in 1992 and a Presidential drought declaration in 2015.

Monmouth's primary water supply comes from four individual groundwater wells, Marion County #1 and #2 are the city's primary water sources, wells #4 and #5 are secondary sources. Combined these sources are capable of providing 3.0 million gallons of water per day. Development of the Willamette River Well Field, three additional wells located south of Independence along the west side of the Willamette River, is underway.²The city has four (4) storage reservoirs totaling 6.20 million gallons of treated water storage capacity.³ Based on current population growth projections the city has adequate storage capacity through 2035. In general, the city's water supply is available and sufficient. Additional, drought-related community impacts are described within the county's Drought Hazard section (Volume I, Section 2). In general, water supply is available and sufficient. Additional, drought-related community impacts are described within the county's Drought Hazard section (Volume I, Section 2).

Expansive Soils

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of drought hazards, as well as the location and extent of a potential event. The addition of moisture to any soil will cause a change in volume, which is referred to as a shrink-swell characteristic.⁴

Per the previous version of this plan the City of Monmouth has critical facilities and infrastructure located within areas of low, moderate and high risk; see Map MA-2 (Attachment A).

Low risk areas contain 2,959 residential structures (value \$391M), 10 government facilities (value \$5.2M), one emergency response facility (value \$3.8M⁵), three education facilities (value \$200M), four care facilities (value \$6.9M), 15 community facilities (value \$669K), two highways (value unknown), and 21 utilities (value \$5.9M). Moderate risk areas contain two community facilities (value \$97K), and two utility facilities (value \$440K).

² Water System Master Plan Update (2000), Monmouth, OR. 4B Engineering and Consulting, LLC

³ Ibid

⁴ US Department of Agriculture, Natural Resources Conservation Service (USDA NRCS). 2008. National Cooperative Soil Survey, Physical Soil Properties—Polk County, Oregon.

⁵ Value updated to 2017 dollars.

A comprehensive risk and vulnerability assessment is not available for the drought hazard. Statewide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks are present to humans and resources. Agriculture, fishing, and timber have historically been impacted, as well as local and regional economies.

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

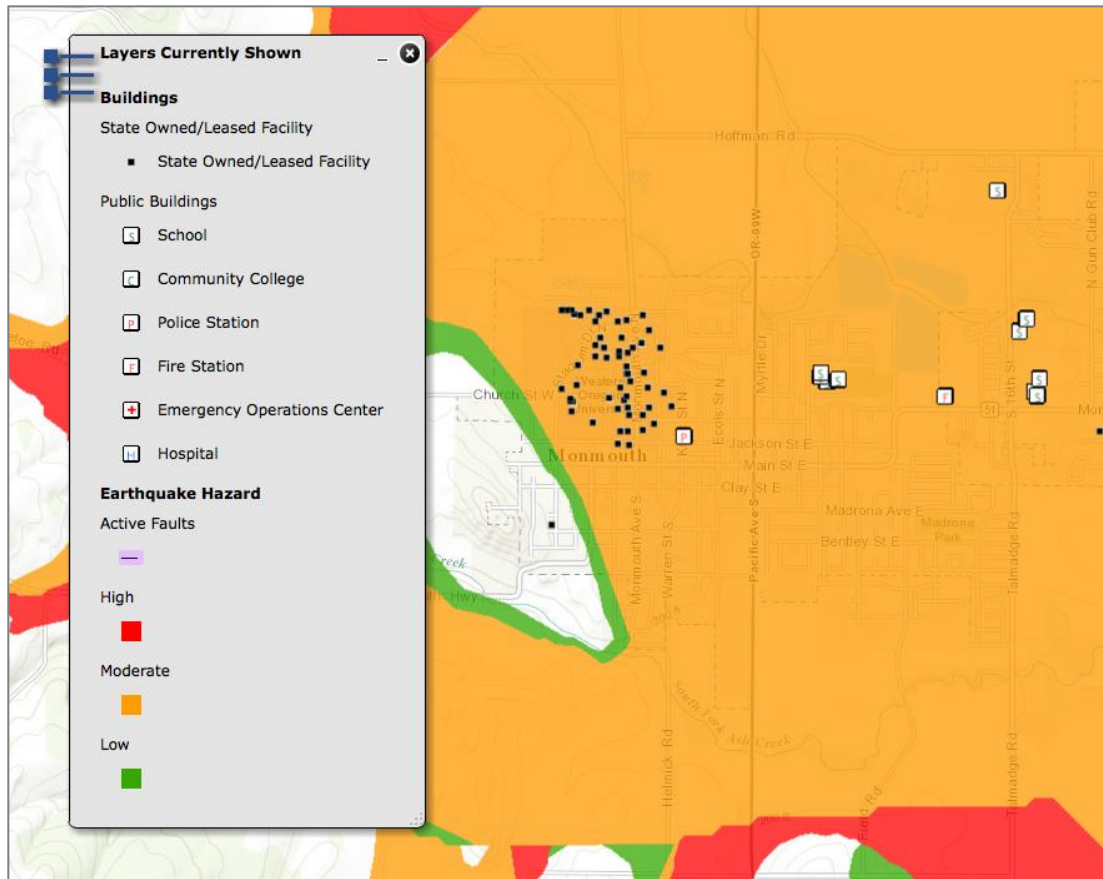
Earthquake

The steering committee determined that the city's probability for a Cascadia Subduction Zone (CSZ) Earthquake event is **moderate** (which is the same as the county's rating) and that their vulnerability to a Cascadia Earthquake event is **high** (which is higher than the county's rating). The steering committee determined that the city's probability for a Crustal Earthquake event is **low** (which is lower than the county's rating) and that their vulnerability to a Crustal Earthquake event is **moderate** (which is the same as the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of earthquake hazards, history, as well as the location and extent of a potential event. Generally, an event that affects the county is likely to affect Monmouth as well. The causes and characteristics of an earthquake event are appropriately described within the county's plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Monmouth as well.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any particular site. In many major earthquakes, damages have primarily been caused by the behavior of the soil. Figure MA-2 displays relative liquefaction hazards. As shown, the area of greatest concern are just outside of the city limits to the north and south (darker areas) and also the area that are adjacent to the Willamette River where the concentration of soft soils is the highest.

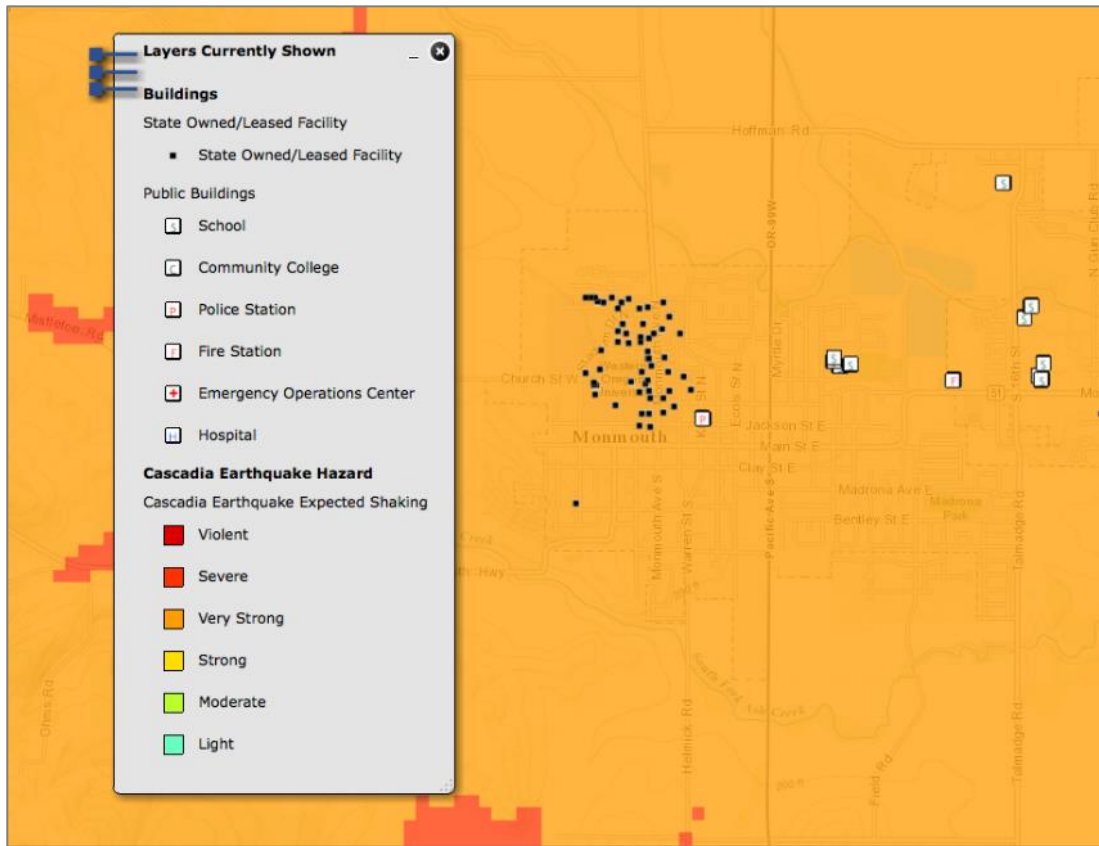
Figure MA-2 Active Faults and Soft Soils



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

Figure MA-3 below shows the expected shaking/ damage potential for Monmouth because of a Cascadia Subduction Zone (CSZ) earthquake event. The figure shows that the city will experience “very strong” shaking that will last two to four minutes. The shaking will be extremely damaging to lifeline transportation routes including Highway 99 and Interstate 5. For more information on expected losses due to a CSZ event see the [Oregon Resilience Plan](#).

Figure MA-3 Cascadia Subduction Zone Expected Shaking



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

As noted in the community profile approximately 54% of residential buildings were built prior to 1990, which increases the city’s vulnerability to the earthquake hazard. Information on specific public buildings’ (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table MA-9; each “X” represents one building within that ranking category. Of the facilities evaluated by DOGAMI using RVS, none have very high (100% chance) collapse potential, and none have a high (greater than 10% chance) collapse potential.

In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage.

Utility systems will be significantly damaged, including damaged buildings and damage to utility infrastructure, including water treatment plants and equipment at high voltage substations (especially 230 kV or higher which are more vulnerable than lower voltage substations). Buried pipe systems will suffer extensive damage with approximately one break per mile in soft soil areas. There would be much lower rate of pipe breaks in other areas. Restoration of utility services will require substantial mutual aid from utilities outside of the affected area.

Table MA-9 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (< 1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Monmouth Elementary (Central SD 13J) (958 E Church St)	Polk_sch04		X, X, X, X		
Ash Creek Intermediate (Central SD 13J) (1360 N 16th St)	Polk_sch07	X			
Public Safety					
Monmouth Police Department (238 E Jackson St)	Polk_pol04	X			

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#)

“*” – Site ID is referenced on the [RVS Polk County Map](#)

A comprehensive risk and vulnerability assessment is not available. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. The Risk Report would provide a quantitative risk assessment that informs communities of their risks related to certain natural hazards (including earthquake). If pursued, once complete the city can incorporate the risk assessment into their addendum to provide greater detail to sensitivity and exposure to the earthquake hazard.

According to the previous version of this plan approximately 2,959 residential structures (value \$391M), 10 government facilities (value \$5.2M), one emergency response facility (value \$3.8M⁶), three education facilities (value \$200M), four care facilities (value \$6.9M), 15 community facilities (value \$669K), two highways (value unknown), and 21 utilities (value \$5.9M) which would be impacted by such an event.⁷

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Flood

The steering committee determined that the city’s probability for riverine flood is **moderate** (which is lower than the county’s rating) and that their vulnerability to flood is **moderate** (which is the same as the county’s rating).

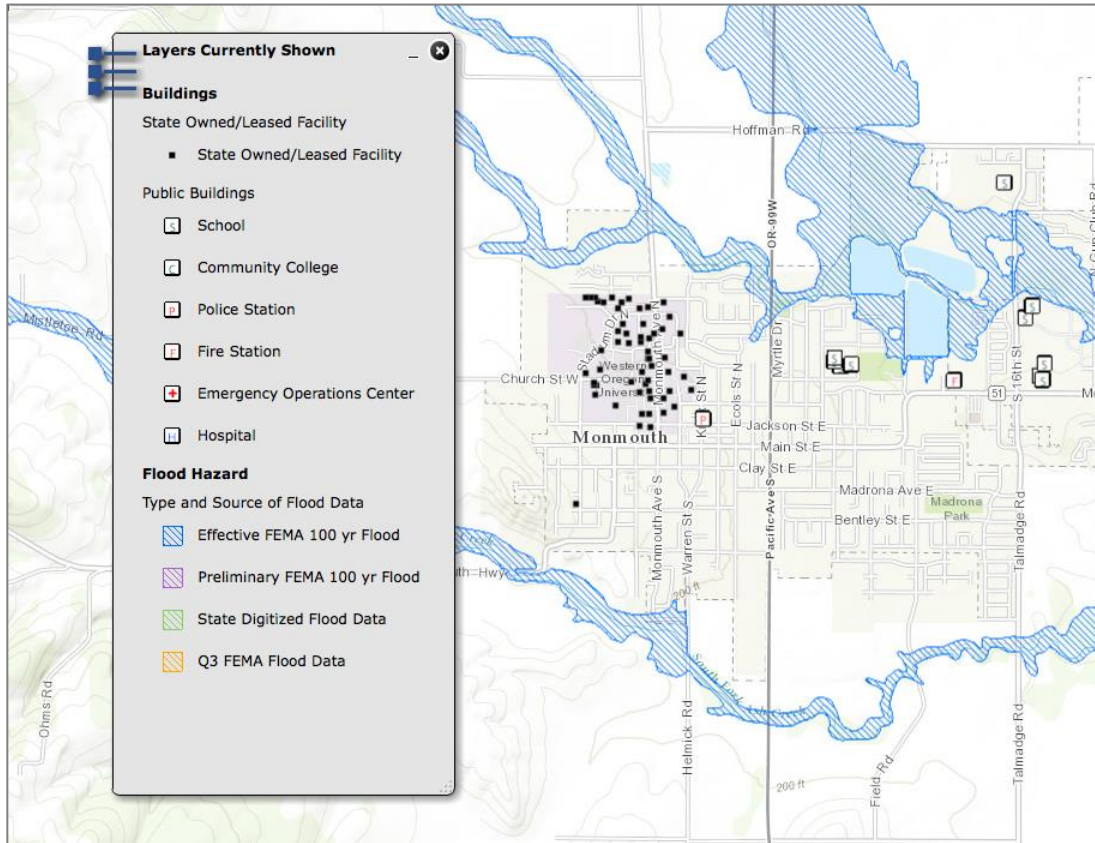
Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of flooding hazards within the region, as well as previous flooding occurrences. General flood-related community impacts are adequately described within the Flood Hazard Annex of Polk County’s Natural Hazards Mitigation Plan. Portions of Monmouth have areas of flood plains (special flood hazard areas). These include areas along the Ash Creek and South Fork Ash

⁶ Value updated to 2017 dollars.

⁷ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

Creek (see Figure MA-4 and Attachment A, Map MA-3). Furthermore, other portions of Monmouth, outside of the mapped floodplains, are also subject to significant, repetitive flooding from local storm water drainage. In general, the 100-year floodplain delineates an area of high risk, while the 500-year floodplain delineates an area of moderate risk.

Figure MA-4 Special Flood Hazard Area



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

A comprehensive risk and vulnerability assessment is not available. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. The Risk Report would provide a quantitative risk assessment that informs communities of their risks related to certain natural hazards (including flood). If pursued, once complete the city can incorporate the risk assessment into their addendum to provide greater detail to sensitivity and exposure to the earthquake hazard.

Per the previous version of this plan approximately four government facilities (value \$775K), four community facilities (value \$181K), and five utility facilities (value \$1M) lie within the 100-year floodplain. There are no facilities within the 500-year floodplain.⁸

For more information on flood risk see the [Polk County Flood Insurance Study \(2006\)](#).

⁸ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

National Flood Insurance Program (NFIP)

FEMA modernized the Monmouth Flood Insurance Rate Maps (FIRMs) in December 2006. Table MA-10 shows that as of September 2016, Monmouth has 22 National Flood Insurance Program (NFIP) policies in force. Of those, four (4) are for properties that were constructed before the initial FIRM. The last Community Assistance Visit (CAV) for Monmouth was on April 20, 2004. Monmouth is not a member of the Community Rating System (CRS). The table shows that most flood insurance policies are for residential structures, primarily single-family homes. There have been zero paid claims. The Community Repetitive Loss record for Monmouth identifies no Repetitive Loss Properties⁹ and no Severe Repetitive Loss Properties¹⁰.

Table MA-10 Flood Insurance Detail

Jurisdiction	Effective FIRM and FIS	Initial FIRM Date	Total Policies	Pre-FIRM Policies	Policies by Building Type				Minus Rated A Zone
					Single Family	2 to 4 Family	Other Residential	Non-Residential	
Polk County	-	-	428	183	334	27	25	42	28
Monmouth	12/19/2006	4/5/1988	22	4	15	7	0	0	0

Jurisdiction	Insurance in Force	Total Paid Claims	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Paid Amount	Repetitive Loss Properties	Severe Repetitive Loss Properties	CRS Class Rating	Last CAV
Monmouth	\$ 5,465,000	0	0	0	\$ -	0	0	-	4/20/2004

Source: Information compiled by Department of Land Conservation and Development, September 2016.

Riverine Erosion

Riverine erosion rarely causes death or injury. However, erosion causes significant destruction of property, development, and infrastructure. Erosion hazard data is not readily available; however, descriptions of several localized areas were identified during the development of this document and are identified only by location on Map MA-4 (Attachment A). Critical facilities that may be at risk of erosion were identified using a 300 foot-buffer in the areas identified as having historic erosion impacts to conservatively account for building footprints.

A comprehensive risk and vulnerability assessment is not available for the riverine erosion hazard. Per the previous version of this plan there are 417 residential structures (value \$55M), two (2) community facilities (value \$97K), and one (1) utility facility (value \$440K) considered at risk.¹¹

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

⁹ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

¹⁰ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000 and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

¹¹ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

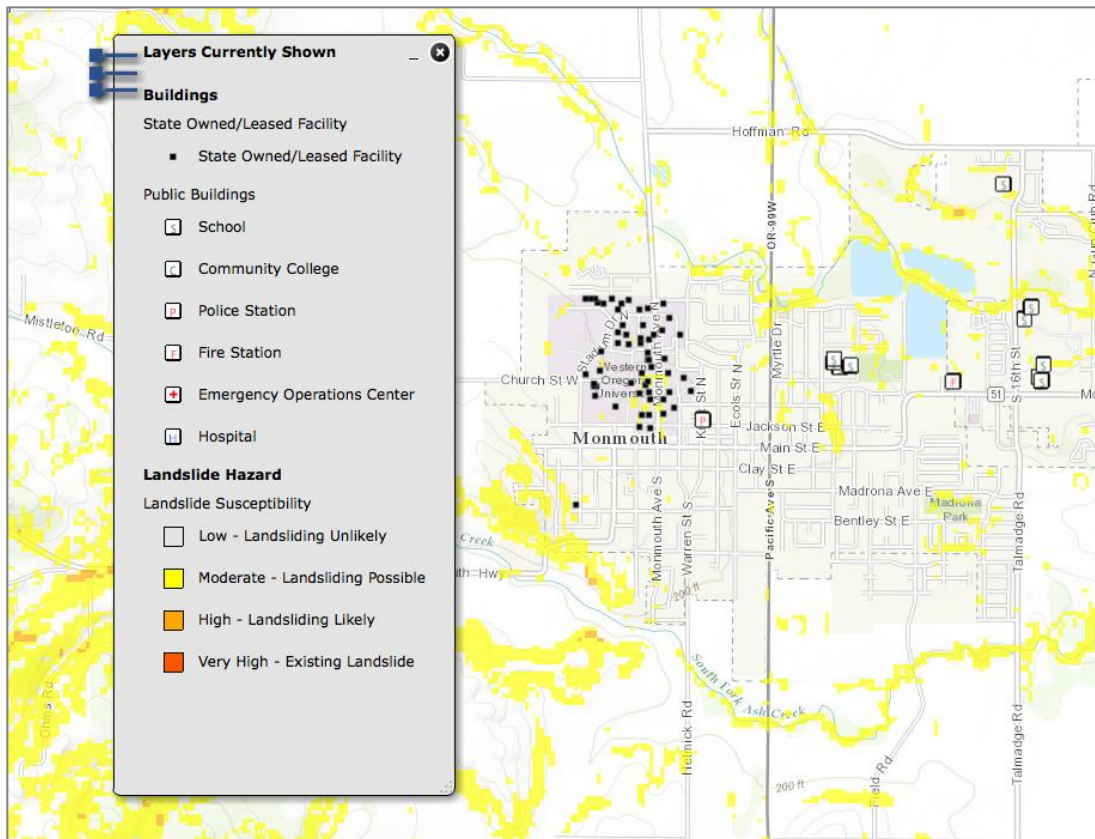
Landslide

The steering committee determined that the city’s probability for landslide is **low** (which is lower than the county’s rating) and that their vulnerability to landslide is **low** (which is the same as the county’s rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Monmouth has a flat topography and the potential for landslide is low except for areas immediately adjacent to Ash Creek and South Fork Ash Creek.

Sedimentary rock underlies Monmouth. Sedimentary rock is primarily conglomerate, claystone, and siltstone with some sandstone. Sedimentary rock is less resistant to stream action. Landslide susceptibility exposure for Monmouth is shown in Figure MA-5. Approximately <1% of Monmouth has High, and approximately 9% Moderate, landslide susceptibility exposure¹².

Figure MA-5 Landslide Susceptibility Exposure



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)

Potential landslide-related impacts are adequately described within the county’s plan, and include infrastructural damages, economic impacts (due to isolation and/or arterial road

¹² DOGAMI Open-File Report, O-16-02, Landslide Susceptibility Overview Map of Oregon (2016)

closures), property damages, and obstruction to evacuation routes. Rain-induced landslides and debris flows can potentially occur during any winter in Polk County, and highway and other major roads beyond city limits are susceptible to obstruction as well.

A comprehensive risk and vulnerability assessment is not available. As of the publication of this NHMP FEMA is providing an opportunity for the county and city to participate in a Risk Mapping, Assessment, and Planning (Risk MAP) process that would generate additional data on risks and vulnerabilities. The Risk Report would provide a quantitative risk assessment that informs communities of their risks related to certain natural hazards (including landslide). If pursued, once complete the city can incorporate the risk assessment into their addendum to provide greater detail to sensitivity and exposure to the earthquake hazard.

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Volcano

The steering committee determined that the city's probability for volcanic event is **low** (which is the same as the county's rating) and that their vulnerability to volcanic event is **low** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes Monmouth's risk to volcanic events. Generally, an event that affects the county is likely to affect Monmouth as well. The causes and characteristics of a volcanic event are appropriately described within the county's plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the county's plan, and the community impacts described by the county would generally be the same for Monmouth as well. Monmouth is very unlikely to experience anything more than volcanic ash during a volcanic event. When Mt. Saint Helens erupted in 1980, the city was not impacted.

A comprehensive risk and vulnerability assessment is not available for the volcano hazard. Due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all residential and critical facilities and infrastructure within the City of Monmouth are at risk.

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Wildfire

The steering committee determined that the city's probability for wildfire is **low** (which is lower than the county's rating) and that their vulnerability to wildfire is **low** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of wildfires, as well as the county and city's history of wildfire events. There are no known large wildfire events in Monmouth. The location and extent of a wildfire vary depending on fuel, topography, and weather conditions. Weather and urbanization conditions are primarily at cause for the hazard level.

The potential community impacts and vulnerabilities described in the county's plan are generally accurate for the city as well. Polk County developed a Community Wildfire Protection Plan (CWPP) in 2009, which mapped wildland urban interface areas and developed actions to mitigate wildfire risk (see Attachment A, Map MA-5). The city is a participant in the CWPP and will update the city's wildfire risk assessment if the CWPP presents better data during future updates. In general, wildfire conditions are greatest in the populated areas adjacent to the interface area.

Irrigated agricultural land surrounds much of Monmouth, thereby reducing the risk to wildfire to the city.

A comprehensive risk and vulnerability assessment is not available. The Polk County CWPP provides some risk and vulnerability information related to Monmouth that has been incorporated into this plan as applicable.

Per the previous version of this plan Monmouth has critical facilities and infrastructure located within areas of moderate and high risk.¹³

Moderate risk areas contain nine government facilities (value \$4.7M), one emergency response facility (value \$3.8M¹⁴), three educational facilities (value \$200M), four care facilities (value \$6.9M), and 15 community facilities (value \$664K).

High risk areas contain four government facilities (value \$2M), two educational facilities (value \$196.1M), one care facility (value \$514K), four community facilities (value \$148K), and four utility facilities (value \$760K).

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Windstorm

The steering committee determined that the city's probability for windstorm is **moderate** (which is lower than the county's rating) and that their vulnerability to windstorm is **moderate** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of windstorms, as well as the location and extent of windstorm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow.

Polk County's plan adequately describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation and economic disruptions result as well.

¹³ URS, 2009 Polk County Natural Hazards Mitigation Plan; values are in 2009 dollars.

¹⁴ Value updated to 2017 dollars.

A comprehensive risk and vulnerability assessment is not available for the windstorm hazard. Due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all residential and critical facilities and infrastructure within Monmouth are at risk.

Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Winter Storm (Snow/ Ice)

The steering committee determined that the city's probability for winter storm is **high** (which is the same as the county's rating) and that their vulnerability to winter storm is **moderate** (which is lower than the county's rating).

Volume I, Section 2, *Risk Assessment*, adequately describes the causes and characteristics of winter storms, as well as the location and extent of winter storm hazards. The region's (and city's) history of events is adequately described within the county's plan as well. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the city typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

Major winter storms can and have occurred in the Monmouth area, and while they typically do not cause significant damage, they are frequent and have the potential to impact economic activity. Road closures on major roads due to winter weather are an uncommon occurrence, but can interrupt commuter and large truck traffic.

A comprehensive risk and vulnerability assessment is not available for the winter storm (snow/ice) hazard. Due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all residential and critical facilities and infrastructure within Monmouth are at risk.

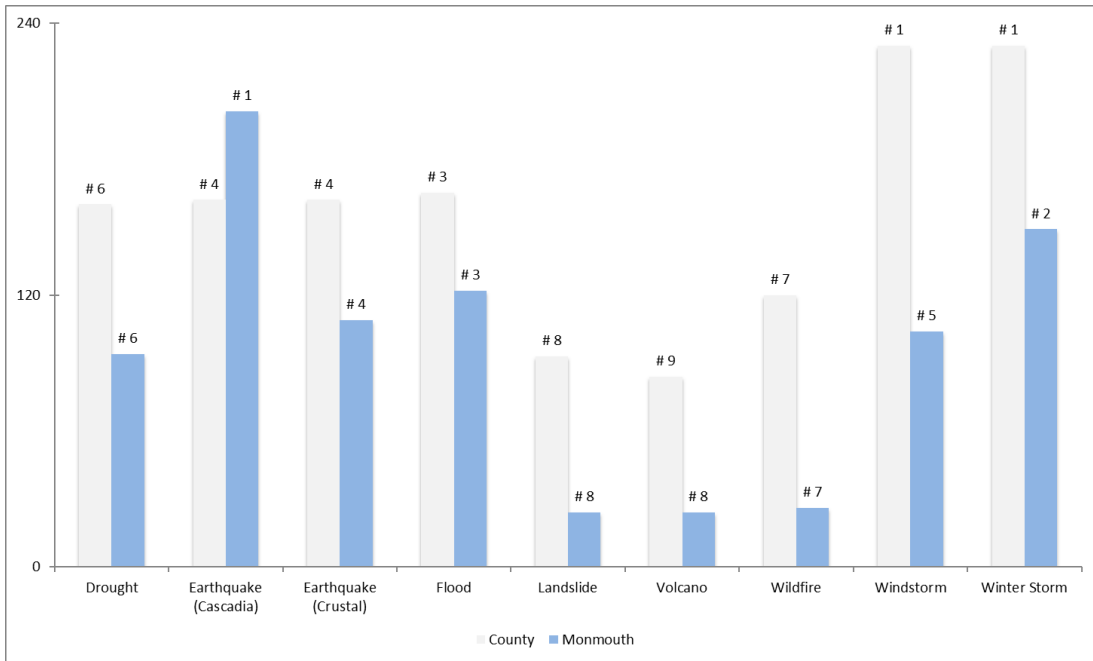
Please review the Risk Assessment (Volume I, Section 2) for additional information on this hazard.

Summary

Figure MA-6 presents a summary of the hazard analysis for the City of Monmouth and compares the results to the assessment completed by Polk County.

The city rated their threat to the Cascadia Subduction Zone earthquake higher than the county. The top four hazards for the city are Cascadia Subduction Zone earthquake, winter storm, flood, and crustal earthquake.

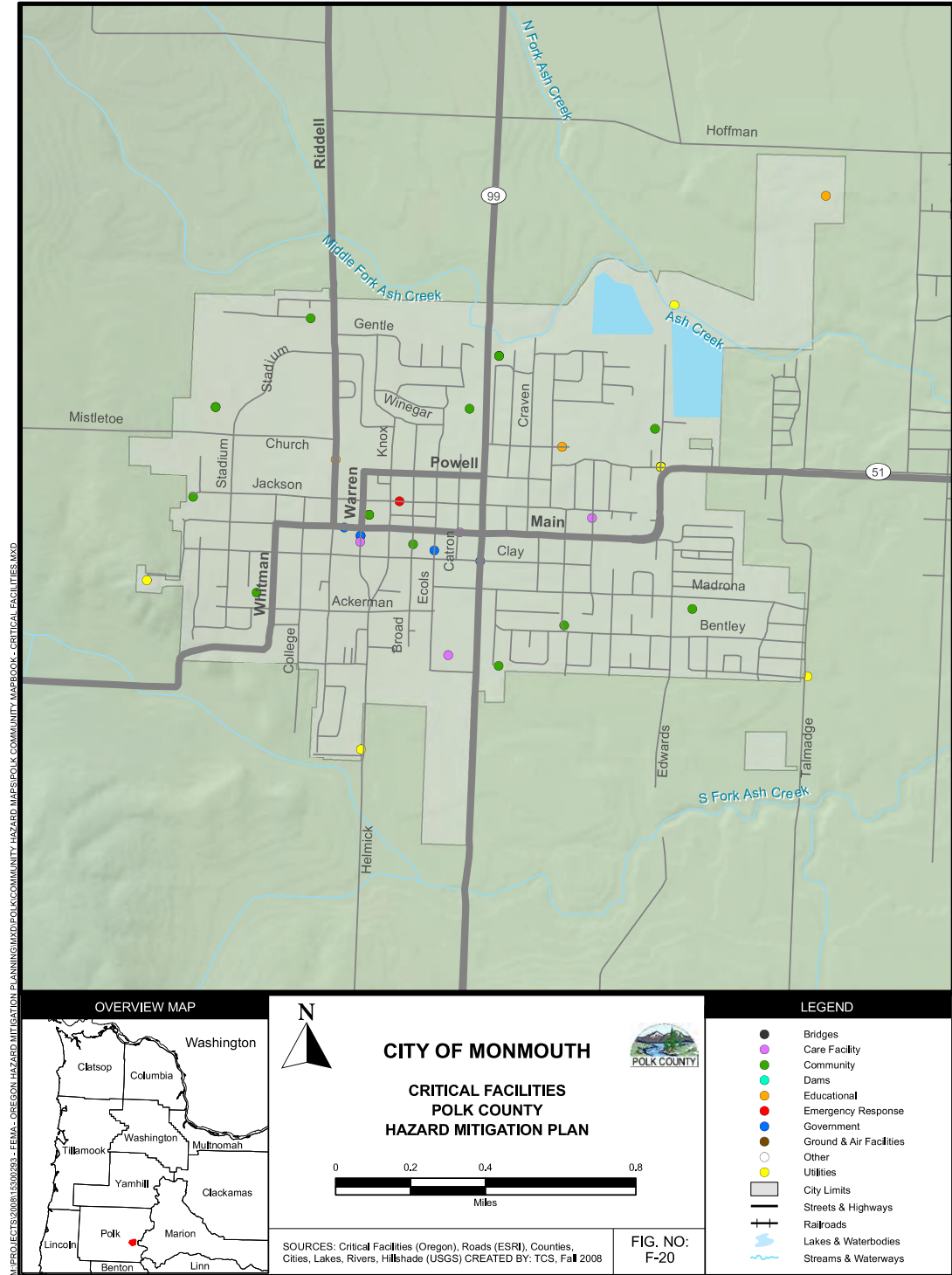
Figure MA-6 Overall Hazard Analysis Comparison –Polk County/ Monmouth



Source: City of Monmouth NHMP Steering Committee and Polk County NHMP Steering Committee

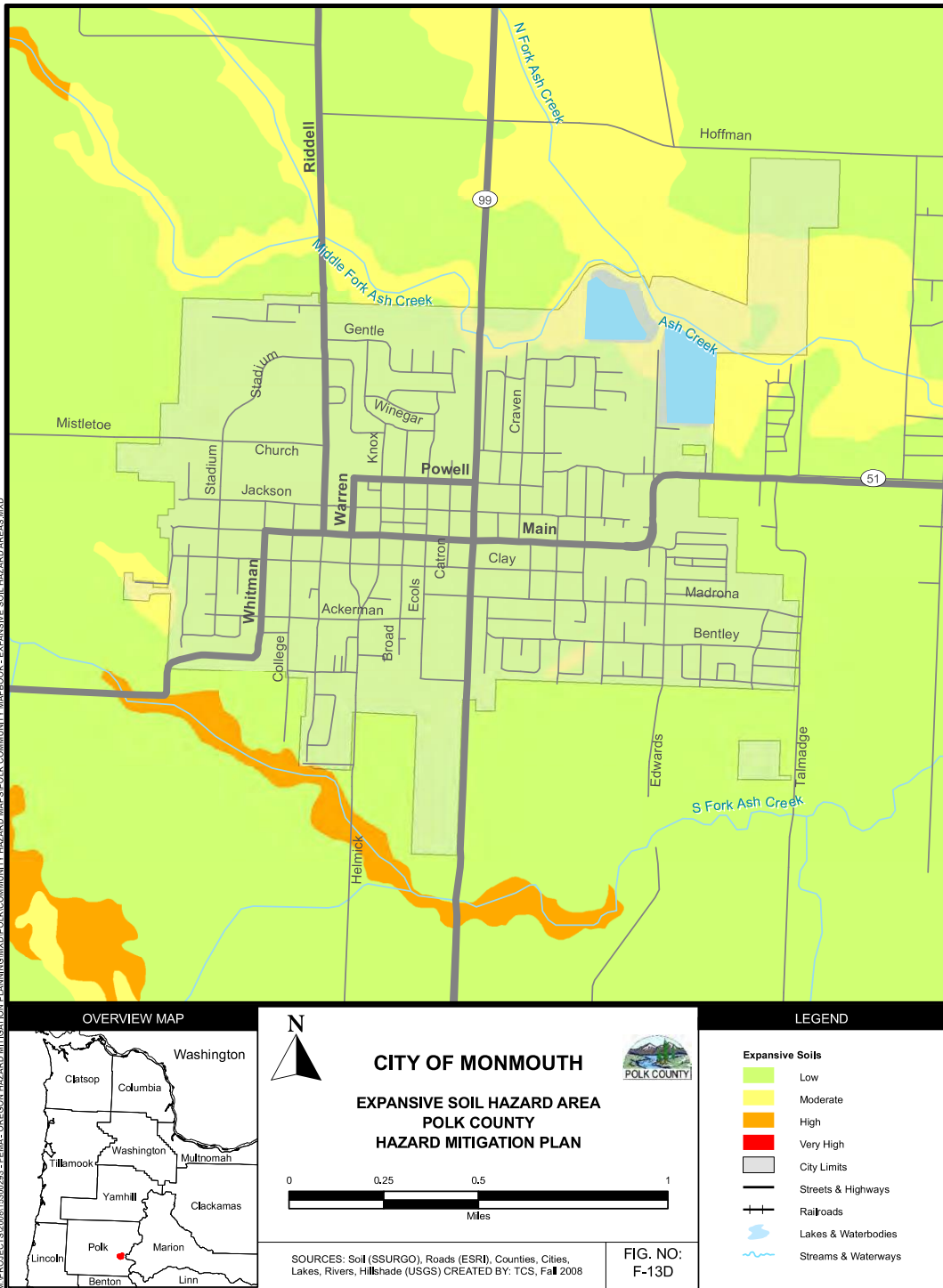
ATTACHMENT A - MAPS

Map MA-I Critical Facilities - Monmouth



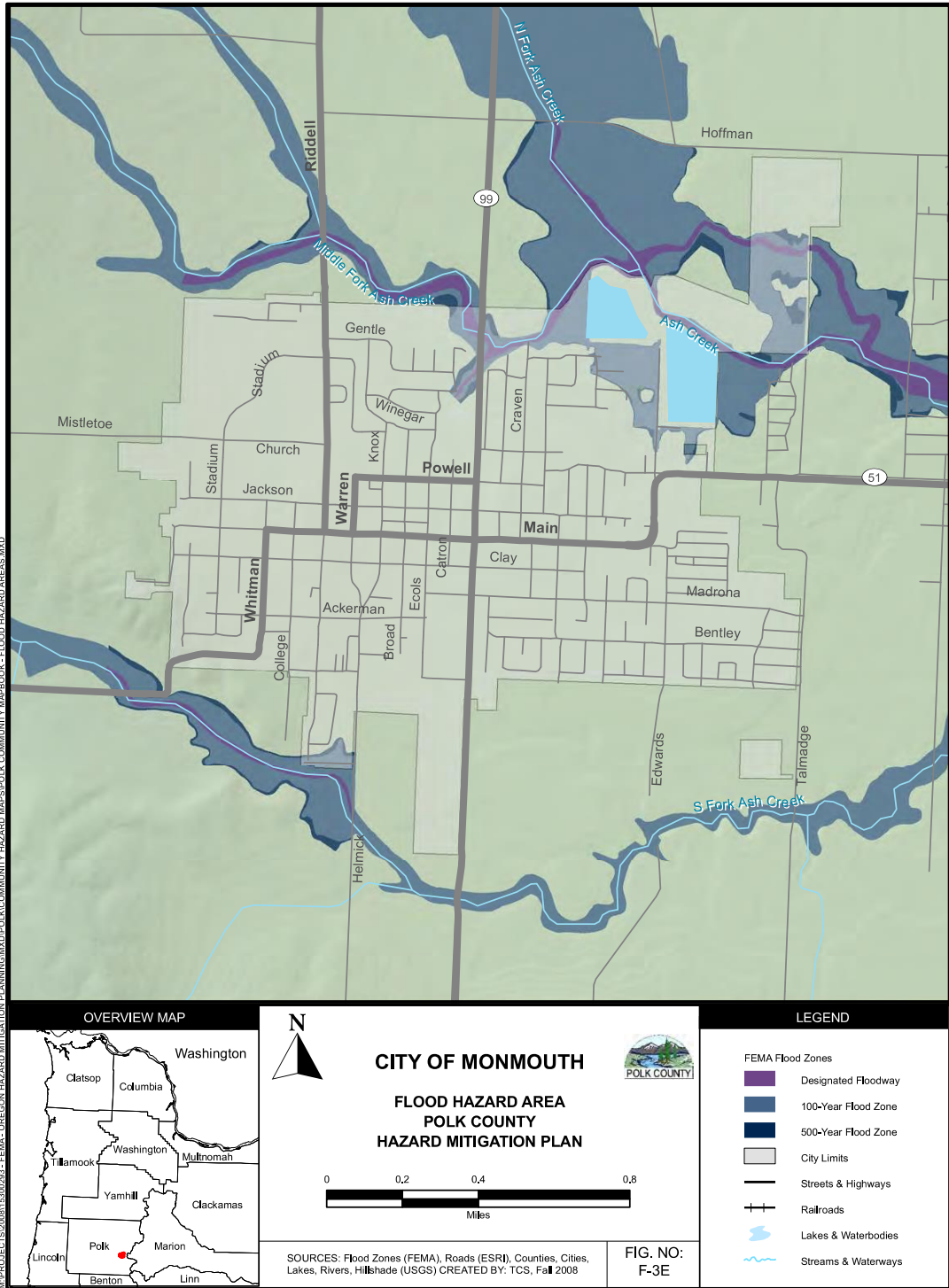
Source: Polk County NHMP (2009).

Map MA-2 Expansive Soils Hazard Area - Monmouth



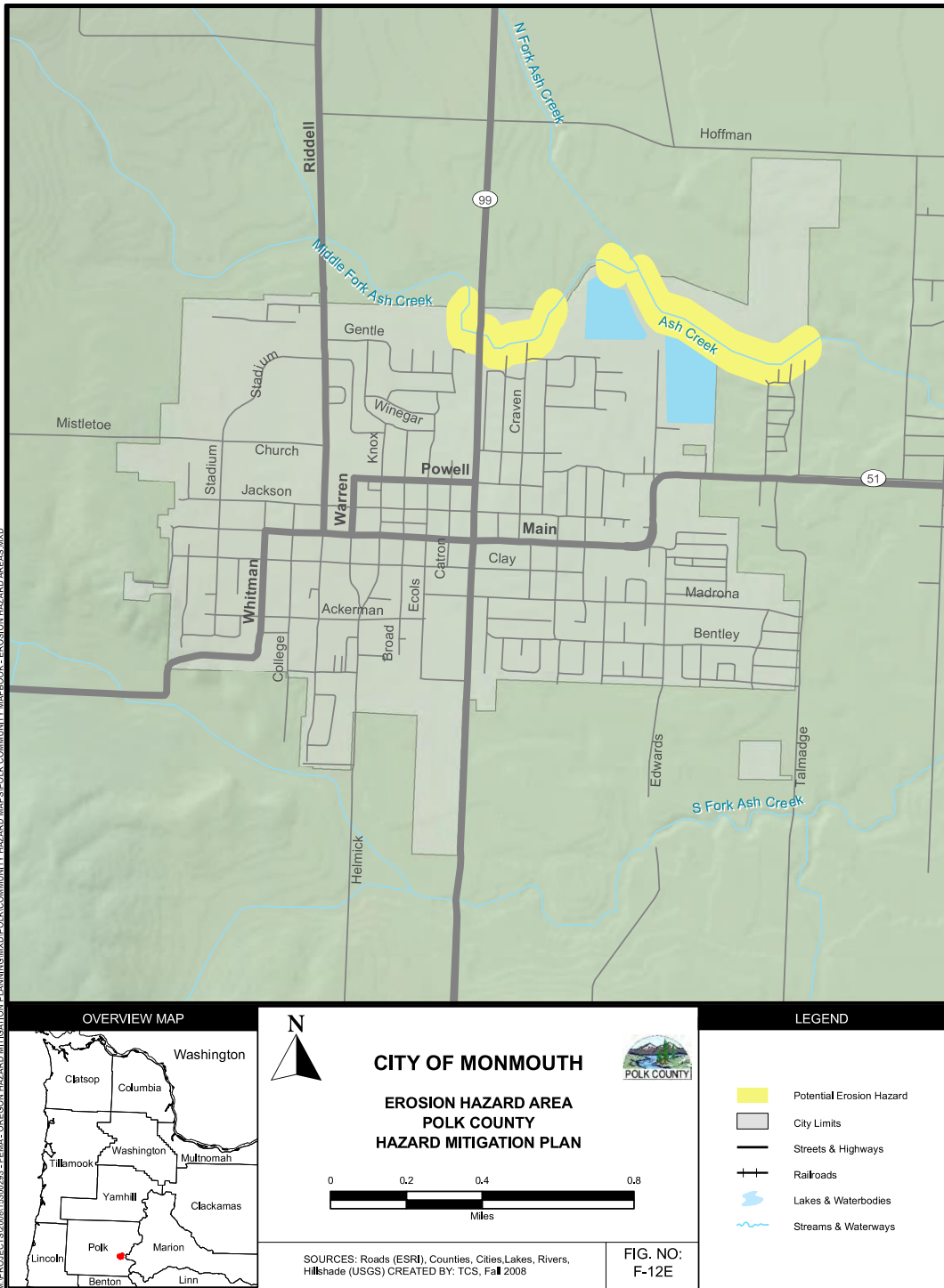
Source: Polk County NHMP (2009).

Map MA-3 Flood Hazard Area - Monmouth



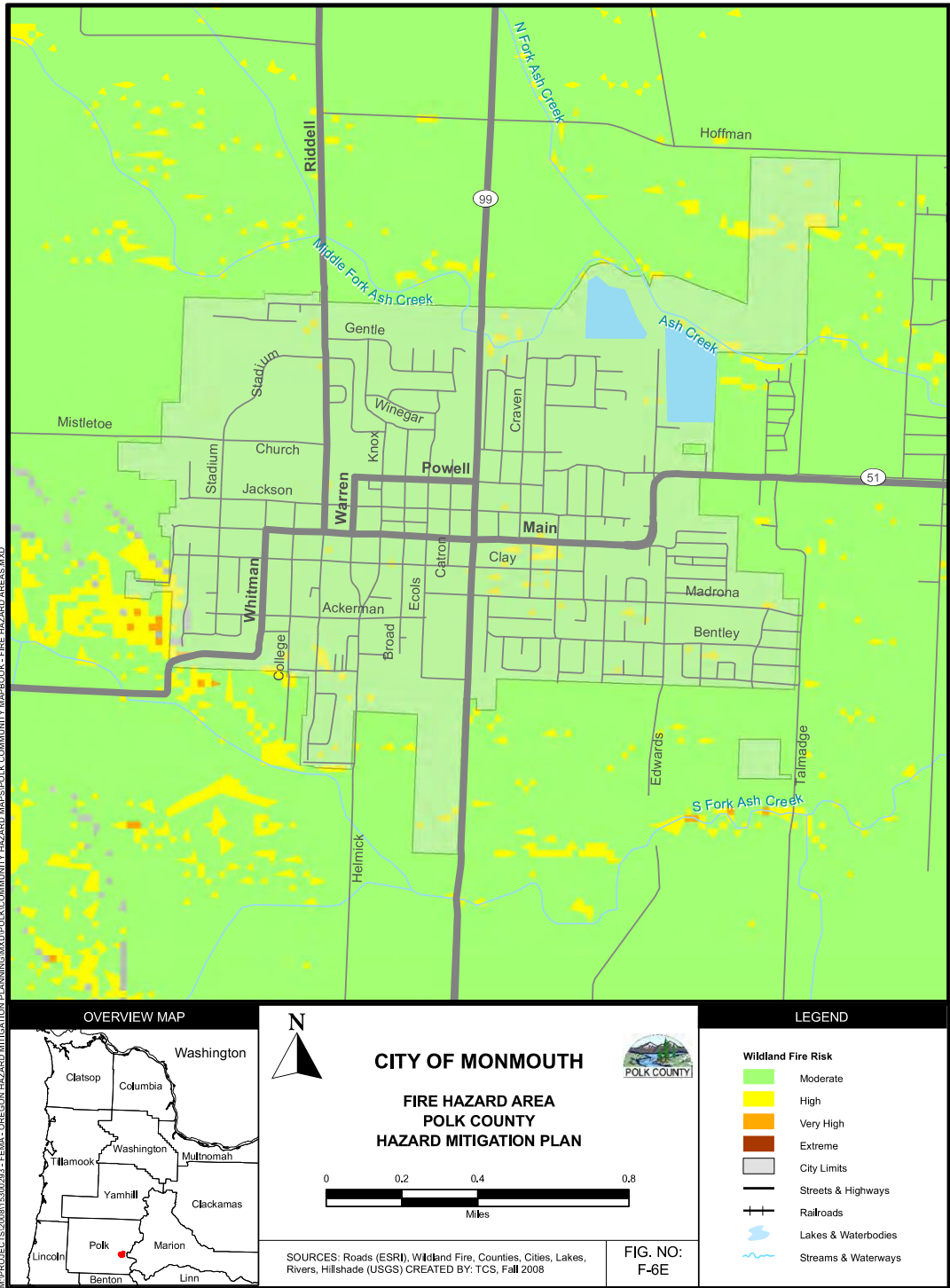
Source: Polk County NHMP (2009).

Map MA-4 Erosion Hazard Area - Monmouth



Source: Polk County NHMP (2009).

Map MA-5 Wildfire Hazard Area - Monmouth



Source: Polk County NHMP (2009).

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Volume II: Appendices

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APPENDIX A: PLANNING AND PUBLIC PROCESS

This appendix describes the changes made to the 2009 Polk County NHMP Natural Hazards Mitigation Plan (NHMP) during the 2016-2017 plan update process.

Project Background

Polk County collaborated with the Oregon Partnership for Disaster Resilience (OPDR) to update the multi-jurisdictional 2009 Polk County NHMP. 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 (HMGP) funding. OPDR met with members of the Polk County steering committee, and participating city steering committees (Dallas, Falls City, Independence, and Monmouth) to update their NHMP. OPDR and the committee(s) made several changes to the previous NHMP. Major changes are documented and summarized in this memo.

2017 Plan Update Changes

The sections below only discuss *major* changes made to the NHMPs during the 2016-2017 plan update process. Major changes include the replacement or deletion of large portions of text, changes to the plan's organization, updated hazard risk and vulnerability assessment, and new mitigation action items. If a section is not addressed in this memo, then it can be assumed that no significant changes occurred.

Table A-1 lists the 2009 Polk County NHMP plan section names and the corresponding 2017 section names, as updated (major Volumes are highlighted). This memo will use the 2017 plan update section names to reference any changes, additions, or deletions within the plan.

Table A-I Changes to Plan Organization

2009 Polk County MNHMP	2017 Polk County MNHMP
-	Acknowledgements
Table of Contents	Table of Contents
Appendix I: Adoption Resolutions	Approval Letters and Resolutions
Appendix H: FEMA Crosswalk	FEMA Review Tool
-	Plan Summary
Volume I: Natural Hazard Mitigation Plan	Volume I: Basic Plan
Section 1: Introduction, Section 2: Prerequisites	Section 1: Introduction
Section 5: Hazard Profiles, Section 6: Vulnerability Analysis, Appendix F: Figures	Section 2: Risk Assessment
Section 7: Mitigation Strategy, Appendix A: Polk County	Section 3: Mitigation Strategy
Section 8: Plan Maintenance, Appendix M: Plan Maintenance Documents	Section 4: Implementation and Maintenance
Section 9: References	Footnotes throughout plan
City Addenda	Volume II: Jurisdictional Addenda
Appendix B: City of Dallas, Appendix F: Figures	City of Dallas Addendum
Appendix C: Falls City, Appendix F: Figures	Falls City Addendum
Appendix D: City of Independence, Appendix F: Figures	City of Independence Addendum
Appendix E: City of Monmouth, Appendix F: Figures	City of Monmouth Addendum
Volume III: Resource Appendices	Volume II: Appendices
Section 4: Planning Process; Appendix J: Steering Committee Meetings, Appendix K: Public Outreach	Appendix A: Planning and Public Process
Appendix L: Benefit-Cost Analysis Fact Sheet	Appendix C: Economic Analysis of Natural Hazard Mitigation Projects
Section 3: Community Description	Appendix B: Community Profile
-	Appendix D: Grant Programs
Appendix G: Manmade and Technological Hazards	-

Front Pages

1. Acknowledgements have been updated to include the 2016-2017 project partners and planning participants.
2. The FEMA approval letter, review tool, and city resolution of adoption are included.

Volume I: Basic Plan

Volume I provides the overall plan framework for the 2017 NHMP update, including the following sections:

Plan Summary

The 2017 NHMP includes an updated plan summary that provides information about the purpose of natural hazards mitigation planning and describes how the plan will be implemented.

Section 1: Introduction

Section 1 introduces the concept of natural hazards mitigation planning and answers the question, “Why develop a mitigation plan?” Additionally, Section 1 summarizes the 2016-2017 plan update process, and provides an overview of how the plan is organized. Major changes to Section 1 include the following:

- Most of Section 1 includes new information that replaces out of date text found in the 2009 NHMP. The new text describes the federal requirements that the plan addresses and gives examples of the policy framework for natural hazards planning in Oregon.
- Section 1 of the 2017 update, outlines the entire layout of the plan update, which has been altered as described above (Table A-1).

Section 2: Risk Assessment

Section 2, Risk Assessment, consists of three phases: hazard identification, vulnerability assessment, and risk analysis. Hazard identification involves the identification of hazard geographic extent, its intensity, and probability of occurrence. The second phase, attempts to predict how different types of property and population groups will be affected by the hazard. The third phase involves estimating the damage, injuries, and costs likely to be incurred in a geographic area over a period of time. Changes to Section 2 include:

- The hazard chapters of the previous Polk County NHMP (2009 NHMP, Section 5) have been integrated into this section.
- Hazard identification, characteristics, history, probability, vulnerability, and hazard specific mitigation activities were updated. Information previously provided in the Hazard Chapters is placed in this section. Extraneous information was removed and links to technical reports were added as a replacement.
- Links to specific hazard studies and data are embedded directly into the plan where relevant and available.
- National Flood Insurance Program (NFIP) information was updated.

Section 3: Mitigation Strategy

This section provides the basis and justification for the mission, goals, and mitigation actions identified in the NHMP. Major changes to Section 3 include the following:

- Mission and Goals were reviewed and compared with the State NHMP Mission and Goals, no changes were made.
- The Polk County steering committee met to review the previous NHMP action items. Steering Committee members provided updates and edits to the actions where applicable. Including, the revision and consolidation of existing actions, managing department/agency designations, timeframe, potential funding source, and benefit-costs/technical feasibility (as shown in Tables 3-1 and 3-2). See Table A-2 through A-6 for changes for the County and Cities.
- A list of prioritized actions for the County was included, Table 3-1.
- New action items are based upon continuous community needs, the identification of new hazards, deferred action items, and current needs based upon the community risk assessment. They are designed to be feasibly accomplished within the next five years and can be found in Table 3-1.

Table A-2 County Action Item Status and Changes

Line #	2009 Action Item #	Combined Actions	2017 Action Item #	Description (2009)	Status	Status Comments
Multi-Hazard (MH)						
1	MH 1		-	Sustain an education and outreach program for local jurisdictions and assist them in developing emergency operations, public information, and hazard mitigation plans.	Completed (Ongoing)	Ongoing action. Not considered necessary to retain in NHMP.
2	MH 2	Combine lines 2 and 3	MH 4	Review and update the Polk County Emergency Operations Plan and the Natural Hazards Mitigation Plan on an annual basis. Conduct a complete review of the plans and have them officially promulgated by the BOC every five years.	Revised	Annual reviews conducted by Emergency Management.
3	MH 3	Combine lines 2 and 3	MH 4	Evaluate the effectiveness of existing programs and identify natural hazard mitigation needs. Balance the objectives of existing programs' goals with natural hazards mitigation.	Revised	Annual reviews conducted by Emergency Management.
4	MH 4	Combine lines 4, 6, 7	MH 5	Identify coordination opportunities to maximize or leverage funding opportunities that address multi-jurisdictional projects.	Revised	
5	MH 6		MH 1	Determine the impact that each natural hazard could have on the priority transportation routes to and from emergency facilities and first responder sites.	Revised/ Prioritized	On-going project - Emergency Management and Public Works have met several times along with ODOT and have outlined primary and secondary routes within the County. Emergency facilities have been identified as a map layer in our GIS system.
6	MH 7	Combine lines 4, 6, 7	MH 5	Identify collaborative programs that recognize ways to decrease the risks of natural hazards.	Revised	
7	MH 8	Combine lines 4, 6, 7	MH 5	Develop public and private partnerships to foster natural hazard mitigation program coordination and collaboration in Polk County.	Revised	
8	MH 9		-	Develop GIS inventories of essential facilities, at-risk buildings and infrastructure, and prioritize mitigation projects.	Completed (Ongoing)	Developed with ongoing maintenance.

Table A-2 Action Item Status and Changes (continued)

Line #	2009 Action Item #	Combined Actions	2017 Action Item #	Description (2009)	Status	Status Comments
9	MH 10		MH 6	Strengthen emergency services preparedness and response by linking emergency services with natural hazard mitigation programs, and enhance public education on a regional scale.	Retained	Polk County is currently developing a Continuity Operations Plan that includes not only preparedness activities in the public sector but outreaches into the private sector. Polk County is also a partner in the Regional 211 program that provides resource information to the public.
10	MH 11	Combine lines 10, 11, 17, 84, and 90	MH 7	Develop, enhance, and implement education programs aimed at mitigating natural hazards and reducing the risk to citizens, public agencies, private property owners, businesses, and schools.	Revised	Emergency Management has completed two tasks in this area by involving schools in our communications emergency planning. Communications is a vital part of the basic response tools. Other tasks include information on the County website to help citizens in the event natural hazard incident.
11	MH 12	Combine lines 10, 11, 17, 84, and 90	MH 7	Sustain a public awareness campaign about natural hazards.	Revised	Web based resources updated regularly.
12	MH 14		-	Promote hazard-resistant utility construction and maintenance methods.	Completed (Ongoing)	Part of floodplain permit process.
13	MH New	Combine lines 13 and 14	MH 8	Cross reference and incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, land use, transportation, and emergency operations plans, etc to demonstrate multi-benefit considerations and facilitate using multiple funding sources.	Revised	Planning activities are routinely coordinated.
14	MH New	Combine lines 13 and 14	MH 8	Develop and incorporate mitigation provisions and recommendations into zoning ordinances and community development processes to maintain the floodway and protect critical infrastructure and private residences from other hazard areas.	Revised	Polk County Planning routinely provides recommendations and conditions in community development process that protect floodway and critical infrastructure through the newly developed floodplain development permit process.
15	MH New	Combine lines 15, 45, and 87	MH 10	Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities susceptible to short term power disruption. (i.e. first responder and medical facilities, schools, correctional facilities, and water and sewage pump stations, etc.)	Revised	Generators upgraded at some County facilities.
16	MH New		MH 10	Install lightning rods and lightning grade surge protection devices on critical electronic components such as warning systems, communications equipment, and computers for critical facilities.	Retained	Some have been installed.
17	MH New	Combine lines 10, 11, 17, 84, and 90	MH 7	Develop, produce, and distribute information materials concerning mitigation, preparedness, and safety procedures for all natural hazards.	Revised	Web based resources.
18	MH New	Combine lines 18, 24, and 25	FL 2	Identify and list repetitively flooded structures and infrastructures, analyze the threat to these facilities, and prioritize mitigation actions to acquire, relocate, elevate, and/or flood proof to protect the threatened population.	Revised	The County has identified all repetitive loss structures and has mitigated through elevation the only repetitive flood loss home.
19	MH New	Combine lines 19, 22, and 23	FL 11	Review hydrologic and hydraulic engineering, and drainage studies and analyses. Use information obtained for feasibility determination and project design at the planning level.	Revised	Note: these projects could potentially receive federal funding if it is a vital component of a large construction project.
Flood						
20	FST2	Combine lines 20 and 26	FL 1	Conduct workshops for target audiences on National Flood Insurance Programs, mitigation activities.	Revised	Polk County regularly targets surveyors and engineers and provides a workshop on NFIP activities, such as how to accurately complete elevation certificates.

Table A-2 Action Item Status and Changes (continued)

Line #	2009 Action Item #	Combined Actions	2017 Action Item #	Description (2009)	Status	Status Comments
21	FST3		FL 3	Continue to coordinate with appropriate agencies, and maintain an inventory of all aggregate operations adjacent to or within the floodplain.	Revised	Aggregated site list prepared and site information geocoded in GIS.
22	FLT1	Combine lines 19, 22, and 23	FL 11	Update the Flood Insurance Rate Maps (FIRM) for Polk County as funding becomes available.	Revised	
23	FLT2	Combine lines 19, 22, and 23	FL 11	Enhance data and mapping for floodplain information within Polk County.	Revised	Polk County has procured LIDAR data for much of the county that assists in evaluating the floodplain.
24	FLT6	Combine lines 18, 24, and 25	FL 2	Mitigate repetitive flood loss properties.	Revised	Polk County Planning is currently working to elevate the only repetitive flood loss dwelling in the county.
25	Flood New	Combine lines 18, 24, and 25	FL 2	Determine and implement most cost beneficial and feasible mitigation actions for locations with repetitive flooding and significant damages or road closures.	Revised	Polk County evaluated a repetitive loss property and obtained funding for mitigation that will elevate the dwelling.
26	Flood New	Combine lines 20 and 26	FL 1	Develop an outreach program to educate public concerning NFIP participation benefits, floodplain development, land use regulation, and NFIP flood insurance availability to facilitate continued compliance with the NFIP.	Revised	Web based outreach.
27	Flood New	Combine lines 27, 28, 29, and 30	FL 4	Increase culvert size to increase its drainage efficiency.	Revised	Some locations completed.
28	Flood New	Combine lines 27, 28, 29, and 30	FL 4	Install debris cribs over culvert inlets to prevent inflow of coarse bed-load and light floating debris.	Revised	Some locations completed. Activity covered in other actions.
29	Flood New	Combine lines 27, 28, 29, and 30	FL 4	Raise bridge height or convert bridge from a multi-span to single span to increase water flow and reduce debris catchment.	Revised	Some locations completed. Ongoing process to replace as funding is available.
30	Flood New	Combine lines 27, 28, 29, and 30	FL 4	Construct concrete wing walls at culvert or bridge entrances and outlets to direct water flow into their openings.	Revised	Some locations completed. Ongoing
Winter Storm (WS) (Includes Drought and ENSO)						
31	WSST 1		WT 1	Enhance strategies for management of debris from severe winter storms.	Retained (Ongoing)	Discussed annually.
32	WSST 2		WT 2	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	Ongoing	The County has begun prioritizing infrastructures/facilities that will be outfitted for backup power.
33	WSST 3	Combine lines 33 and 82	MH 11	Update the county's debris management plan.	Revised	Evaluated annually.
34	WSLT 1	Combine lines 34 and 43	WT 3	Increase and maintain public awareness of severe winter storms and the benefits of mitigation activities through education aimed at households and businesses, and increase targeting of special needs populations.	Revised	Web based outreach.
35	WSLT 4		WT 4	Encourage harvesting of trees along utility and road corridors, preventing potential winter storm damage.	Revised	Public Works implements in the field.
36	WSLT 5		-	Encourage right-of-way coordination, education and management between property owners, utility operators, and government agencies.	Delete	Public Works implements in the field.
37	WS	Combine lines 37 and 39	DR 1	Encourage dissemination of ideas by county-based agencies on effective methods of water use curtailment.	Revised	Polk County is currently studying water use curtailment ideas.
38	WS		DR 2	Encourage water providers to inter-tie water systems	Retained	Polk County is currently studying potential water system inter-ties.
39	WS	Combine lines 37 and 39	DR 1	Provide information about emergency water rights for domestic uses.	Revised	Provide information when requested.

Table A-2 Action Item Status and Changes (continued)

Line #	2009 Action Item #	Combined Actions	2017 Action Item #	Description (2009)	Status	Status Comments
40	WS		DR 3	Support the technical service and low interest loans provided to farmers and ranchers so that they can develop livestock watering systems.	Retained	Provide assistance when requested.
41	WS		DR 4	Encourage storage of water, especially off stream storage.	Retained	Polk County is currently studying potential water storage projects within the county.
42	WS		DR 5	Support agencies' plan for long-range water resources development that leads to additional water supplies and help determine funding sources for the studies.	Retained	Polk County has obtained two SB 1069 grants from the Oregon Department of Water Resources to assist in long range water planning.
43	WS New	Combine lines 34 and 43	WT 3	Develop and implement strategies and educational outreach programs for debris management from severe winter storms.	Revised	This is part of debris management planning.
44	WS New		-	Update or develop, implement, and maintain jurisdictional debris management plans.	Delete	This is part of debris management planning.
45	WS New	Combine lines 15, 45, and 87	MH 10	Develop critical facility list needing emergency back-up power systems, prioritize, seek funding and implement mitigation actions.	Revised	Developed critical facility list.
46	WS New		FL 5	Install new precipitation measuring gauges and develop monitoring and early warning program.	Retained/ Ongoing	Completed gauge install. Warning program developed and is ongoing.
47	WS New		WT 5	Implement and enforce the most current Uniform International, and State, Building Codes to ensure structures can withstand winter storm hazards such as high winds, rain, water and snow.	Revised/ Ongoing	Part of permit program. Ongoing
48	WS New		WT 6	Review critical facilities and government building energy efficiency, winter readiness, and electrical protection capability. Identify, prioritize, and implement infrastructure upgrade or rehabilitation project prioritization and development.	Retained	Upgrades have been made to government buildings.
Landslide						
49	Landslide ST1	Combine Lines 49 and 50	LS 1	Improve knowledge of landslide hazard areas and understanding of vulnerability and risk to life and property in hazard-prone areas.	Revised	Polk County is obtaining LIDAR data to improve knowledge of landslide hazard areas.
50	Landslide ST3	Combine Lines 49 and 50	LS 1	Identify alternative travel routes in high risk debris flow and landslide areas.	Revised	Polk County is obtaining LIDAR data to assist in identifying alternative travel routes.
51	Landslide LLT1		-	Mitigate activities in identified potential and historical landslide areas through public outreach.	Deleted	Polk County is obtaining LIDAR data to assist in landslide mitigation. See LS 1
52	Landslide LLT2		FL 6	Maintain public and encourage property owners to maintain private drainage systems.	Retained	
53	Landslide New		-	Develop prioritized list of mitigation actions for threatened critical facilities and other buildings or infrastructure.	Deleted	Developed critical facility list. Incorporated actions in Emergency Operations Plan.
Wildland Fire (WF)						
54	WFST1	Combine lines 54 and 65	WF 1	Work with Polk Fire Defense Board in the review of plans and inspection of structures, access, and water supply for fire code compliance.	Revised	
55	WFST 2		WF 2	Advocate accessible water storage facilities in developments not connected to a community water/hydrant system in the wildland/urban interface (WUI).	Retained	Part of permit program.
56	WFST 3	Combine lines 56, 61, 62, 66, and 70	WF 3	Continue to promote public awareness campaigns for individual property owners living in the WUI.	Revised	Web based outreach.
57	WFST 4	Combine Lines 57, 68, and 69	WF 4	Create incentives and assist landowners in reducing fuel loads on private property.	Revised	Part of land use permit program.

Table A-2 Action Item Status and Changes (continued)

Line #	2009 Action Item #	Combined Actions	2017 Action Item #	Description (2009)	Status	Status Comments
58	WFST 6		-	Enhance emergency services to increase the efficiency of wildfire response and recovery activities.	Deleted	
59	WFLT 1		WF 5	Look for solutions to protect structures located outside of fire districts through partnerships, grant funding, fire protection contracts, or expansion of fire district services.	Retained	
60	WFLT 4		-	Maintain and further develop interagency and private industry relationships for continuing strong fire response in Polk County.	Deleted	
61	WFLT 5	Combine lines 56, 61, 62, 66, and 70	WF 3	Enhance existing outreach and education programs aimed at mitigating wildfire hazards and reducing or preventing the exposure of citizens, public agencies, private property owners, and businesses to natural hazards.	Revised	Web resources updated.
62	WFLT 6	Combine lines 56, 61, 62, 66, and 70	WF 3	Encourage development and dissemination of maps relating to fire hazards to help educate and assist builders and homeowners in being engaged in wildfire mitigation activities, and to help guide emergency services during response.	Revised	Maps available as outreach from Assessors Office.
63	WF New		WF 6	Identify evacuation routes away from high hazard areas and develop outreach program to educate the public concerning warnings and evacuation procedures.	Retained	
64	WF New		WF 7	Develop Community Wildland Fire Protection Plans for all at-risk communities.	Revised	Polk County completed a Wildland Urban Interface fire protection plan (2009). Revise action to "maintain" CWPP.
65	WF New	Combine lines 54 and 65	WF 1	Promote FireWise building siting, design, and construction materials.	Revised	Part of permit program. Web resources part of Assessors Office.
66	WF New	Combine lines 56, 61, 62, 66, and 70	WF 3	Provide wildland fire information in an easily distributed format for all residents.	Revised	Web based resources part of Assessors Office.
67	WF New		-	Schedule and perform government facility "fire drills" at least twice per year.	Deleted	
68	WF New	Combine Lines 57, 68, and 69	WF 4	Develop outreach program to educate and encourage home landscape cleanup (defensible space) and define debris disposal programs.	Revised	Web based resources and a handout.
69	WF New	Combine Lines 57, 68, and 69	WF 4	Identify, develop, and implement, and enforce mitigation actions such as fuel breaks and reduction zones for potential wildland fire hazard areas.	Revised	Incorporated as enforceable conditions in residential permits in forest zones.
70	WF New	Combine lines 56, 61, 62, 66, and 70	WF 3	Develop outreach program to educate and encourage fire-safe construction practices for existing and new construction in high risk areas.	Revised	Outreach as part of permit review. Web resources.
Earthquake (EQ)						
71	EQST 2	Combine lines 71 and 72	EQ1	Encourage reduction of nonstructural and structural earthquake hazards in homes, schools, businesses, and government offices.	Revised	The County has provided literature at safety fairs as well as information on our website on how people can mitigate hazards at home, work and schools.
72	EQST 3	Combine lines 71 and 72	EQ1	Inform residents of value of earthquake hazard insurance.	Revised	The County provides literature on Earthquake insurance. The County continues to review current standards and makes changes to reflect best practices in the building industry.
73	EQLT 1	Delete	-	Promote and continue building code standards.	Implemented	Part of building permit program.

Table A-2 Action Item Status and Changes (continued)

Line #	2009 Action Item #	Combined Actions	2017 Action Item #	Description (2009)	Status	Status Comments
74	EQLT 2	Combine lines 74 and 75	EQ 2	Encourage seismic strength evaluations of critical facilities to identify vulnerabilities and to meet current seismic standards.	Revised	The County has participated in the seismic study of critical facilities. Currently, Dallas Fire just completed a seismic upgrade of their Fire Station here in Dallas.
75	EQLT 5	Combine lines 74 and 75	EQ 2	Improve local capabilities to perform earthquake building safety evaluations.	Revised	Polk County has provided training opportunities to building officials on building safety evaluations.
76	EQ New		EQ 3	Retrofit bridges that are not seismically adequate for lifeline transportation routes.	Revised	Many bridges completed.
77	EQ New	Combine lines 77, 78, and 79	EQ 4	Update existing (or adopt the most current) Uniform Building Code.	Revised	Automatic updates.
78	EQ New	Combine lines 77, 78, and 79	EQ 4	Implement and enforce the Uniform, International, and State Building Codes.	Revised	Part of permit program.
79	EQ New	Combine lines 77, 78, and 79	EQ 4	Inspect and/or certify all new construction as applicable.	Revised	Part of permit program.
Volcano						
80	VST 1		VE 1	Increase awareness of volcanic eruptions and their potential impact to the county.	Retained	Web based outreach.
Wind (W)						
81	WST 1	Combine lines 81, 86, 88, and 89	WS 1	Develop and implement programs to keep trees from threatening lives, property, and public infrastructure during windstorm events.	Revised/ Prioritized	
82	WST 2	Combine lines 33 and 82	MH 11	Enhance strategies for debris management and/or removal after windstorm events.	Revised	Part of debris management planning.
83	WLT 2	Combine lines 83 and 85	WS 2	Support/encourage electrical utilities to use underground construction methods where possible to reduce power outages from windstorms.	Revised	Outreach ongoing.
84	WLT 3	Combine lines 10, 11, 17, 84, and 90	MH 7	Increase public awareness of windstorm and tornado mitigation activities.	Revised	Polk County has developed a link on the County website to help the public obtain information on all hazards.
85	WLT 4	Combine lines 83 and 85	WS 2	Support/encourage contractors, homeowners, and electrical utilities to use windstorm resistant construction methods where possible to reduce damage and power outages from windstorms.	Revised	Polk County has developed information on the County website to help the public and contractors obtain information on wind and snow load standards. Provide support and encouragement on a project by project basis.
86	WLT 6	Combine lines 81, 86, 88, and 89	WS 1	Identify trees that are potentially susceptible to wind throw.	Revised/ Prioritized	This task is primarily conducted by Public Works in the field.
87	WLT 7	Combine lines 15, 45, and 87	MH 10	Encourage critical facilities to secure emergency power.	Revised	
88	WLT 8	Combine lines 81, 86, 88, and 89	WS 1	Encourage harvesting of trees along utility and road corridors, preventing potential windstorm damage.	Revised/ Prioritized	
89	WLT 9	Combine lines 81, 86, 88, and 89	WS 1	Encourage harvesting of trees blown down during a windstorm or tornado.	Revised/ Prioritized	Polk County Public Works has removed known hazards during windstorm events to mitigate further issues like power outages.
90	WLT 10	Combine lines 10, 11, 17, 84, and 90	MH 7	Increase and maintain public awareness of severe windstorms and the benefits of mitigation activities through education aimed at households and businesses and increase targeting of special needs populations.	Revised	Polk County has developed a link on the County website to help the public obtain information on all hazards.

Table A-2 Action Item Status and Changes (continued)

Line #	2009 Action Item #	Combined Actions	2017 Action Item #	Description (2009)	Status	Status Comments
<i>Erosion - Change to Landslide Hazard since Erosion is not covered as a separate hazard</i>						
91	Erosion New		FL 7	Develop and provide information to all residents on riverbank erosion and methods to prevent it in an easily distributed format.	Revised	Web resources.
92	Erosion New		FL 8	Install riprap, or pilings to harden or "armor" a stream bank where severe erosion occurs.	Revised	Some areas completed.
93	Erosion New		FL 9	Install bank protection such as rock, concrete, asphalt, vegetation, or other armoring or protective materials to provide river bank protection.	Revised	Some projects incorporated as appropriate.
94	Erosion New		FL 10	Harden culvert entrance bottoms with asphalt, concrete, rock, to reduce erosion or scour.	Revised	Some areas completed.
<i>Expansive Soils (ES)</i>						
95	ESLT1		DR 6	Educate the public about expansive soils.	Revised	Regular component of permit review.
96	ESLT 2	Combine lines 96 and 97	DR 7	Develop revisions for and revise the Polk County Road Standards for areas of the county with expansive soils.	Revised	To date, the standards have not been updated. However, Polk County has developed an appropriate cross-section drawing for road construction in areas of expansive soils to be incorporated into the Polk County Road Standards. Polk County has also mapped the areas of the county with expansive soils.
97	ES New	Combine lines 96 and 97	DR 7	Require road design, engineering, and construction processes that address expansive soil conditions. Water absorption prevention, impermeable membrane, soil compaction, and drainage methods need to be considered once geologic studies determine soil composition.	Revised	
98	-	-	MH 2	Reduce potential isolation of critical facilities in the event of a natural hazard by creating redundancy. Create a map with alternatives transportation routes. Create a plan for multiple communication alternatives.	New/ Prioritized	
99	-	-	MH 3	Utilize social media as a communication outlet in the event of a natural hazard.	New/ Prioritized	The Sheriff's Office already maintains a Facebook account where they announce important information. Emergency Management is part of the Sheriff's Department and can use this outlet for: important announcements (ie road closures in the event of a natural hazard, training opportunities, upcoming meetings, etc.) Members from the Steering Committee can inform the Emergency manager when we would like something "posted".

Table A-3 Dallas: Status of Complete and Deleted Action Items

2009 Action Item #	Description	Managing Department / Agency	Timeframe	Potential Funding Source(s)	Benefit- Costs / Technical Feasibility
Determined to be complete by City					
MH	Develop and incorporate mitigation provisions and recommendations into zoning ordinances and community development processes to maintain the floodway and protect critical infrastructure and private residences from other hazard areas.	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
MH	Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities susceptible to short term power disruption. (i.e. first responder and medical facilities, schools, correctional facilities, and water and sewage pump stations, etc.)	Community Development	Ongoing	General Fund, DHS	BC: TBD TF: Yes
MH	Explore the need for, develop, and implement hazard zoning ordinances for high-risk hazard area land-use.	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
Earthquake	Update existing (or adopt the most current) Uniform Building Code	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
Earthquake	Implement and enforce the Uniform, International, and State Building Codes.	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
Earthquake	Inspect and/or certify all new construction.	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
Flood	Develop, or revise, adopt, and enforce storm water ordinances and regulations to manage run-off from new development, including buffers and retention basins.	Public Works	Ongoing	General Fund	BC: TBD TF: Yes
Flood	Increase culvert size to increase its drainage efficiency.	Public Works	Ongoing	General Fund, HMGP	BC: TBD TF: Yes
Wind	Review ordinances and develop outreach programs to assure manufactured buildings are protected from severe wind and flood hazards. (Anchoring, elevation, siting, and other methods as applicable)	Community Development	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes
Wind	Revise requirements to place utilities underground to reduce power disruption from wind storm / tree blow down damage when upgrading or during new development.	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
Winter Storm	Develop critical facility list needing emergency back-up power systems, prioritize, seek funding and implement mitigation actions.	Police, Public Work	Ongoing	General Fund	BC: TBD TF: Yes
Winter Storm	Implement and enforce the most current Uniform International, and State, Building Codes to ensure structures can withstand winter storm hazards such as high winds, rain, water and snow.	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
Winter Storm	Review critical facilities and government building energy efficiency, winter readiness, and electrical protection capability. Identify, prioritize, and implement infrastructure upgrade or rehabilitation project prioritization and development.	Police, Fire, Public Work/ Community Development	Ongoing	General Fund	BC: TBD TF: Yes
Obsolete or determined to be unrealistic and deleted by City					
MH	Review ordinances and develop outreach programs to assure mobile homes and manufactured buildings are protected from severe wind and flood hazards. (Anchoring, elevation, and other methods as applicable)	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
MH	Review ordinances and develop outreach programs to assure fuel oil and propane tanks are properly anchored and hazardous materials are properly stored and protected from known natural hazards such as seismic or flooding events.	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
MH	Install lightning rods and lightning grade surge protection devices on critical electronic components such as warning systems, communications equipment, and computers for critical facilities.	Community Development	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes
MH	Acquire, demolish, or relocate structures from hazard prone area. Property deeds shall be restricted for open space uses in perpetuity to keep people from rebuilding in hazard areas.	Community Development, Public Works	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes
MH	Establish a formal role for the jurisdictional Hazard Mitigation Planning Committees to develop a sustainable process to implement, monitor, and evaluate citywide mitigation actions.	County Administration, Community Development, Police, Fire, Public Works /	Ongoing	General Fund	BC: TBD TF: Yes

Table A-3 Dallas: Status of Complete and Deleted Action Items (continued)

2009 Action Item #	Description	Managing Department / Agency	Timeframe	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Obsolete or determined to be unrealistic and deleted by City					
MH	Identify and pursue funding opportunities to implement mitigation actions.	Public Works, Community Development	Ongoing	General Fund	BC: TBD TF: Yes
MH	Develop and incorporate building ordinances commensurate with building codes to reflect survivability from wind, seismic, fire, and other hazards to ensure occupant safety.	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
Erosion	Install riprap, or pilings to harden or "armor" a stream bank where severe erosion occurs.	Public Works	Ongoing	General Fund, HMGP, HMA, NRCS	BC: TBD TF: Yes
Erosion	Harden culvert entrance bottoms with asphalt, concrete, rock, to reduce erosion or scour.	Public Works	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes
Erosion	Install embankment protection such as vegetation, riprap, gabion baskets, sheet piling, and walls to reduce or eliminate erosion.	Public Works	Ongoing	General Fund, HMGP, HMA, NRCS	BC: TBD TF: Yes
Erosion	Apply for grants/funds to implement riverbank protection methods.	Public Works	Ongoing	General Fund	BC: TBD TF: Yes
Expansive Soils	Review construction codes to require non-absorbent fill soils that slope away from foundations for a minimum of five feet to prevent ponding and water retention.	Community Development	Ongoing	General Fund	BC: TBD TF: Yes
Flood	Develop and maintain GIS mapped inventory of repetitive loss properties to include the types and numbers of properties.	Public Work	1-5 years	General Fund, HMA	BC: TBD TF: Yes
Flood	Develop and implement mitigation actions for repetitive loss properties.	Public Works	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes
Flood	Establish flood mitigation priorities for critical facilities and residential and commercial buildings located within the 100-year floodplain using survey elevation data.	Public Works	Ongoing	General Fund	BC: TBD TF: Yes
Flood	Determine and implement most cost beneficial and feasible mitigation actions for locations with repetitive flooding and significant damages or road closures.	Public Works	1-5 years	General Fund, HMGP, HMA	BC: TBD TF: Yes
Flood	Develop outreach program to educate residents concerning flood proofed well and sewer/septic installation.	Public Works	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes
Flood	Install new streamflow and rainfall measuring gauges.	Public Works	Ongoing	General fund, NOAA/NWS, HMGP, HMA	BC: TBD TF: Yes
Dam Failure	Prepare high resolution dam failure inundation area maps; use to update emergency response plans, evacuation route identification, public notification, and evacuation procedures.	Public Works	Ongoing	General Fund, USACOE	BC: TBD TF: Yes
HAZMAT	Enhance emergency planning, emergency response training, and equipment acquisition to address hazardous materials incidents for emergency and first responders and public works staff.	Public Works, Police, Fire	Ongoing	General Fund, EPA, SARA, HSGP	BC: TBD TF: Yes
HAZMAT	Evaluate existing security measures for sites with large quantities of hazardous substances (HS) or any quantities of extremely hazardous substances (EHS) and enhance security as necessary.	Public Works, Police, Fire	Ongoing	General Fund, EPA, SARA, HSGP	BC: TBD TF: Yes
HAZMAT	Train Public Works staff to identify extremely hazardous substances (EHS) and to follow EMS protocols.	Public Works, Police, Fire	Ongoing	General Fund, SARA, HSGP	BC: TBD TF: Yes
HAZMAT	Research, develop, and implement methods to protect waterways from hazardous materials events.	Police Dept	Ongoing	General Fund, SARA, EPA, USACOE, NRCS	BC: TBD TF: Yes
HAZMAT	Prepare a site-specific summary of hazardous materials used, stored, and commonly transported in the jurisdictional area. The summary should include mapped facility locations with a hazardous materials inventory, emergency response protocols, and mitigation actions.	Public Works	Ongoing	General Fund, SARA, EPA, HSGP,	BC: TBD TF: Yes

Table A-4 Falls City: Status of Complete and Deleted Action Items

2009 Action Item #	Description	Managing Department / Agency	Timeframe	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Obsolete or determined to be unrealistic and deleted by City					
MH 2	Pursue funding opportunities to implement mitigation actions.	City Manager	1-5 yrs	General Fund, HMGP, HMA, HSGP, NRCS, NOAA/ NWS	BC: TBD TF: Yes
MH 4	Cross reference and incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, land use, transportation plans, etc to demonstrate multi-benefit considerations and facilitate using multiple funding source consideration.	MWVCOG	Ongoing	General Fund	BC: TBD TF: Yes
MH 5	Develop and incorporate mitigation provisions and recommendations into zoning ordinances and community development processes to maintain the floodway and protect critical infrastructure and private residences from other hazard areas.	MWVCOG	Ongoing	General Fund	BC: TBD TF: Yes
MH 6	Identify and list repetitively flooded structures and infrastructures, analyze the threat to these facilities, and prioritize mitigation actions to acquire, relocate, elevate, and/or flood proof to protect the threatened population.	MWVCOG	Ongoing	General Fund	BC: TBD TF: Yes
FL 3	Evaluate and implement preferred flood protection initiatives to prevent or reduce riverine flood damages to residential structures and road drainage systems.	MWVCOG Planning & City Manager	1-5 yrs	General Fund, HMGP, HMA	BC: TBD TF: Yes
FL 4	Develop and implement mitigation actions for repetitive loss properties.	MWVCOG Planning, Public Works	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes
FL 5	Determine and implement most cost beneficial and feasible mitigation actions for locations with repetitive flooding and significant damages or road closures.	Public Works	Ongoing	General Fund	BC: TBD TF: Yes
FL 6	Develop, implement, and enforce floodplain management ordinances.	MWVCOG and City Manager	Ongoing	General Fund	BC: TBD TF: Yes
FL 9	Apply for grants/funds to implement riverbank protection methods.	MWVCOG Planning, City Manager, & Public Works	1-5 yrs	General Fund	BC: TBD TF: Yes
WF 2	Develop, adopt, and enforce burn ordinances that require burn permits, restricts campfires, and controls outdoor burning.	Polk County South West (PCSW) Rural Fire District	Ongoing	General Fund, FMAP	BC: TBD TF: Yes
WD 2	Review ordinances and develop outreach programs to assure manufactured buildings are protected from severe wind and flood hazards. (Anchoring, elevation, siting, and other methods as applicable)	County Bldg Dept	Ongoing	General Fund, HMGP, HMA	BC: TBD TF: Yes
WT 1	Develop critical facility list needing emergency back-up power systems, prioritize, seek funding, and implement mitigation actions.	Public Works	Ongoing	General Fund	BC: TBD TF: Yes
DUTS	Purchase backup power systems for all identified critical facilities.	City Manager & Public Works	Ongoing	General Fund, HSGP	BC: TBD TF: Yes
DUTS	Review and update emergency response plans for utility and transportation disruptions.	MWVCOG Planning City Engineer & City Manager	1-5 yrs	General Fund, HSGP	BC: TBD TF: Yes

Table A-5 Independence: Status of Complete and Deleted Action Items

2009 Action Item #	Description	Managing Department / Agency	Timeframe	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Determined to be complete by City					
MH	Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities susceptible to short term power disruption. (i.e., City Hall, first responder and medical facilities, schools, correctional facilities, and water and sewage pump stations, etc..	City/Community Development	0-2 years	Homeland Security Grants/State Grants	BC: TBD TF: Yes
Earthquake	Build a new City Hall/Civic Center to mitigate the present building's significant seismic vulnerabilities.	City/Community Development	1+ year	General Fund/URD/State Public Facility Grants	BC: TBD TF: Yes
Flood	Relocate sand and gravel operation to avoid repeated flooding.	City/LUBA/Community Development/Mayor	0-5 years	General Fund/URD	BC: TBD TF: Yes
Flood	Build flood walls around City Hall.	City/Community Development	0-2 years	General Fund	BC: TBD TF: Yes
Flood	Clean out the ditch line that runs Hoffman Road to Ash Creek so that it can move more freely and retain more water to mitigate flooding in nearby neighborhoods	City/Public Works	0-5 years	General Fund/Stormwater Fund/Mitigation Grant	BC: TBD TF: Yes
Landslide	Update the storm water management plan to include regulations to control runoff, both for flood reduction and to minimize saturated soils on steep slopes that can cause landslides.	City/Community Development	0-5 years		BC: TBD TF: Yes
Wildfire	Define a city yard waste disposal program to prevent fires from backyard burnings.	Fire District/City/Community Development	0-5 years		BC: TBD TF: Yes
Obsolete or determined to be unrealistic and deleted by City					
Flood	Deepen the Willamette River channel to mitigate floods hazards in our community.	DEQ/Community Development	5-10 years	Feds	BC: TBD TF: Yes
Erosion	Pursue embankment protection alternatives to protect identified infrastructure	DEQ/Community Development	0-5 years		BC: TBD TF: Yes
Volcano	Evaluate capability of water treatment plants to deal with high turbidity from ash falls, update emergency response plans, and upgrade treatment facilities' physical plant to deal with ash falls. Prioritize and initiate actions to fill capability gaps.	City/Public Works	0-5 years	General Fund/Water Fund/DEQ	BC: TBD TF: Yes
Volcano	Evaluate ash impact on storm water drainage system and develop mitigation actions.	City/Public Works	0-5 years	General Fund/Storm Fund	BC: TBD TF: Yes
Winter Storm	Trim back trees growing into power lines to prevent line damage during high winds or ice storms.	PP&L/Public Works	0-2 years	PP&L	BC: TBD TF: Yes
MH	Work with power company to remove overhead utilities that could drop during high winds, ice storms, earthquakes and fires.	PP&L/Fire District/Community Development	0-5 years	PP&L & General Fund	BC: TBD TF: Yes
MH	Maintain a formal role for the jurisdictional Hazard Mitigation Planning Committee to develop a sustainable process to implement, monitor and evaluate citywide mitigation actions.	City/Project Coordinator	0-5 years		BC: TBD TF: Yes
HAZMAT	Evaluate and improve railroad track conditions to address potential hazardous materials incidents due to instability of railroad tracks.	Willamette RR/Community Development	0-2 years	RR/State & Fed Transportation Grants/URD/General Funds	BC: TBD TF: Yes
HAZMAT	Create a well defined, multi-agency public/private response plan to the Simplot hazardous chemical storage plant.	City/Simplot/Fire District/Police Dept/Community Development	0-5 years	URD/Simplot Hazard Mitigation Grant	BC: TBD TF: Yes
HAZMAT	Develop a hazardous materials drop-off program more often than annual.	Polk County/Fire District	0-5 years		BC: TBD TF: Yes
HAZMAT	Relocate hazardous material critical facilities for prevention of hazmat incidents.	City/Simplot/Fire District/Police Dept/Community Development	0-5 years	URD/Simplot Hazard Mitigation Grant	BC: TBD TF: Yes

Table A-5 Independence: Status of Complete and Deleted Action Items (continued)

2009 Action Item #	Description	Managing Department / Agency	Timeframe	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Obsolete or determined to be unrealistic and deleted by City					
Terrorism	The South Well Field needs fencing and other security systems installed to protect this critical infrastructure from unauthorized entry.	City/Public Works	0-5 years	Homeland Security	BC: TBD TF: Yes
Terrorism	Harden the perimeter security around City owned critical infrastructures to mitigate against potential terrorist attacks.	City/Public Works	0-5 years	Homeland Security	BC: TBD TF: Yes
Terrorism	Create an enhanced, special Emergency Response Team (Swat Team) to respond to terrorist issues.	City/Police Department	0-5 years	Homeland Security	BC: TBD TF: Yes
Terrorism	The Sewer Treatment Plant, #4 Lagoon needs fencing and other security systems installed to protect this critical infrastructure from unauthorized entry.	City/Public Works	0-5 years	Homeland Security	BC: TBD TF: Yes

Table A-6 Monmouth: Status of Complete and Deleted Action Items

2009 Action Item #	Description	Managing Department / Agency	Timeframe	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Determined to be complete by City					
Multi-Hazard	Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities susceptible to short term power disruption. (i.e. first responder and medical facilities, schools, correctional facilities, City Hall, and water and sewage pump stations, etc.).	Public Works Department	2-5 years	General Fund, HSGP, HMGP	BC: TBD TF: Yes
Multi-Hazard	Based on known high-risk hazard areas, identify hazard-specific signage needs and purchase and install hazard warning signs near these areas to notify and educate the public of potential hazards.	Public Works Department	0-2 years	General Fund, HMGP, HMA, NEHRP	BC: TBD TF: Yes
Winter Storm (Drought)	Develop educational programs and initiatives related to water conservation and irrigation during drought periods.	Community Development Department Public Works Department	0-2 years	General Fund, NRCS	BC: TBD TF: Yes
Wildland Fire	Develop, adopt, and enforce burn ordinances that require burn permits, restrict campfires, and controls outdoor burning.	Community Development Department Fire District	2-5 years	General Fund, FMAP	BC: TBD TF: Yes
Wind	Identify alternate interoperable communication method as backup for emergency personnel when phone lines are disrupted due to down power lines and cell phones are inoperable.	Hazard Mitigation Plan Steering Committee	2-5 years	General Fund, HSGP, IECGP	BC: TBD TF: Yes
2009 Action Item #	Description	Managing Department / Agency	Timeframe	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Obsolete or determined to be unrealistic and deleted by City					
Multi-Hazard	Establish and maintain a formal role for the jurisdictional Hazard Mitigation Steering Committee to develop a sustainable process to implement, monitor, and evaluate citywide mitigation actions.	Hazard Mitigation Steering Committee	0-2 years	General Fund	BC: TBD TF: Yes
DUTS	Develop outreach program to educate and encourage residents to maintain several days of emergency supplies for power outages or road closures.	Community Development Department Public Works Department	0-2 years	General Fund, HSGP, EMPG	BC: TBD TF: Yes
DUTS	Review and update emergency response plans for utility disruptions.	Hazard Mitigation Plan Steering Committee	0-2 years	General Fund, HSGP, EMPG	BC: TBD TF: Yes
DUTS	Identify and prioritize all "jurisdiction owned" & "non-jurisdiction owned" critical facilities that have backup power and emergency operations plans.	Hazard Mitigation Plan Steering Committee	0-2 years	General Fund	BC: TBD TF: Yes
HAZMAT	Enhance emergency planning, emergency response training, and equipment acquisition to address hazardous materials incidents for emergency and first responders and public works staff.	Public Works Department Fire District Police Department	0-5 years	General Fund, EPA, CERCLA, CSEEP, EPA, HSGP	BC: TBD TF: Yes
Terrorism	Enhance emergency planning, organization, equipment, exercise, and emergency response training to address all potential terrorism incidents.	Hazard Mitigation Plan Steering Committee	2-5 years	General Fund, HSGP, CTGP	BC: TBD TF: Yes

Section 4: Plan Implementation and Maintenance

The steering committee informally met several times since the previous version of this NHMP. Progress towards action items is documented in Section 3 (above). The steering committee agreed to meet semi-annually and the Polk County Community Development Department will be the plan convener. The steering committee will discuss options to integrate the NHMP into other planning documents (including the comprehensive plan) during their semi-annual meetings.

Volume II: Jurisdictional Addenda

All cities that participated in the previous NHMP also participated in this update process. City changes are reflected herein and within each city addendum.

Volume III: Appendices

Appendix A: Planning and Public Process

This planning and public process appendix reflects changes made to the Polk County NHMP and documents the 2017 planning and public process.

Appendix B: Community Profile

The community profile has been updated to conform with the OPDR template and includes information for Polk County.

Appendix C: Economic Analysis of Natural Hazard Mitigation Projects

Updates are provided for the economic analysis of natural hazard mitigation projects.

Appendix D: Grant Programs and Resources

Some of the previously provided resources were deemed unnecessary since this material is covered within the Oregon NHMP. Updates were made to the remaining grant programs and resources.

PUBLIC PARTICIPATION PROCESS

2016-2017 NHMP Update

Polk County is dedicated to directly involving the public in the review and update of the natural hazard mitigation plan. Although members of the steering committee represent the public to some extent, the residents of Polk County were also given the opportunity to provide feedback about the Plan. In addition, the public will be involved during the annual implementation and maintenance meeting.

Polk County made the draft NHMP available via the Oregon Partnership for Disaster Resilience's website for public comment from January 17, 2017 through the FEMA review period.

Public Involvement Summary

Polk County provided a press release on January 17, 2017 and announced the plan on its website to inform the public that an update to the NHMP was occurring and to provide an opportunity for the public to learn more about the update and comment.

Falls City also provided a press release on their website.

There were no comments received during the public review period via the OPDR project page for the Polk County NHMP update. Members of the steering committee provided edits and updates to the NHMP during this period as reflected in the final document.

Polk County Board of Commissioners Public Meeting: December 27, 2017

On December 27, 2017 Polk County staff briefed the Polk County Board of Commissioners on the updated Polk County Multi-Jurisdictional Natural Hazard Mitigation Plan.

Press Release – Polk County

NOTICE FOR ITEMIZER-OBSERVER ATTENTION: IO LEGALS

Polk County Community Development

Press Release - Polk County's Multi-jurisdictional Hazard Mitigation Plan Update

Please start ad on: January 18, 2017

For this number of weeks: one (1) time only

Via E-Mail @ iolegals@polkio.com

Please submit the attached press release in the Public Notice section of the Itemizer-Observer. Please send us an Affidavit of Publication, and we would appreciate you forwarding one to us following publication, along with your invoice for services.

If you have any questions please give me a call.

Thank you,

Cole Steckley
Polk County Community Development
Phone: (503) 623-9237
Fax: (503) 623-6009

Submitted to Itemizer-Observer on January 10, 2017 @ 11:30 AM

PRESS RELEASE

REQUEST FOR COMMENTS: MULTI-JURISDICTIONAL NATURAL HAZARD MITIGATION PLAN UPDATE

The Polk County Multi-jurisdictional Natural Hazard Mitigation Plan is the result of collaborative planning effort between Polk County, local cities, Polk County residents, public agencies, and federal, state, and regional organizations. The purpose of this plan is to provide a set of strategies and measures the County can pursue to reduce the risk and fiscal loss to the County and its residents in the event of a natural hazard. Polk County is currently in the process of updating its Natural Hazard Mitigation Plan which was last updated in 2009. Prior to the plan's final approval, Polk County is requesting input and comments from the public. Please submit comments to the Polk County Community Development Department at 850 Main Street, Dallas, Oregon 97338, before February 1, 2017.

For more information, please contact Austin McGuigan with the Polk County Community Development Department at: 503-623-9237.



Falls City, Oregon

[Home](#) [Community](#) [City Committees](#) [Major Documents Center](#) [Water Master Plan Project](#) [Contact Us](#) [Helpful Links](#)

Welcome to Falls City, to view main tabs, just click and scroll down. Dropdown menus contain additional information not listed on main pages. Select dropdown and scroll to view that page.



2016 Update of the Falls City Appendix of the Polk County Natural Hazard Mitigation Plan

Summary: The purpose of hazard mitigation planning is to implement projects that eliminate the risk or reduce the severity of hazards on people and property. Mitigation programs may include short and long-term activities to reduce the hazard; reduce exposure to hazards; or reduce the effects of hazards. Mitigation could include better preparation, response and recovery measures. There are very specific federal requirements that must be met when preparing a Hazard Mitigation Plan: planning process, hazard identification, risk assessment, goals, mitigation programs, actions and projects, and a resolution adopting the plan.

Background: In 2009, Polk County adopted a Polk County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). The NHMP plan expired October 2014. On July 27, 2016, Polk County hosted a multi-jurisdiction project Kick-Off Meeting to update the plan. The NHMP needs to be updated to regain the eligibility for Federal pre-disaster mitigation project grant assistance from Federal Emergency Management Agency (FEMA).

In 2009, Falls City organized a Natural Hazard Mitigation Plan (NHMP) development Steering Committee that identified hazard threats and developed actions that could be taken to mitigate damage and life losses from those threats. Steering Committee participants included staff, city planner, mayor, public works, fire chief, two members of the planning commission and citizens. This project will update the [Falls City NHMP created in 2009](#).

Plan Update Process: [The Oregon Partnership for Disaster Resilience \(OPDR\)](#) has been contracted with Polk County through Oregon Emergency Management and a Pre-Disaster Mitigation Grant provided by FEMA to assist with the plan update. This effort will review the existing NHMP for needed revisions and for identification and prioritization of pre-disaster mitigation candidate projects. Each jurisdiction will participate. Public comments are welcome. The updated plan will be sent to FEMA in January 2017 for their review and approval. Once the plan is approved by FEMA, the plan will assist when applying for mitigation funding. This includes earthquake retrofitting, storm water management, elevate/ or relocate structures to avoid riverine flooding, public education, protective measures for utilities, water and sanitary sewer systems, and/ or infrastructure such as roads and bridges, localized flood control projects, and volunteer acquisition of real property for conversion to open space in perpetuity (any hazard).

Project Timeline

July 27, 2016
Multi-Jurisdiction Project Kick off meeting

August 2016

- Falls City City Council NHMP Project Agenda included in the August 11, 2016 Agenda packet.
- Add a tab to the website for the project and encourage public participation.
- Public Notice inviting comments.

August – October 2016

Update the Falls City Appendix of the Polk County Hazardous Mitigation Plan (e.g., community profile, action items, risk assessment, recent flood/wind events...)

October 2016

- Next Meeting of the Steering Committee. Steering Committee will review updates to action items & risk assessment.

November 2016

Final Review of updated plan

November –December 2016

Jurisdictions adopt their Appendix of the Polk County Hazardous Mitigation Plan by Resolution. Polk County adopts the overall plan.

January 2017

Polk county natural hazard mitigation plan forwarded to FEMA for Review and Acceptance.

How to participate:

1. Review the Falls City Appendix of the Polk County Natural Hazard Mitigation Plan and provide comments to City Hall at 299 Mill Street, Falls City, Oregon 97344: [Falls City Appendix](#)
2. Monitor this tab of the Falls City Website and read the monthly newsletter for updates.

Resources:

Polk County Natural Hazard Mitigation Plan: <http://www.co.polk.or.us/sheriff/em/multi-jurisdictional-hazard-mitigation-plan-mhmp>

2009 Falls City Natural Hazard Mitigation Plan: [Falls City Appendix](#)

City of Falls City
299 Mill St.
Falls City, Oregon 97344
503-787-3631

Office hours: Monday - Thursday 10:00 am to 5:30 pm Closed for lunch 1:00 pm to 1:30 pm
Closed to the public each Friday

THIS ORGANIZATION IS AN EQUAL OPPORTUNITY PROVIDER

Polk County Board of Commissioners Public Meeting

POLK COUNTY BOARD OF COMMISSIONERS' WEDNESDAY AGENDA

DATE & TIME: December 27, 2017, 9:00 a.m.
LOCATION: Polk County Courthouse, Dallas, Oregon

THE LOCATION OF THIS MEETING IS ADA ACCESSIBLE. PLEASE ADVISE THE BOARD (503-623-8173), AT LEAST 24 HOURS IN ADVANCE, OF ANY SPECIAL ACCOMMODATIONS NEEDED TO ATTEND OR PARTICIPATE IN THE MEETING.

1. **CALL TO ORDER AND NOTE OF ATTENDANCE**
2. **ANNOUNCEMENTS**
 - (a) Regular meetings of the Board of Commissioners are held on Tuesday and Wednesday each week. The Tuesday meeting is held in the Board of Commissioners' Office Conference Room, 850 Main Street, Dallas, Oregon. The Wednesday meeting is held in the Courthouse Conference Room, 850 Main Street, Dallas, Oregon. Each meeting begins at 9:00 a.m. and is conducted according to a prepared agenda that lists the principal subjects anticipated to be considered. Pursuant to ORS 192.640, the Board may consider and take action on subjects that are not listed on the agenda.
 - (b) Department Head/staff meetings with the Board of Commissioners are held on Monday, Thursday, and Friday. The meetings are held in the Board of Commissioners' Office Conference Room and are conducted between 9:00 a.m. and 5:00 p.m. The principal subjects anticipated to be considered are on-going, upcoming, and new matters bearing on County operations. Pursuant to ORS 192.640, the Board of Commissioners may consider and take action on subjects not listed within this announcement.
3. **COMMENTS (for items not on this agenda)**
4. **APPROVAL OF AGENDA**
5. **APPROVAL OF CONSENT CALENDAR**
6. **APPROVAL OF MINUTES OF BOARD MEETING OF DECEMBER 20, 2017**
7. **POLK COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN**

The Board will consider adopting updates to the Polk County Multi-Jurisdictional Hazard Mitigation Plan.
(Sidney Mulder, Senior Planner)
8. **LEGISLATIVE AMENDMENT LA 17-02**

Consider initiating Legislative Amendment LA 17-02 regarding Polk County Zoning Ordinance updates.
(Austin McGuigan, Community Development Director)

CONSENT CALENDAR

- (a) **BEHAVIORAL HEALTH – CONTRACT NO. 17-201**

Approve Contract 17-201 with Courtney Hagemann to provide mental health services to referred Polk County Mental Health individuals.
(Jim Morris, Business Services Supervisor)

**THE BOARD OF COMMISSIONERS WILL MEET IN EXECUTIVE SESSION
PURSUANT TO ORS 192.660.**

ADJOURNMENT

MEMORANDUM

TO: Board of Commissioners
FROM: Sidney Mulder, Senior Planner
DATE: December 1, 2017
SUBJECT: Updates to the Polk County Multi-Jurisdictional Hazard Mitigation Plan

Wednesday, December 27, 2017 (public meeting)

RECOMMENDATION:

Federal Emergency Management Agency (FEMA) completed a pre-adoption review of an update to the Polk County Multi-Jurisdictional Hazard Mitigation Plan, and FEMA has committed to approve the plan upon receiving documentation of the County's adoption of the plan. The Polk County Community Development Director and the Polk County Emergency Manager recommend adoption of the updated Polk County Multi-Jurisdictional Hazard Mitigation Plan.

ISSUE:

Should Polk County adopt by resolution the updated Polk County Multi-Jurisdictional Hazard Mitigation Plan?

BACKGROUND:

Natural hazard mitigation is the development and implementation of activities designed to reduce or eliminate losses resulting from natural hazards. In 2000, FEMA issued the Disaster Mitigation Act of 2000. Under the Disaster Mitigation Act of 2000, communities, states, and tribal governments must complete FEMA-approved natural hazard mitigation plans to be eligible for certain federal assistance programs such as the Hazard Mitigation Grant Program and the Pre-Disaster Mitigation Grant Program.

Polk County obtained an Emergency Management Performance Grant to develop the Polk County Natural Hazards Mitigation Plan in July 2003. The County completed the Polk County Natural Hazards Mitigation Plan in January 2006.

In May 2009, Polk County updated the 2006 Polk County Natural Hazards Mitigation Plan as part of a greater effort to develop hazard mitigation plans for the cities located within Polk County. This update included a Multi-Jurisdictional Hazard Mitigation Plan that identified hazards affecting individual jurisdictions.

In June 2016, Polk County began an update of the 2009 Polk County Multi-Jurisdictional Hazard Mitigation Plan. This updated plan includes a county-wide comprehensive risk assessment and vulnerability analysis, potential funding sources, and community based mitigation actions for individual jurisdictions within Polk County.

Natural hazards present a threat to public and private property in Polk County, as well as to the health and safety of the County's residents. To minimize risk of harm to humans, property and/or the economy, it is vital to continue to plan for the occurrence of potential natural hazards.

The update to the Polk County Multi-Jurisdictional Hazard Mitigation Plan is the result of a collaborative planning effort between Polk County, local cities, Polk County residents, public agencies, and federal, state and regional organizations.

The updated Polk County Multi-jurisdictional Hazard Mitigation Plan addresses six (6) chronic hazards and two catastrophic hazards. Chronic hazards occur with some regularity and may be predicted through historic evidence and scientific methods. The six (6) chronic hazards in the plan are: windstorm, winter storm, flooding, drought, wildfires, and landslides. Catastrophic hazards do not occur with the frequency of chronic hazards, but can have devastating impacts on life, property, and the environment. Earthquakes and volcanic eruptions are the two catastrophic hazards presented in the plan. Each of the hazard-specific sections includes information on the hazard history, characteristics, location and extent, risk assessment, probability assessment, and vulnerability assessment.

The updated Polk County Multi-Jurisdictional Hazard Mitigation Plan provides a set of strategies and measures the County can pursue to reduce the risk and fiscal loss to the County and its residents from natural hazards events. The plan includes updated resources and information that will assist County residents, public and private sector organizations and other interested people in participating in natural hazard mitigation activities.

Federal Emergency Management Agency (FEMA) completed a pre-adoption review of the updated Polk County Multi-Jurisdictional Hazard Mitigation Plan, and FEMA has committed to approve the plan upon receiving documentation of the County's adoption of the plan. The Polk County Community Development Director and the Polk County Emergency Manager recommend adoption of the updated Polk County Multi-jurisdictional Hazard Mitigation Plan.

DISCUSSION / ALTERNATIVES:

1. The Polk County Community Development Director and the Polk County Emergency Manager recommend adoption of the updated Polk County Multi-jurisdictional Hazard Mitigation Plan.
2. Do not adopt the updated Polk County Multi-jurisdictional Hazard Mitigation Plan at this time.
3. Other, as described by the Board of Commissioners.

FISCAL IMPACTS:

Costs associated with staff time and copying of materials. No other impacts have been identified for Polk County.

ATTACHMENTS:

EXHIBIT A - FEMA Pre-Adoption Review Approval Letter dated November 27, 2017.

EXHIBIT B - Polk County Multi-Jurisdictional Hazard Mitigation Plan, dated October, 2017.

Polk County Steering Committee

Steering committee members possessed familiarity with the Polk County community and how it's affected by natural hazard events. The steering committee guided the update process through several steps including goal confirmation and prioritization, action item review and development and information sharing to update the plan and to make the plan as comprehensive as possible. Member's from the city steering committees also participated in the county steering committee meeting that met on the following dates:

- **Meeting #1:** Kickoff, July 27, 2016
- **Meeting #2:** Risk Assessment, Mitigation Strategies, Implementation and Maintenance, October 18, 2016

In addition, each city held steering committee meeting as indicated below, for a list of meeting attendees see the individual city addendum within Volume II:

Dallas:

- December 6, 2016 – Dallas Steering Committee Meeting #1
- December 13, 2016 – Dallas Steering Committee Meeting #2

Falls City:

- August 2016 – NHMP project agenda to city council. Also, added an NHMP update tab to city website and encouraged public participation.

Independence:

- November 1, 2016 – City meeting focused on mitigation strategy. Several follow-up conversations between steering committee members.

Monmouth:

- April 3, 2017 – Reviewed draft Monmouth addendum.

The county's and cities' NHMP reflects decisions decided upon at the plan update meetings and during subsequent work and communication internally between steering committee members and other staff and externally with OPDR.

The following pages provide copies of meeting agendas and sign-in sheets from county steering committee meetings.

Meeting #1



Agenda

Meeting: Polk County Natural Hazard Mitigation Plan Update: Kick-off Meeting
Date: July 27, 2016
Time: 10:00 AM – 12:00 PM
Location: Polk County Courthouse, First Floor Hearing/Conference Room,
850 Main Street, Dallas

I. Introduction and Background	5 minutes
a. Community Service Center	
b. Project Context	
c. Committee Introductions	
II. Natural Hazard Mitigation Planning	10 minutes
a. Emergency Management Overview	
b. Natural Hazard Mitigation Plans (NHMP) Overview	
c. Project Timeline	
III. Community Profile Update	20 minutes
a. Community Profile	
b. Critical facilities	
IV. FEMA Discovery Report Review	20 minutes
a. Hazard History	
BREAK	5 minutes
V. State and County Goals	15 minutes
VI. Mitigation Actions Review	30 minutes
VII. Public Outreach Strategy	10 minutes
VIII. Wrap Up and Next Steps	5 minutes
a. Next Steps	
b. Future Meetings	

OREGON PARTNERSHIP FOR DISASTER RESILIENCE | COMMUNITY SERVICE CENTER
1209 University of Oregon | Eugene, Oregon 97403 | T: 541.346.3889 | F: 541.346.2040 <http://csc.uoregon.edu/opdr>



Meeting Sign-In

Polk County NHMP Update: Kickoff July 27, 2016
Dallas, Oregon

Please complete your contact information and initial next to your name

FIRST	LAST	AGENCY	TITLE	EMAIL
Sidney	Mulder	Polk County	Assistant Planner	mulder.sidney@co.polk.or.us
Domenica	Proteroco	Falls City	City Clerk	domenica.proteroco@fallscl.gov
Austin	McGowan	Polk County	Com Dev Dir	mcgowan.austin@co.polk.or.us
Jason	Loeber	DALLAS	Com Dev Dir	jason.loeber@dallas.gov
Autumn	Hillebrand	Polk County	Com. Dev. Dept. Manager	hillebrand.autumn@co.polk.or.us
Shawn	Irvin	Independence	Econ Dev. Dir	shawn.irvin@independence.or.us
Mark	Fancy	City of Monmouth	Comm-Dev. Director	mfancy@ci.monmouth.or.us
Dan	RENDEK	PCSO	County EM	Dan.Rendek@co.polk.or.us

Meeting #2



Agenda

Meeting: Polk County Natural Hazard Mitigation Plan Update: Kick-off Meeting
Date: October 18, 2016
Time: 9:00 AM – 12:00 PM
Location: Polk County Courthouse, First Floor Hearing/Conference Room,
850 Main Street, Dallas

- | | |
|--|-------------------|
| I. Welcome and Meeting Goals | 5 minutes |
| a. Project Updates | |
| II. Risk Assessment Updates (County and City) | 60 minutes |
| a. Jurisdiction Vulnerabilities | |
| b. Polk Hazard Vulnerability Assessment (Jan. 2016) | |
| i. City Risk Assessments | |
| Break | 5 minutes |
| III. Action Item Update and Review | 60 minutes |
| a. Present changes | |
| b. Discuss new actions | |
| c. Prioritize actions | |
| Break | 5 minutes |
| IV. Plan Implementation and Maintenance | 30 minutes |
| a. Recommended updates | |
| b. Discuss committee membership | |
| c. Discuss meeting schedule | |
| V. Questions and Discussion | 10 minutes |
| VI. Wrap Up and Next Steps | 5 minutes |
| a. Next Steps | |



Meeting Sign-In

Polk County NHMP Update: Meeting #2 October 18, 2016
Dallas, Oregon

Please complete your contact information and initial next to your name

FIRST	LAST	AGENCY	TITLE	EMAIL
Anthony	Hillebrand	Polk County	Comm. Dev. Dept. Manager	hillebrand.antonio@co.polk.or.us
Sidney	Muder	Polk County	Associate Planner	muder.sidney@co.polk.or.us
JERRY	UNKRICHT	Falls City	MAYOR/MANAGER	mayor@cityoffalls.org
TRICIA	ROTHROB	" "	City Clerk	drothrob@cityofpolk.org
Shawn	Irvine	Independence	Economic Development	sirovin@independence.or.us
STAN	Locke	DALLAS	Construction Director	stan.locke@dallas.or.gov
TODD	WHITAKER	Polk Co Pw	Pub Works Dir	whitaker.todd@co.polk.or.us
MELK	Fancy	City of Monmouth	Community Dev. Director	mfancy@ci.monmouth.or.us

2009 Plan Update

The 2009 Polk County Multi-Jurisdictional Hazard Mitigation Plan Update: included newly identified hazards affecting individual jurisdictions; provided a comprehensive risk assessment and vulnerability analysis; provided community based mitigation actions; identified funding sources; and included the incorporated jurisdictions with the county as part of the update.

The first step in the planning process was to establish Steering Committees within each participating jurisdiction. These Steering Committees consisted of the county and city representatives as well as representatives from the rural fire districts within the county. Austin McGuigan, Polk County, Community Development Director, served as the primary point of contact for the overall plan update and development.

Once the Steering Committees were formed, the following six-step planning process took place during April 2008 to March 2009.

1. **Organize Resources:** The Steering Committees identified resources, including county staff, city departments and agencies, and local non-governmental organizations (NGOs), which could provide the technical expertise and historical information needed to update the MHMP.
2. **Profile Hazards:** Each Steering Committee identified the hazards specific to Polk County and the cities of Dallas, Falls City, Independence, and Monmouth. A hazard analysis was then developed for these hazards.
3. **Assess Risks:** A vulnerability analysis was developed for the county and each of the incorporated communities. The county and incorporated communities used the vulnerability analyses results during the mitigation strategy development.
4. **Assess Capabilities:** Each Steering Committee reviewed the current administrative and technical, legal and regulatory, and fiscal capabilities to determine whether existing provisions and requirements adequately address relevant hazards in each respective jurisdiction.
5. **Develop Mitigation Strategy:** Each Steering Committee developed a comprehensive range of potential mitigation goals and actions. Subsequently, Polk County and the incorporated communities identified, evaluated, and prioritized the actions to be implemented in the jurisdiction-specific Mitigation Action Plans (Appendices A-E).
6. **Monitor Progress:** Each Steering Committee developed an implementation process to ensure the success of an ongoing program to minimize hazard impacts to Polk County and the incorporated communities.

The comprehensive planning process enabled the County to review and update each section of the 2006 HMP; converting it to a Multi-Jurisdiction Hazard Mitigation Plan containing “incorporated city” specific planning initiatives as well as addressing the update criteria for the county portion of the plan.

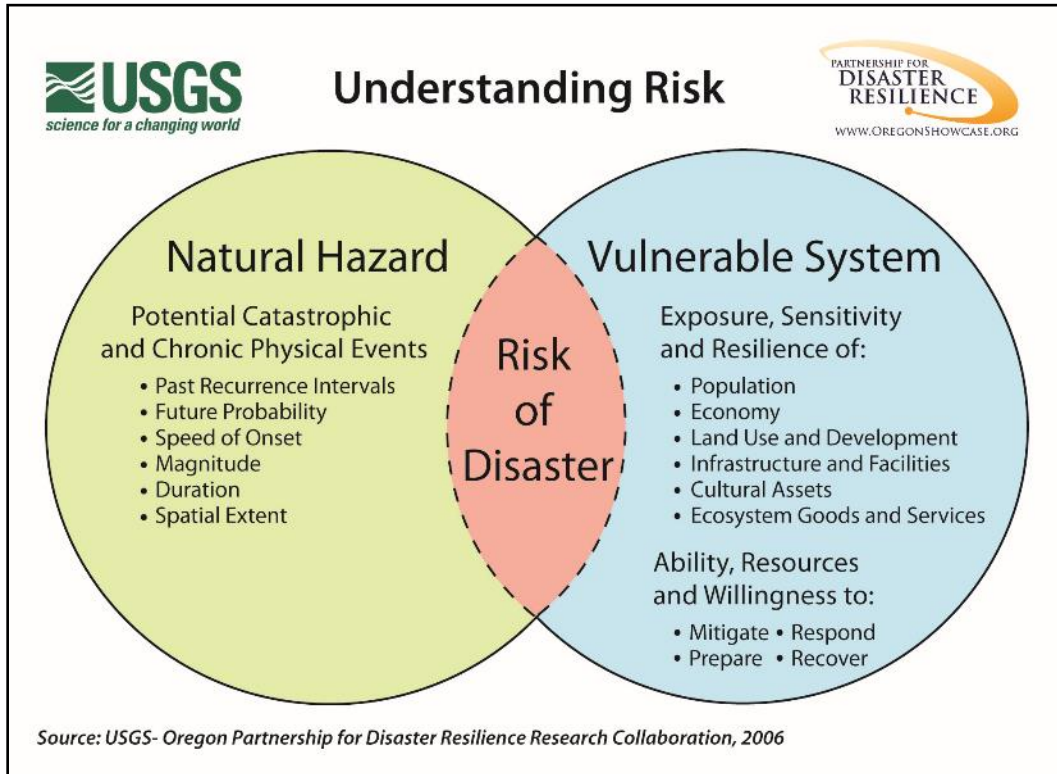
APPENDIX B: COMMUNITY PROFILE

Community resilience can be defined as the community’s ability to manage risk and adapt to natural hazard impacts. In order to help define and understand the county’s sensitivity and resilience to natural hazards, the following capacities must be examined:

Natural Environment Capacity	3
Location, Geography, History	3
Climate	4
Synthesis	6
Social/Demographic Capacity	7
Population.....	7
Vulnerable Populations	8
Language	8
Race	9
Gender.....	10
Age.....	10
Families and Living Arrangements	11
Income	12
Education	14
Health	14
Synthesis	17
Economic Capacity.....	18
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The Community Profile describes the sensitivity and resilience to natural hazards of Polk County, and its incorporated cities, as they relate to each capacity. It provides a snapshot in time when the plan was developed and will assist in preparation for a more resilient county. The information in this section, along with the hazard assessments located in Section 2 – Risk Assessment, should be used as the local level rationale for the risk reduction actions identified in Section 3 – Mitigation Strategy. The identification of actions that reduce the county’s sensitivity and increase its resiliency assist in reducing overall risk of disaster, the area of overlap in the figure below.

Figure B-1 Understanding Risk



Source: Oregon Partnership for Disaster Resilience

Natural Environment Capacity

Natural environment capacity is recognized as the geography, climate, and land cover of the area such as, urban, water and forested lands that maintain clean water, air and a stable climate.¹ Natural resources such as wetlands and forested hill slopes play significant roles in protecting communities and the environment from weather-related hazards, such as flooding and landslides. However, natural systems are often impacted or depleted by human activities adversely affecting community resilience.

Location, Geography, History

Polk County is located in the lower northwestern part of Oregon within the Mid-Willamette Valley between the Coastal Range and the Cascade Range (see Map B-1). The county was officially created from the Yamhill District of the Oregon Territory on December 22, 1845. On August 13, 1848, President James K. Polk signed a bill approving the boundaries of the Oregon territory, which officially separated the territory from England.

The present area of Polk County comprises 472,960 acres (739 square miles). Elevations within the county range from 325 feet in the east to 3,450 feet near Sugarloaf Mountain in the west. The western half of the County is timbered, with the eastern half as prairie or farmlands.

Further settlement from eastern United States migrations began in the early 1840's, one of the earliest settlements is near the present site of Dallas. Jason Lee was the vanguard of this settlement, having established his mission at Wheatland on the east bank of the Willamette River in 1834.

The County seat was located at Cynthian (later Dallas) in 1850. A new courthouse was completed in 1860 and destroyed by fire in 1898 and the present courthouse was completed in 1900. The City of Dallas is the northern most incorporated jurisdiction located centrally within the county.

The City of Independence was named after Independence, Missouri by E.A. Thorp, a former resident of the Missouri city who platted the town in 1850. The site began to be settled in 1845. Located close to the eastern border of the county, the City of Independence is a close neighbor to the City of Monmouth.

The City of Monmouth was founded in 1853 by settlers from Monmouth, Illinois in August, 1852 who spent their first winter at a point about three and one-half miles north-northeast of Rickreall. Monmouth University, now known as Western Oregon State College, was originally founded in 1858.

Falls City, named for the historically prominent falls was originally named both Syracuse and Luckiamute Falls. In 1891, when the town was incorporated, the name was changed. However, due to the dual origin, there are two "Main Streets" in town – North and South Main Street run parallel to each other on either side of the river. Historical photos show a power plant constructed at the top of the falls, and records indicate a sawmill operation

¹ Mayunga, J. 2007. Understanding and Applying the Concept of Community Disaster Resilience: A capital-based approach. Summer Academy for Social Vulnerability and Resilience Building.

operated by John Thorpe in 1852. The elevation at the falls is approximately 300 feet. Falls City is located centrally in the county.

The Grand Ronde Indian Reservation was formed in 1856 combining settlements from several Willamette Valley Indian tribes as well as Indians from other parts of Oregon. The reservation is located in northwestern Polk County as well as southwestern Yamhill County. More than 1,000 Indians were on the reservation at one time during the 1860's. The reservation was divided in 1908 among the various Indians residing there. The Grand Ronde Agency was terminated in 1925 with the U.S. Federal Government maintaining supervisory control over the remaining 500 acres of reservation land until 1957.

River navigation, agriculture, timber, and livestock all contributed to Polk County's development, economy, industry, and trade activities during its early history. World War II changed the county's land use focus towards more residential or other urban uses. Agricultural land was decreasing rapidly requiring the County to allocate agricultural and timber land to preserve the industries.

Climate

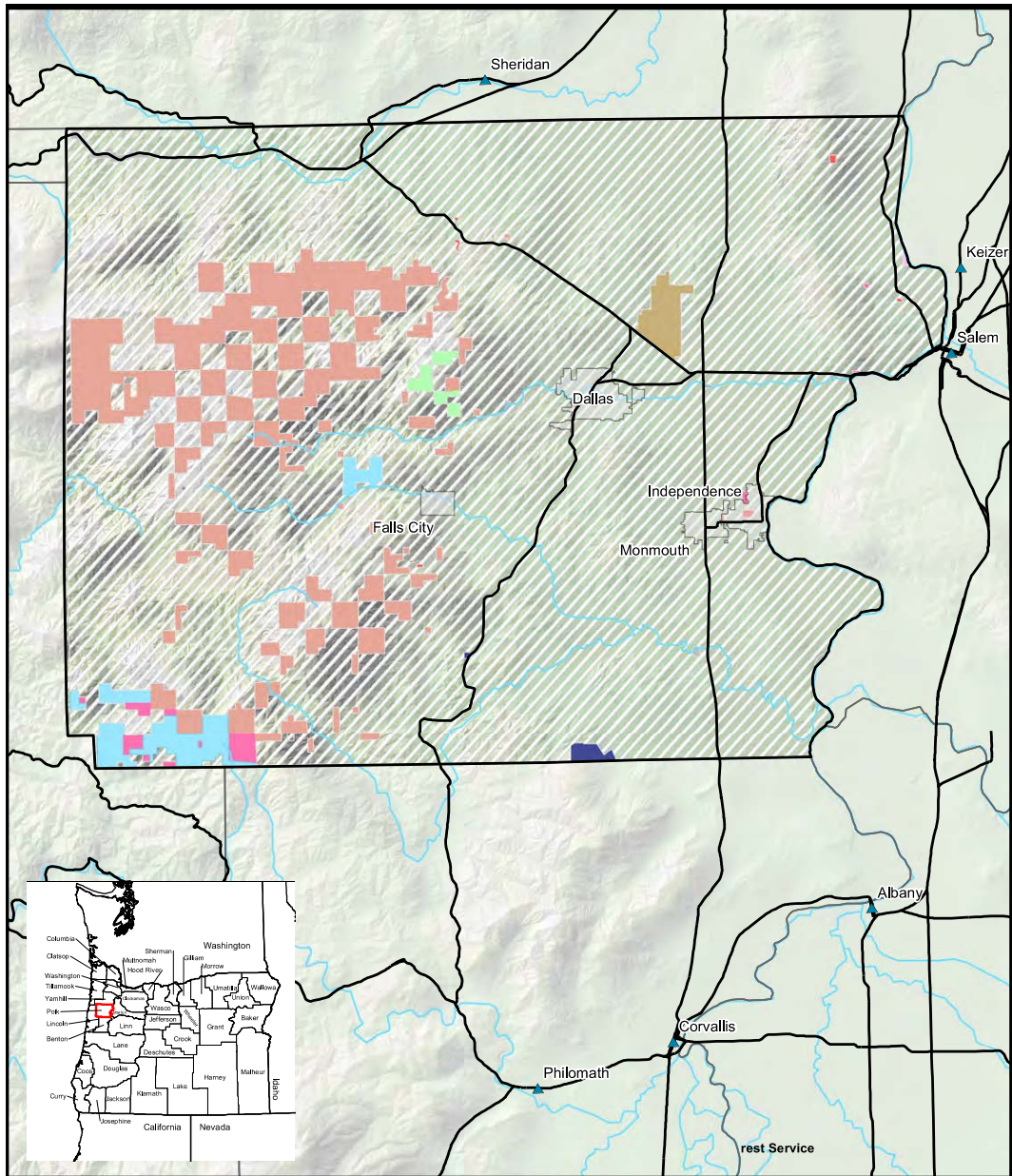
Polk County has a modified marine climate where winters are cool and wet, while summers are moderately warm and dry. Cool air flows west from the Pacific Ocean and is tempered by the Cascade Mountains to the east. From 1961 to 1990, the average annual precipitation in Polk County was approximately 52 inches with most received in the Coast Range and gradually decreasing eastward toward the Willamette Valley floor. The Laurel Mountain Weather Station, located at an elevation of 3,589 feet in the Coast Range west of Falls City, was established in 1970. Between 1970 and 2000, average annual precipitation recorded at the station was about 121 inches. A total of 204 inches was recorded during the winter of 1996-97. In the Mid-Willamette Valley, 90 percent of the rainfall is experienced between October and the end of May.

Total precipitation in the Pacific Northwest region may remain similar to historic levels but climate projections indicate the likelihood of increased winter precipitation and decreased summer precipitation.

Increasing temperatures affects hydrology in the region. Spring snowpack has substantially decreased throughout the Western part of the United States, particularly in areas with milder winter temperatures, such as the Cascade Mountains. In other areas of the West, such as east of the Cascades Mountains, snowfall is affected less by the increasing temperature because the temperatures are already cold and more by precipitation patterns.²

² Mote, Philip W., et. al., "Variability and trends in Mountain Snowpack in Western North America," <http://cses.washington.edu/db/pdf/moteetalvarandtrends436.pdf>

Map B-I Location and Land Ownership



Source: Polk County NHMP (2009).

Hazard Severity

Dynamic weather combined with the diverse geography across Polk County are indicators of hazard vulnerability when combined with the changing climate and severe weather related events. Both wet and dry cycles are likely to last longer and be more extreme, leading to periods of deeper drought and more frequent flash flooding. Less precipitation in the summers and subsequently lower soil moisture with hotter temperatures will likely increase the amount of vegetation consumed by wildfire.

Synthesis

The physical geography, weather, climate and land cover of an area represent various interrelated systems that affect overall risk and exposure to natural hazards. The projected climate change models representing Western Oregon indicate the potential for increased effects of hazards, particularly drought and wildfire due to changing climate of the region. Western Oregon is projected to have warmer and drier summers with less precipitation. In addition, winter temperatures will be warmer, which means a decrease in mountain snowpack. These factors combined with periods of population growth and development intensification can lead to increasing risk of hazards, threatening loss of life, property and long-term economic disruption if land management is inadequate.

Social/Demographic Capacity

Social/demographic capacity is a significant indicator of community hazard resilience. The characteristics and qualities of the community population such as language, race and ethnicity, age, income, educational attainment, and health are significant factors that can influence the community's ability to cope, adapt to and recover from natural disasters. Population vulnerabilities can be reduced or eliminated with proper outreach and community mitigation planning.

Population

Polk County's population grew 4.1% from 2010 to 2015, Dallas and Salem (portion in Polk County) had the fastest growth rate at 3.1% and 5.1% respectively, while the unincorporated areas of the county outpaced them all at 6.7%. The western part of Salem (25,542), Dallas (15,040), and the unincorporated parts of the county (17,775) are the county's most populous. The unincorporated area of the county accounts for about 22.6% of the overall population and is growing faster than the largest cities (1.31% AAGR).

Oregon's state-wide land use planning policies require local jurisdictions to manage growth using an urban growth boundary, which contains most new growth inside of incorporated areas. Since 2010 the unincorporated area of the county grew faster than almost all of the incorporated cities; reversing the trend from previous years when incorporated areas grew faster. Although the trend reversed the growth in these areas does emphasize the importance of partnerships between the county and the cities for effective county-wide mitigation efforts.

Table B-I Population Estimates for Polk County and Cities

Jurisdiction	2010		2015		Change (2010-2015)		AAGR
	Number	Percent	Number	Percent	Number	Percent	
Polk County	75,495	100%	78,570	100%	3,075	4.1%	0.80%
Dallas	14,590	19.3%	15,040	19.1%	450	3.1%	0.61%
Falls City	945	1.3%	950	1.2%	5	0.5%	0.11%
Independence	8,600	11.4%	8,775	11.2%	175	2.0%	0.40%
Monmouth	9,545	12.6%	9,640	12.3%	95	1.0%	0.20%
Salem*	24,312	32.2%	25,542	32.5%	1,231	5.1%	0.99%
Willamina*	845	1.1%	848	1.1%	3	0.3%	0.07%
Unincorporated	16,658	22.1%	17,775	22.6%	1,116	6.7%	1.31%

Source: Portland State University, Population Research Center, "Annual Population Estimates", 2015.

* - Portion of city within Polk County.

The Office of Economic Analysis' Long-term County Population Forecast projects that by 2035 Polk County's population will increase to over 113,000, a 44% increase from the 2015 estimate.³

³ Office of Economic Analysis. Long Term County Population Forecast, 2010-2050 (2013 release).

Tourists

Tourists are not counted in population statistics; and are therefore considered separately in this analysis. Tourists are specifically vulnerable due to the difficulty of locating or accounting for travelers within the region. Tourists are often at greater risk during a natural disaster because of unfamiliarity with evacuation routes, communication outlets, or even the type of hazard that may occur. Knowing whether the region's visitors are staying in friends'/relatives' homes in hotels/motels, or elsewhere can be instructive when developing outreach efforts.⁴ For hazard preparedness and mitigation purposes, outreach to residents in Polk County will likely be transferred to these visitors in some capacity. Visitors staying at hotel/motels are less likely to benefit from local preparedness outreach efforts aimed at residents.

Vulnerable Populations

Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, often experience the impacts of natural hazards and disasters more acutely. Hazard mitigation that targets the specific needs of these groups has the potential to greatly reduce their vulnerability. Examining the reach of hazard mitigation policies to special needs populations may assist in increasing access to services and programs. FEMA's Office of Equal Rights addresses this need by suggesting that agencies and organizations planning for natural hazards identify special needs populations, make recovery centers more accessible, and review practices and procedures to remedy any discrimination in relief application or assistance.

Population size itself is not an indicator of vulnerability. More important is the location, composition, and capacity of the population within the community. Research by social scientists demonstrates that human capital indices such as language, race, age, income, education and health can affect the integrity of a community. Therefore, these human capitals can impact community resilience to natural hazards.

Language

Special consideration should be given to populations who do not speak English as their primary language. Language barriers can be a challenge when disseminating hazard planning and mitigation resources to the general public, and it is less likely they will be prepared if special attention is not given to language and culturally appropriate outreach techniques.

There are various languages spoken across Polk County; the primary language is English. Approximately 13% of the Polk County population speaks a language other than English, Spanish is the second most widely spoken language with about 10% of the population 5 years and over speaking Spanish (25% of the population of Independence speaks Spanish).⁵ Overall, about 4.4% of the total population in Polk County is not proficient in English. Independence (11,4%) and Monmouth (5.5%) have the largest populations of residents who

⁴ MDC Consultants (n.d.). When Disaster Strikes – Promising Practices. Retrieved March 18, 2014, from <http://www.mdcinc.org/sites/default/files/resources/When%20Disaster%20Strikes%20-%20Promising%20Practices%20-%20Tourists.pdf>

⁵ U.S. Census Bureau, 2011-2015 American Community Survey, Table DP02.

have limited or no English language proficiency. Outreach materials used to communicate with, plan for, and respond to non-English speaking populations should take into consideration the language needs of these populations.

Table B-2 Polk County Language Barriers

	Population 5 years and over	English Only		Multiple Languages		Limited or No English	
		Number	Percent	Number	Percent	Number	Percent
Polk County	72,709	63,018	86.7%	9,691	13.3%	3,196	4.4%
Dallas	13,730	12,737	92.8%	993	7.2%	150	1.1%
Falls City	938	903	96.3%	35	3.7%	7	0.7%
Independence	7,883	5,815	73.8%	2,068	26.2%	899	11.4%
Monmouth	9,492	7,809	82.3%	1,683	17.7%	524	5.5%

Source: U.S. Census Bureau, 2011-2015 American Community Survey Estimates, Table DP02.

Race

The impact in terms of loss and the ability to recover may also vary among minority population groups following a disaster. Studies have shown that racial and ethnic minorities can be more vulnerable to natural disaster events. This is not reflective of individual characteristics; instead, historic patterns of inequality along racial or ethnic divides have often resulted in minority communities that are more likely to have inferior building stock, degraded infrastructure, or less access to public services. The table below describes Polk County's population by race and ethnicity.

The majority of the population in Polk County is racially white (79.7%); Independence and Monmouth have the largest percentages of non-white population. Individually, Independence supports a 34% Hispanic or Latino population while Monmouth supports 25%. Approximately 13% of the county population is Hispanic or Latino.

Table B-3 Polk Race and Hispanic or Latino Origin

Race	Polk	Dallas	Falls City	Independence	Monmouth
Total Population	77,264	14,896	994	8,772	9,869
White	79.7%	89.9%	88.0%	66.1%	75.1%
Black	0.7%	0.1%	0%	0.4%	1.5%
AIAN	1.0%	0.5%	2.0%	0.1%	0.6%
Asian	2.1%	1.6%	0.1%	0.6%	3.3%
NHPI	0.4%	0.1%	0%	0.4%	0%
Some Other Race	0.0%	0.0%	0%	0.0%	0.0%
Two or More Races	3.4%	2.6%	7.0%	3.8%	4.5%
Hispanic or Latino	9,910	772	28	2,503	1,482
Percent	12.8%	5.2%	2.8%	28.5%	15.0%

Source: Social Explorer, Table T12, U.S. Census Bureau, 2011-2015 American Community Survey Estimates
AIAN = American Indian and Alaskan Native, NHPI = Native Hawaiian and Other Pacific Islanders

It is important to identify specific ways to support all portions of the community through hazard mitigation, preparedness, and response. Culturally appropriate, and effective outreach can include both methods and messaging targeted to diverse audiences. For example, connecting to historically disenfranchised populations through already trusted sources or providing preparedness handouts and presentations in the languages spoken by the population will go a long way to increasing overall community resilience.

Gender

Polk County has slightly more females than males (Female 51.9%, Male: 48.1%).⁶ It is important to recognize that women tend to have more institutionalized obstacles than men during recovery due to sector-specific employment, lower wages, and family care responsibilities.⁷

Age

Of the factors influencing socio demographic capacity, the most significant indicator in Polk County may be age of the population. Depicted in the table below, as of 2015, 16.4% of the county population is over the age of 64, a percentage that is projected to rise to 21.7% by 2035. The Polk County age dependency ratio⁸ is 55.4 (Dallas has the largest age dependency ration at 70.3). The age dependency ratio indicates a higher percentage of dependent aged people to that of working age. The Oregon Office of Economic Analysis projects that, in 2035, there will be a higher percentage of the county population over the age of 64. As the population ages, Polk county may need to consider different mitigation and preparedness actions to address the specific needs of this group. The age dependency ratio for Polk County is expected to rise to 61.5 in 2035, largely because of the rise in the older age cohorts.

Table B-4 Polk Population by Vulnerable Age Groups

Jurisdiction	Total	< 15 Years Old		> 64 Years Old		15 to 64 Years Old	Age Dependency Ratio
		Number	Percent	Number	Percent		
Oregon	3,939,233	712,967	18.1%	606,877	15.4%	2,619,389	50.4
Polk County	77,264	14,887	19.3%	12,648	16.4%	49,729	55.4
Dallas	14,896	3,225	21.7%	2,922	19.6%	8,749	70.3
Falls City	994	159	16.0%	185	18.6%	650	52.9
Independence	8,772	2,232	25.4%	722	8.2%	5,818	50.8
Monmouth	9,869	1,628	16.5%	934	9.5%	7,307	35.1
2035							
Oregon	4,995,200	865,889	17.3%	1,082,781	21.7%	3,046,530	62.9
Polk County	113,348	20,994	18.5%	21,798	19.2%	70,556	61.5

Source: Social Explorer, Table 17, U.S. Census Bureau, 2011-2015 American Community Survey Estimates, Office of Economic Analysis, Long-Term County Population Forecast, 2010-2050 (2013 release).

⁶ Social Explorer, Table 4, U.S. Census Bureau, 2011-2015 American Community Survey Estimates

⁷ Ibid.

⁸ The age dependency ratio is derived by dividing the combined under 15 and 65-and-over populations by the 15-to-64 population and multiplying by 100. A number close to 50 indicates about twice as many people are of working age than non-working age. A number that is closer to 100 implies an equal number of working age population as non-working age population. A higher number indicates greater sensitivity.

The age profile of an area has a direct impact both on what actions are prioritized for mitigation and how response to hazard incidents is carried out. School age children rarely make decisions about emergency management. Therefore, a larger youth population in an area will increase the importance of outreach to schools and parents on effective ways to teach children about fire safety, earthquake response, and evacuation plans. Furthermore, children are more vulnerable to the heat and cold, have few transportation options and require assistance to access medical facilities. Older populations may also have special needs prior to, during and after a natural disaster. Older populations may require assistance in evacuation due to limited mobility or health issues. Additionally, older populations may require special medical equipment or medications, and can lack the social and economic resources needed for post-disaster recovery.⁹

Families and Living Arrangements

Two ways the census defines households are by type of living arrangement and family structure. A householder may live in a “family household” (a group related to one another by birth, marriage or adoption living together); in a “nonfamily household” (a group of unrelated people living together); or alone. Polk County is predominately comprised of family households (68.0%). Of all households, 23.4% are one-person non-family households (householder living alone). Countywide about 11% of householders live alone and are over the age of 65 (about 15% of all households in Dallas).

Table B-5 Polk County Family vs. Non-Family Households

Jurisdiction	Total Households		Family Households		Household Living Alone		Householder Living Alone (age 65+)	
	Estimate		Estimate	Percent	Estimate	Percent	Estimate	Percent
Polk County	28,458		19,363	68.0%	6,672	23.4%	3,165	11.1%
Dallas	5,667		3,896	68.7%	1,432	25.3%	838	14.8%
Falls City	357		260	72.8%	78	21.8%	37	10.4%
Independence	2,932		2,055	70.1%	493	16.8%	140	4.8%
Monmouth	3,500		1,653	47.2%	1,007	28.8%	305	8.7%

Source: U.S. Census Bureau, 2011-2015 American Community Survey Estimates, Table DP02

The table below shows household structures for families with children. Nearly 20% of all households within the county are married family households that have children; Independence and Dallas have the highest percentages. Dallas (11.4%) and Independence (14.4%) have the highest percentage of single parent households. These populations will likely require additional support during a disaster and will inflict strain on the system if improperly managed.

⁹ Wood, Nathan. Variations in City Exposure and Sensitivity to Tsunami Hazards in Oregon. U.S. Geological Survey, Reston, VA, 2007.

Table B-6 Polk County Family vs. Non-Family Households

Jurisdiction	Total Households	Married-Couple with Children		Single Parent with Children	
	Estimate	Estimate	Percent	Estimate	Percent
Polk County	28,458	5,677	19.9%	2,129	7.5%
Dallas	5,667	1,062	18.7%	646	11.4%
Falls City	357	41	11.5%	27	7.6%
Independence	2,932	720	24.6%	421	14.4%
Monmouth	3,500	561	16.0%	157	4.5%

Source: U.S. Census Bureau, 2011-2015 American Community Survey Estimates, Table DP02

Income

Household income and poverty status are indicators of socio demographic capacity and the stability of the local economy. Household income can be used to compare economic areas as a whole, but does not reflect how the income is divided among the area residents. Between 2010 and 2015 the share of households making less than \$15,000 increased more than other income cohorts; no other income cohort saw a gain.

Table B-7 Household Income

Household Income	2010 [^]		2015		Change in Share	
	Households	Percent	Households	Percent	Households	Percent
Less than \$15,000	2,904	10.5%	3,638	12.8%	734	2.3%
\$15,000-\$29,999	3,876	16.2%	4,479	15.7%	603	-0.4%
\$30,000-\$44,999	4,276	14.2%	3,929	13.8%	-347	-0.4%
\$45,000-\$59,999	3,785	13.7%	3,876	13.6%	91	0.0%
\$60,000-\$74,999	2,973	11.7%	3,228	11.3%	255	-0.3%
\$75,000-\$99,999	3,739	13.6%	3,753	13.2%	14	-0.4%
\$100,000-\$199,999	5,297	19.1%	4,987	17.5%	-310	-1.6%
\$200,000 or more	840	3.0%	568	2.0%	-272	-1.0%

Source: Social Explorer, Table 56, U.S. Census Bureau, 2011-2015 American Community Survey and 2006-2010 American Community Survey

[^] 2010 dollars are adjusted for 2015 using the Social Explorers Inflation Calculator.

The 2015 median household income across Polk County is \$52,821; this is lower than the inflation adjusted 2010 figure, representing a 4.7% decline in real incomes. Dallas and Independence have the highest median household incomes, while Monmouth and Falls City have the lowest median household incomes. The table below shows decreases in real incomes across Polk County and cities.

Table B-8 Median Household Income

	Median Household Income		Percent Change
	2010 [^]	2015	
Polk County	\$55,433	\$52,821	-4.7%
Dallas	\$52,969	\$48,843	-7.8%
Falls City	\$43,588	\$33,309	-23.6%
Independence	\$50,304	\$44,454	-11.6%
Monmouth	\$39,516	\$32,027	-19.0%

Source: Social Explorer, Table 57, U.S. Census Bureau, 2011-2015 American Community Survey Estimates and 2006-2010 American Community Survey Estimates

Note: ^ - 2010 dollars adjusted for 2015 via Social Explorer's Inflation Calculator

The table below identifies the percentage of individuals and cohort groups that are below the poverty level in 2015. It is estimated that about 16% of individuals, 19% of children under 18, and 7% of seniors live below the poverty level across the county. Falls City, Independence, and Monmouth have the highest poverty rates. Falls City has the highest poverty rate for children under 18. Overall, 8% of Polk County residents live in "deep poverty" (having incomes below half the federal poverty level), the percent is greatest in Monmouth at 20%.¹⁰

Table B-9 Poverty Rates

	Total Population in Poverty		Children Under 18 in Poverty		18 to 64 in Poverty		65 or over in Poverty	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Polk County	12,270	16.3%	3,378	18.9%	7,988	17.7%	904	7.2%
Dallas	2,449	16.7%	913	25.3%	1,287	15.8%	249	8.7%
Falls City	250	25.7%	84	44.0%	149	24.9%	17	9.2%
Independence	2,168	24.8%	650	26.5%	1,443	25.8%	75	10.8%
Monmouth	2,807	32.3%	391	22.5%	2,340	39.0%	76	8.1%

Source: Social Explorer Tables 114, 115, 116, U.S. Census Bureau, 2011-2015 American Community Survey Estimates

Cutter's research suggests that lack of wealth contributes to social vulnerability because individual and community resources are not as readily available. Affluent communities are more likely to have both the collective and individual capacity to more quickly rebound from a hazard event, while impoverished communities and individuals may not have this capacity –leading to increased vulnerability. Wealth can help those affected by hazard incidents to absorb the impacts of a disaster more easily. Conversely, poverty, at both an individual and community level, can drastically alter recovery time and quality.¹¹

¹⁰ Social Explorer Tables 117, U.S. Census Bureau, 2011-2015 American Community Survey Estimates

¹¹ Statewide Supplemental Nutrition Assistance Program Activity - Nov. 2014 (SSP, APD, and AAA combined); P. 3 of report. Temporary Assistance for Needy Families One and two Parent Families Combined; P. 3 of report. <http://www.oregon.gov/dhs/assistance/Pages/data/main.aspx>

Federal assistance programs such as food stamps are another indicator of poverty or lack of resource access. Statewide social assistance programs like the Supplemental Nutritional Assistance Program (SNAP) and Temporary Assistance for Needy Families (TANF) provide assistance to individuals and families. In Polk County, TANF reaches approximately 1,192 families per month and SNAP helps to feed about 10,428 people per month.¹² Those reliant on state and federal assistance are more vulnerable in the wake of disaster because of a lack of personal financial resources and reliance on government support.

Education

Educational attainment of community residents is also identified as an influencing factor in socio demographic capacity. Educational attainment often reflects higher income and therefore higher self-reliance. Widespread educational attainment is also beneficial for the regional economy and employment sectors as there are potential employees for professional, service and manual labor workforces. An oversaturation of either highly educated residents or low educational attainment can have negative effects on the resiliency of the community.

Approximately 88.6% of the Polk County population over 25 years of age has graduated from high school or received a high school equivalency, with 26.7% going on to earn a Bachelor’s Degree. Independence (82.1%) and Falls City (86.5%) have the lowest percentages of high school graduates.

Table B-10 Educational Attainment

	Polk County		Falls		
	Dallas	City	Independence	Monmouth	
Population 25 years and over	49,104	10,041	719	4,506	4,734
Less than high school	4,274	737	92	757	350
High school graduate or GED	13,150	3,113	261	1,139	1,199
Some college, no degree	17,226	4,130	287	1,754	1,577
Bachelor's degree	8,879	1,465	48	605	974
Graduate or professional degree	4,236	455	26	200	473
Percent without Highschool Degree	8.7%	7.3%	12.8%	16.8%	7.4%
Percent High School Graduate or Higher	88.6%	91.3%	86.5%	82.1%	89.2%
Percent Bachelor's Degree or Higher	26.7%	19.1%	10.3%	17.9%	30.6%

Source: Social Explorer, Table 25, U.S. Census Bureau, 2011-2015 American Community Survey Estimates

Health

Individual and community health play an integral role in community resiliency, as indicators such as health insurance, people with disabilities, dependencies, homelessness and crime

¹² Sabatino, J. (2016). Oregon TANF Caseload FLASH, “One and Two Parent Families Combined”, District 3 (Dallas); December 2016 data, and Sabatino, J. (2016). Oregon SNAP Program Activity, “SSP, APD and AAA Combined”, District 3 (Dallas); December 2016 data. Retrieved from State of Oregon Office of Business Intelligence website: <http://www.oregon.gov/DHS/ASSISTANCE/Pages/Data.aspx>, January 2017.

rate paint an overall picture of a community’s well-being. These factors translate to a community’s ability to prepare, respond to, and cope with the impacts of a disaster.

The Resilience Capacity Index recognizes those who lack health insurance or are impaired with sensory, mental or physical disabilities, have higher vulnerability to hazards and will likely require additional community support and resources. Polk County has 10.3% of its population without health insurance; Monmouth (15.4%) has the highest percentage. The percentage of uninsured changes with age, the highest rates of uninsured are within the 18 to 64-year cohort; Monmouth has the highest percentage of this age group that is uninsured. The ability to provide services to the uninsured populations may burden local providers following a natural disaster.

Table B-11 Health Insurance Coverage

Jurisdiction	Population	Without Health Insurance							
		Total Population		Under 18 years		18 to 64 years		65+	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Polk County	76,884	7,934	10.3%	984	1.3%	6,907	9.0%	43	0.1%
Dallas	14,695	1,376	9.4%	193	1.3%	1,183	8.1%	0	0.0%
Falls City	994	134	13.5%	37	3.7%	97	9.8%	0	0.0%
Independence	8,737	920	10.5%	0	0.0%	920	10.5%	0	0.0%
Monmouth	9,863	1,520	15.4%	146	1.5%	1,361	13.8%	13	0.1%

Source: Social Explorer, Table 146, U.S. Census Bureau, 2011-2015 American Community Survey Estimates.

The table below describes disability status of the population. Approximately 14.7% of the Polk County civilian non-institutionalized population identifies with one or more disabilities. Falls City has the highest percentage of its total population with a disability (30.5%) and the highest percentage of individuals 65 years and over with a disability (54.1%). Independence has the highest percentage of individuals under 18 with a disability (8.5%).

Table B-12 Disability Status by Age Group

	Population Estimate^	With a disability		Under 18 years with a disability		65 years and over with a disability	
		Estimate	Percent	Estimate	Percent*	Estimate	Percent*
Polk County	76,884	11,292	14.7%	846	4.7%	4,647	37.0%
Dallas	14,695	2,728	18.6%	136	3.7%	1,169	40.8%
Falls City	994	303	30.5%	8	3.8%	100	54.1%
Independence	8,737	974	11.1%	209	8.5%	249	35.8%
Monmouth	9,863	1,157	11.7%	67	3.9%	368	39.4%

Source: U.S. Census Bureau, 2011-2015 American Community Survey, Table DP02.

^ Non-institutionalized civilian population, * Percent of age group

The table below describes disability status of the population by type and age. Older populations tend to have more disabilities than younger populations in Polk County. Approximately 8.0% of the population has an ambulatory disability while 6.3% have a cognitive disability, and 6.2% have an independent living disability. More than 22% of the 65 and over population has an ambulatory disability. Depending on the type of disability outreach, mitigation, and response efforts may need to be adjusted.

Table B-13 Disability Type by Age Group

	Hearing Disability	Vision Disability	Cognitive Disability	Ambulatory Disability	Self-Care Disability	Independent Living Disability
Total Population^	4.4%	2.1%	6.3%	8.0%	3.1%	6.2%
Under 18*	0.9%	0.7%	5.1%	0.7%	0.9%	0.0%
18 to 64*	2.4%	2.0%	5.8%	6.3%	2.2%	4.2%
65 and over*	17.0%	4.7%	9.2%	22.1%	8.7%	13.7%

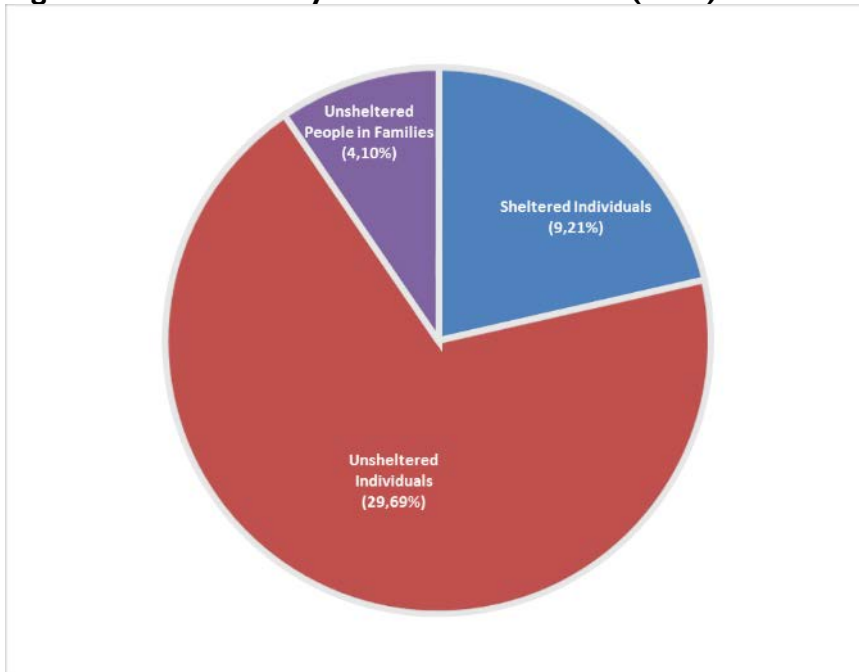
Source: U.S. Census Bureau, 2011-2015 American Community Survey, Table S1810.

^ Non-institutionalized civilian population, * Percent of age group

In 2015, Oregon Housing and Community Services (OHCS) conducted a point-in-time homeless count to identify the number of homeless, their age and their family type. The OHCS study found that 42 individuals and persons in families in Polk County identify as homeless; 9 were sheltered, 33 were unsheltered (29 individuals and 4 persons in families).

The homeless have little resources to rely on, especially during an emergency. It will likely be the responsibility of the county and local non-profit entities to provide services such as shelter, food and medical assistance. Therefore, it is critical to foster collaborative relationships with agencies that will provide additional relief such as the American Red Cross and homeless shelters. It will also be important to identify how to communicate with these populations, since traditional means of communication may not be appropriate or available.

Figure B-2 Polk County PIT Homeless Count (2015)



Source: Oregon Housing and Community Services, 2015 Point-in-Time Homeless Count

Synthesis

For planning purposes, it is essential Polk County consider both immediate and long-term socio-demographic implications of hazard resilience. Immediate concerns include the growing elderly population and language barriers associated with a culturally diverse community. Even though the vast majority of the population is reported as proficient in English, there is still a segment of the population not proficient in English. These populations would serve to benefit from mitigation outreach, with special attention to cultural, visual and technology sensitive materials. The current status of other social/-demographic capacity indicators such as graduation rate, poverty level, and median household income can have long-term impacts on the economy and stability of the community ultimately affecting future resilience.

In mitigation and preparedness planning it is critical for the safety of all residents that messaging and actions are culturally sensitive to all racial and ethnic groups. This may range from providing multi-lingual services to adopting entirely different strategies for outreach or specialized mitigation actions to address the unique risk faced by various racial and ethnic groups. For example, if multigenerational family units are more typical in some cultures, evacuation may be more take longer to accommodate the elderly and children living at home, or could even be impeded if there is only one family car. Additionally, varying cultural perceptions of the trustworthiness of government may need to be overcome so that suggestions to evacuate or shelter in place are taken seriously by residents.

Economic Capacity

Economic capacity refers to the financial resources present and revenue generated in the community to achieve a higher quality of life. Income equality, housing affordability, economic diversification, employment and industry are measures of economic capacity. However, economic resilience to natural disasters is far more complex than merely restoring employment or income in the local community. Building a resilient economy requires an understanding of how the component parts of employment sectors, workforce, resources and infrastructure are interconnected in the existing economic picture. Once any inherent strengths or systematic vulnerabilities become apparent, both the public and private sectors can take action to increase the resilience of the local economy.

Regional Affordability

The evaluation of regional affordability supplements the identification of Social/demographic capacity indicators, i.e. median income, and is a critical analysis tool to understanding the economic status of a community. This information can capture the likelihood of individuals' ability to prepare for hazards, through retrofitting homes or purchasing insurance. If the community reflects high-income inequality or housing cost burden, the potential for home-owners and renters to implement mitigation can be drastically reduced. Therefore, regional affordability is a mechanism for generalizing the abilities of community residents to get back on their feet without Federal, State or local assistance.

Income Equality

Income equality is a measure of the distribution of economic resources, as measured by income, across a population. It is a statistic defining the degree to which all persons have a similar income. The table below illustrates the county and cities level of income inequality. The Gini index is a measure of income inequality. The index varies from zero to one. A value of one indicates perfect inequality (only one household has any income). A value of zero indicates perfect equality (all households have the same income).¹³

The cities within the county have similar income equality scores; Dallas and Independence have slightly greater income equality than do Falls City and Monmouth. Independence and Monmouth have the highest level of income inequality of the incorporated cities (0.46). Based on social science research, the region's cohesive response to a hazard event may be affected by the distribution of wealth in communities that have less income equality¹⁴.

¹³University of California Berkeley. Building Resilient Regions, Resilience Capacity Index. <http://brr.berkeley.edu/rci/>.

¹⁴Susan Cutter, Christopher G. Burton, and Christopher T. Emrich. 2010. "Disaster Resilience Indicators for Benchmarking Baseline Conditions," *Journal of Homeland Security and Emergency Management* 7, no.1: 1-22

Table B-14 Regional Income Equality

Jurisdiction	Income Inequality Coefficient
Polk County	0.42
Dallas	0.42
Falls City	0.46
Independence	0.40
Monmouth	0.46

Source: Social Explorer, Table 157, U.S. Census Bureau, 2011-2015 American Community Survey Estimates

Housing Affordability

Housing affordability is a measure of economic security gauged by the percentage of an area’s households paying less than 30% of their income on housing.¹⁵ Households spending more than 30% are considered housing cost burdened. The table below displays the percentage of homeowners and renters reflecting housing cost burden across the region.

Overall roughly 30% of homeowners with a mortgage have a housing cost burden, compared to over 50% of renters. Amongst renters, the cities of Falls City, Independence, and Monmouth have more than 60% of renters with a housing cost burden. In general, the population that spends more of their income on housing has proportionally fewer resources and less flexibility for alternative investments in times of crisis.¹⁶ This disparity imposes challenges for a community recovering from a disaster as housing costs may exceed the ability of local residents to repair or move to a new location. These populations may live paycheck to paycheck and are extremely dependent on their employer, in the event their employer is also impacted it will further the detriment experienced by these individuals and families.

Table B-15 Households Spending > 30% of Income on Housing

Jurisdiction	Owners		Renters
	With Mortgage	Without Mortgage	
Polk County	31.4%	5.3%	53.1%
Dallas	27.2%	7.1%	51.6%
Falls City	43.3%	20.3%	63.9%
Independence	34.3%	1.5%	65.0%
Monmouth	41.4%	2.8%	69.5%

Source: Social Explorer, Tables 103 and 109, U.S. Census Bureau, 2011-2015 American Community Survey Estimates

¹⁵ University of California Berkeley. Building Resilient Regions, Resilience Capacity Index. <http://brr.berkeley.edu/rci/>.

¹⁶ Ibid.

Economic Diversity

Economic diversity is a general indicator of an area’s fitness for weathering difficult financial times. Business activity in the Willamette Valley region is fairly homogeneous and consists mostly of small businesses.

Economic diversity is a general indicator of an area’s fitness for weathering difficult financial times. One method for measuring economic diversity is through use of the Herfindahl Index, a formula that compares the composition of county and regional economies with those of states or the nation as a whole. Using the Herfindahl Index, a diversity ranking of 1 indicates the county with the most diverse economic activity compared to the state as a whole, while a ranking of 36 corresponds with the least diverse county economy. The table below describes the Herfindahl Index Scores for counties in the region.

Table B-16 shows that Polk County has an economic diversity rank of 9 as of 2013, this is on a scale between all 36 counties in the state where 1 is the most diverse economic county in Oregon and 36 is the least diverse. The county’s ranking has increased since 2008.

Table B-16 Regional Herfindahl Index Scores

County	2008			2013		
	Employment	Number of Industries	State Rank	Employment	Number of Industries	State Rank
Polk	12,837	178	18	12,179	167	9
Benton	26,433	199	23	25,247	201	21
Linn	36,360	225	5	33,934	222	4
Marion	105,758	252	3	101,571	245	3
Yamhill	27,797	209	9	27,860	209	6

Source: Oregon Employment Department

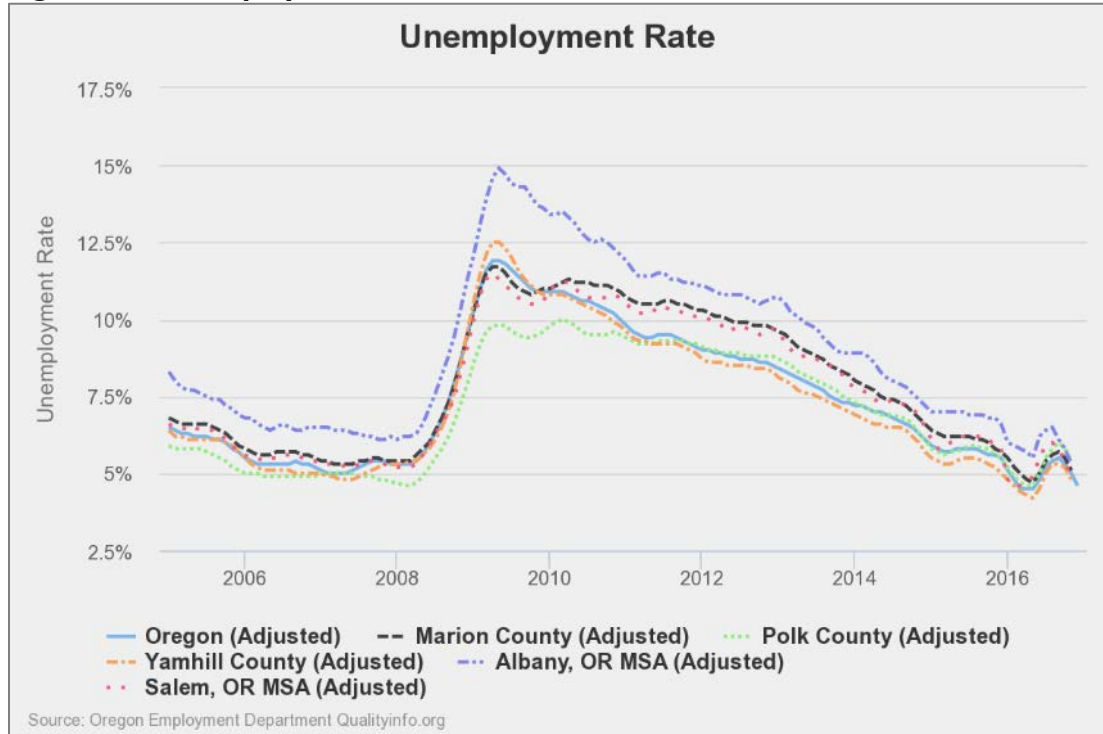
While illustrative, economic diversity is not a guarantor of economic vitality or resilience. Polk County, as of 2017, is not listed as an economically distressed community as prescribed by Oregon Law. The economic distress measure is based on indicators of decreasing new jobs, average wages and income, and is associated with an increase of unemployment.¹⁷

¹⁷ Business Oregon – Oregon Economic Data “Distressed Communities List”, <http://www.oregon4biz.com/Publications/Distressed-List/>

Employment and Wages

According to the Oregon Employment Department, unemployment has declined since 2009 (9.8%) and remains at a rate similar to the State of Oregon and other counties in the region (5.4%).

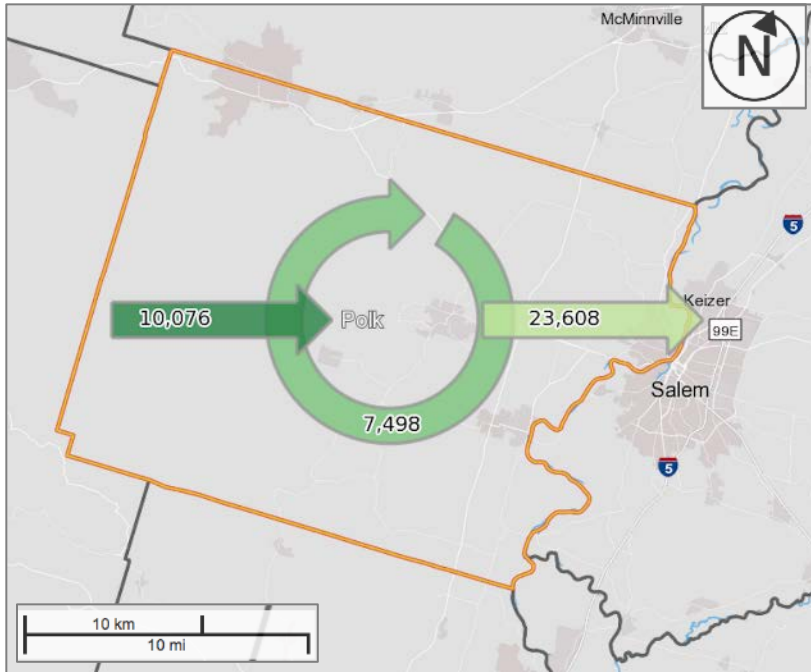
Figure B-3 Unemployment Rate



Source: Oregon Employment Department, "Local Area Employment Statistics" 2005-2016, Qualityinfo.org .

Polk County employers draw in more than 57% (10,076) of their workers from outside the county. The Polk County economy is a cornerstone of regional economic vitality. Figure B-4 shows the county's laborshed; the map shows that about 18% of workers live and work in the county (7,498), 25% of workers come from outside the county (10,076), and about 57% of residents work outside of the county (23,608).

Figure B-4 Polk County Laborshed



Source: U.S. Bureau of the Census, [On The Map](#).

Mitigation activities are needed at the business level to ensure the health and safety of workers and limit damage to industrial infrastructure. Employees are highly mobile, commuting from all over the surrounding area to industrial and business centers. As daily transit rises, there is an increased risk that a natural hazard event will disrupt the travel plans of residents across the region and seriously hinder the ability of the economy to meet the needs of Polk County residents and businesses.

Industry

Key industries are those that represent major employers and are significant revenue generators. Different industries face distinct vulnerabilities to natural hazards, as illustrated by the industry specific discussions below. Identifying key industries in the region enables communities to target mitigation activities towards those industries' specific sensitivities. It is important to recognize that the impact that a natural hazard event has on one industry can reverberate throughout the regional economy.

This is of specific concern when the businesses belong to the basic sector industry. Basic sector industries are those that are dependent on sales outside of the local community; they bring money into a local community via employment. The farm and ranch, information, and wholesale trade industries are all examples of basic industries. Non-basic sector industries are those that are dependent on local sales for their business, such as retail trade, construction, and health services.

Employment by Industry

Economic resilience to natural disasters is particularly important for the major employment industries in the region. If these industries are negatively impacted by a natural hazard, such that employment is affected, the impact will be felt throughout the regional economy. Thus, understanding and addressing the sensitivities of these industries is a strategic way to increase the resiliency of the entire regional economy.

The table below identifies Employment by industry. The top five industry sectors in Polk County with the most employees, as of 2015, are Local Government (3,536), Education and Health Services (2,659), Manufacturing (2,232), Trade, Transportation and Utilities (2,141), and Natural Resources and Mining (1,781). While Polk County has some basic industries, such as Manufacturing four out of the five largest industrial sectors are of the non-basic nature and thus they rely on local sales and services. Trending towards basic industries can lead to higher community resilience.

Table B-17 Total Employment by Industry 2015, Expected Growth 2024

Employment Sector	2015				Percent Change in Employment (2009-2015)	Employment Forecast* (2014-2024)
	Firms	Employees	Percent Workforce	Average Wage		
Total Payroll Employment	1,807	18,985	100%	\$ 33,896	14.9%	9.6%
Total Private	1,719	13,769	72.5%	\$ 31,121	15.4%	11.5%
Natural Resources and Mining	127	1,781	9.4%	\$ 31,983	15.5%	10.7%
Construction	186	840	4.4%	\$ 45,704	-14.3%	18.6%
Manufacturing	84	2,232	11.8%	\$ 38,003	18.3%	8.5%
Trade, Transportation & Utilities	232	2,141	11.3%	\$ 32,203	0.9%	8.4%
Information	18	54	0.3%	\$ 42,748	20.0%	0%
Financial Activities	143	435	2.3%	\$ 37,661	4.4%	5.0%
Professional and Business Services	222	1,127	5.9%	\$ 32,219	18.7%	16.7%
Education and Health Services	219	2,659	14.0%	\$ 31,421	21.0%	15.5%
Leisure and Hospitality	141	1,584	8.3%	\$ 14,511	27.0%	9%
Other Services	343	909	4.8%	\$ 19,579	53.8%	14.6%
Private Non-Classified	0	-	-	-	-	-
Government	88	5,216	27.5%	\$ 41,221	6.0%	2.9%
Federal	12	70	0.4%	\$ 52,460	-29.4%	-4.8%
State	11	1,609	8.5%	\$ 39,678	0.0%	4.2%
Local	64	3,536	18.6%	\$ 41,712	0.0%	2.3%

Source: Oregon Employment Department, "2009 and 2015 Covered Employment and Wages Summary Reports" and "Regional Employment Projections by Industry & Occupation 2014-2024". <http://www.qualityinfo.org>.

*Based on 2024 projections for Linn, Marion, Polk, and Yamhill counties – Department of Administrative Services

High Revenue Sectors

In 2012, the three sectors with the highest revenue were Manufacturing, Retail Trade, and Health Care & Social Assistance. The table below shows the revenue generated by each economic sector (Note: not all sectors are reported).

Polk County relies on both basic and non-basic sector industries and it is important to consider the effects each may have on the economy following a disaster. Basic sector businesses have a multiplier effect on a local economy that can spur the creation of new jobs, some of which may be non-basic. The presence of basic sector jobs can help speed the

local recovery; however, if basic sector production is hampered by a natural hazard event, the multiplier effect could be experienced in reverse. In this case, a decrease in basic sector purchasing power results in lower profits and potential job losses for the non-basic businesses that are dependent on them.

Table B-18 Revenue of Top Sectors in Polk County (Employer)

Sector Meaning (NAICS code)	Sector Revenue (\$1,000)
Manufacturing	\$ 424,650
Retail trade	\$ 360,670
Health care and social assistance	\$ 168,554
Transportation and warehousing	\$ 46,192
Professional, scientific, and technical services	\$ 36,222
Administrative and support and waste management and remediation services	\$ 26,321
Other services (except public administration)	\$ 25,738
Real estate and rental and leasing	\$ 19,399
Arts, entertainment, and recreation	\$ 4,599
Educational services	\$ 1,701
Utilities	Q
Information	N
Finance and insurance	N
Accommodation and food services	D

Source: U.S. Census Bureau, 2012 Economic Census, Table EC1200A1.

D = Withheld to avoid disclosing data for individual companies; data are included in higher level totals

N = Not available or not comparable

Q= Revenue not collected at this level of detail for multi-establishment firms

The *Manufacturing* sector was the largest revenue generator, generating \$424.6 million. It is highly dependent upon the transportation network in order to access supplies and send finished products to outside markets. As a base industry, manufacturers are not dependent on local markets for sales, which contribute to the economic resilience of this sector.

The *Retail Trade* sector generated \$360.7 million, making it the second largest earning sector in Polk County. The *Retail Trade* sector typically relies on local residents and tourists and their discretionary spending ability. Residents' discretionary spending diminishes after a natural disaster when they must pay to repair their homes and properties. In this situation, residents will likely concentrate their spending on essential items that would benefit some types of retail (e.g., grocery) but hurt others (e.g., gift shops). The potential income from tourists also diminishes after a natural disaster as people are deterred from visiting the impacted area. Retail trade is also largely dependent on wholesale trade and the transportation network for the delivery of good for sale. Disruption of the transportation system could have severe consequences for retail businesses. In summary, depending on the type and scale, a disaster could affect specific segments of retail trade, or all segments.

Health Care & Social Assistance generated about \$168.6 million. Health Care & Social Assistance has a broad client base, with families and non-families as the typical clientele. Health and social services will likely see an increase in demand after a natural disaster, as affected populations seek care and assistance. Functional operation of health and social

services may be negatively impacted by hazards and access to services by residents may be limited.

In the event that any of these primary sectors are impacted by a disaster, Polk County may experience a significant disruption of economic productivity.

Future Employment in Industry

Between 2009 and 2015, the sectors that experienced the largest percent growth were Other Services (53.8%), Leisure and Hospitality (27.0%), Education and Health Services (21.0%), Information (20.0%), and Professional and Business Services (18.7%). Some of these sectors often require more training and education, while others require less education and have lower wages. Education and Health Services (2,659 employees) and Local Government (3,536) are among the highest employers, Other Services (53.8%) and Leisure and Hospitality (27%) are the fastest growing, and Federal Government (\$52,460) and Construction (\$45,704) have the highest average wages.

Sectors that are anticipated to be major employers in the future also warrant special attention in the hazard mitigation planning process. As shown in Table B-17, between 2014 and 2024, the largest employment growth in the region is anticipated within Construction (18.6%), Professional and Business Services (16.7%), Education and Health Services (15.5%), and Other Services (14.6%); Federal Government is expected to continue to decline by almost 5%.¹⁸

Synthesis

The current and anticipated financial conditions of a community are strong determinants of community resilience, as a strong and diverse economic base increases the ability of individuals, families and the community to absorb disaster impacts for a quick recovery. Because Local Government, Education and Health Services, and Manufacturing are key to post-disaster recovery efforts, the region is bolstered by its major employment sectors. The county's economy is expected to grow by 2024, with much of the growth within the industries of Construction, Professional and Business Services, Education and Health Services, and Other Services. It is important to consider what might happen to the county economy if the largest revenue generators and employers are impacted by a disaster. Areas with less income equality, particularly in the smaller cities, higher housing costs, and overall low economic diversity are factors that may contribute to slower recovery from a disaster.

¹⁸ Oregon Employment Department, "Employment Projections by Industry and Occupations: 2014-2024 Oregon and Regional Summary", <https://www.qualityinfo.org/documents/10182/92203/Mid-Valley+Industry+Employment+Projections+2014-2024?version=1.5>, January 2017.

Built Environment Capacity

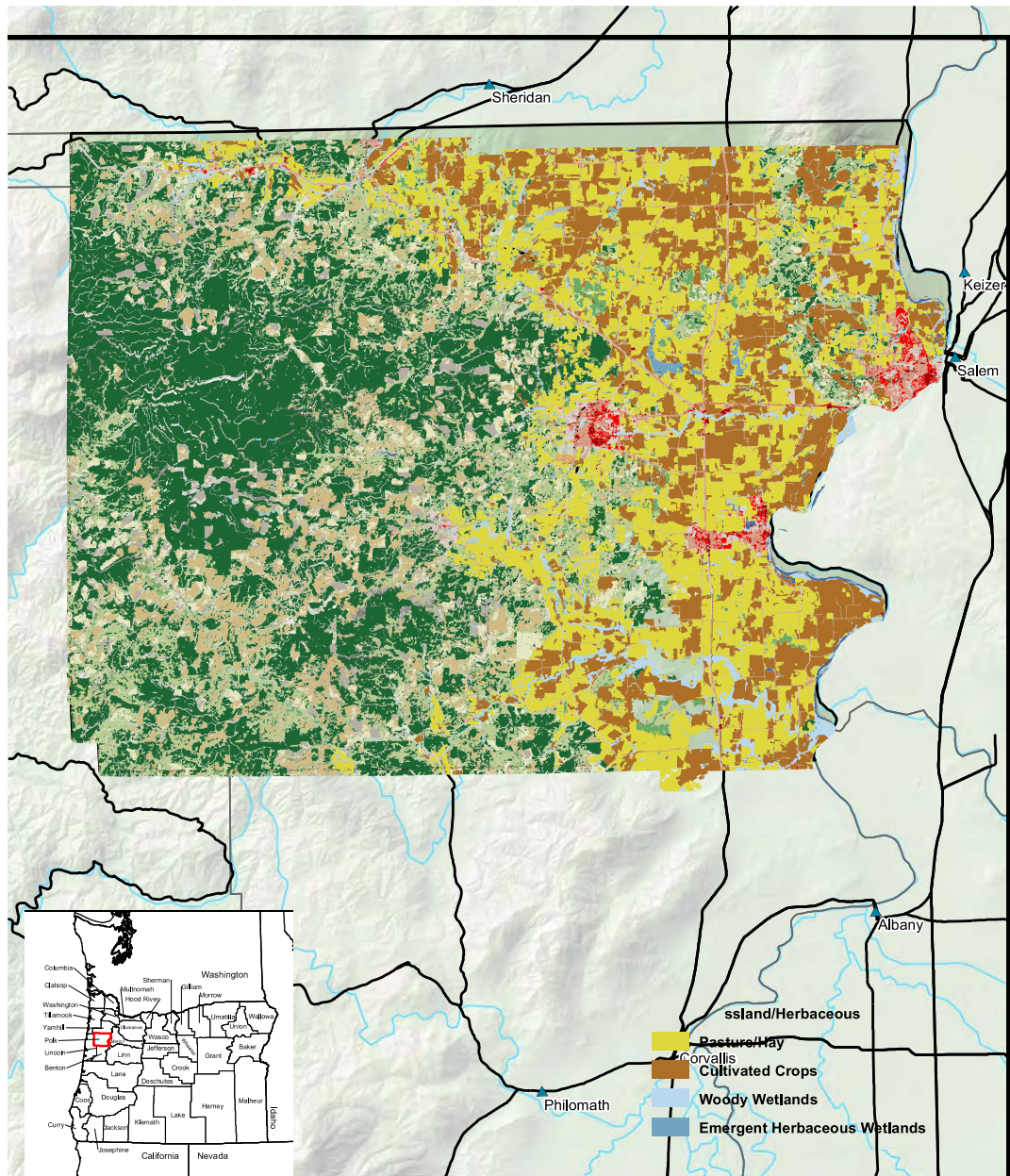
Built Environment capacity refers to the built environment and infrastructure that supports the community. The various forms, quantity, and quality of built capital mentioned above contribute significantly to community resilience. Physical infrastructures, including utility and transportation lifelines, are critical during a disaster and are essential for proper functioning and response. The lack or poor condition of infrastructure can negatively affect a community's ability to cope, respond and recover from a natural disaster. Following a disaster, communities may experience isolation from surrounding cities and counties due to infrastructure failure. These conditions force communities to rely on local and immediately available resources.

Land Use and Development Patterns

The Polk County Comprehensive Plan states that the vast majority of the County is devoted to private timber production with minimal federal, state, and county managed forested lands (see Map B-2). A very limited percentage of land is designated as High Density Use, approximately four percent. The county feels limited high density increases will occur around the four incorporated jurisdictions of Dallas, Falls City, Independence, and Monmouth. However, there is significant pressure to develop low density residential development. The County has designated two percent of its land area for such use.

One significant way in which Polk County residents can increase or decrease their vulnerability to natural hazards is through development patterns. The way in which land is used – is it a parking lot or maintained as an open space – will determine how closely the man-made systems of transportation, economy, etc., interact with the natural environment. All patterns of development, density as well as sprawl, bring separate sets of challenges for hazard mitigation.

Map B-2 Land Cover



Source: Polk County NHMP (2009).

Regulatory Context

Oregon land use laws require land outside Urban Growth Boundaries (UGBs) to be protected for farm, forest, and aggregate resource values. For the most part, this law limits the amount of development in the rural areas. However, the land use designation can change from resource protection in one of two ways:

- The requested change could qualify as an exception to Statewide Planning Goals, in which case the city must demonstrate to the State that the change meets requirements for an exception. These lands, known as exception lands, are predominantly designated for residential use.
- Resource land can also be converted to non-resource use when it can be demonstrated that the land is no longer suitable for farm or forest production.

Local and state policies currently direct growth away from rural lands into UGBs, and, to a lesser extent, into rural communities. If development follows historical development trends, urban areas will expand their UGBs, rural unincorporated communities will continue to grow, and overall rural residential density will increase slightly with the bulk of rural lands kept in farm and forest use. The existing pattern of development in the rural areas, that of radiating out from the urban areas along rivers and streams is likely to continue. Most of the “easy to develop” land is already developed, in general leaving more constrained land such as land in the floodplains or on steep slopes to be developed in the future, perhaps increasing the rate at which development occurs in natural hazard areas.

Since 1973, Oregon has maintained a strong statewide program for land use planning. The foundation of that program is a set of 19 statewide planning goals that express the state's policies on land use and on related topics, such as citizen involvement, land use planning, and natural resources.

Most of the goals are accompanied by "guidelines," which are suggestions about how a goal may be applied. Oregon's statewide goals are achieved through local comprehensive planning. State law requires each city and city to adopt a comprehensive plan and the zoning and land-division ordinances needed to put the plan into effect. The local comprehensive plans must be consistent with the statewide planning goals. Plans are reviewed for such consistency by the state's Land Conservation and Development Commission (LCDC). When LCDC officially approves a local government's plan, the plan is said to be "acknowledged." It then becomes the controlling document for land use in the area covered by that plan.

Goal 7

Goal 7: Areas Subject to Natural Disasters and Hazards has the overriding purpose to “protect people and property from natural hazards”. Goal 7 requires local governments to adopt comprehensive plans (inventories, policies and implementing measures) to reduce risk to people and property from natural hazards. Natural hazards include floods, landslides, earthquakes, tsunamis, coastal erosion, and wildfires.

To comply with Goal 7, local governments are required to respond to new hazard inventory information from federal or state agencies. The local government must evaluate the hazard risk and assess the:

- a) frequency, severity, and location of the hazard;
- b) effects of the hazard on existing and future development;
- c) potential for development in the hazard area to increase the frequency and severity of the hazard; and
- d) types and intensities of land uses to be allowed in the hazard area.

Local governments must adopt or amend comprehensive plan policies and implementing measures to avoid development in hazard areas where the risk cannot be mitigated. In addition, the siting of essential facilities, major structures, hazardous facilities and special occupancy structures should be prohibited in hazard areas where the risk to public safety cannot be mitigated. The state recognizes compliance with Goal 7 for coastal and riverine flood hazards by adopting and implementing local floodplain regulations that meet the minimum National Flood Insurance Program (NFIP) requirements.

In adopting plan policies and implementing measures for protection from natural hazards local governments should consider:

- a) the benefits of maintaining natural hazard areas as open space, recreation, and other low density uses;
- b) the beneficial effects that natural hazards can have on natural resources and the environment; and
- c) the effects of development and mitigation measures in identified hazard areas on the management of natural resources.

Local governments should coordinate their land use plans and decisions with emergency preparedness, response, recovery and mitigation programs. Given the numerous waterways, agricultural, and forest lands, special attention should be given to problems associated with river bank erosion and potential for wild land/urban interface fires.

Goal 7 guides local governments to give special attention to emergency access when considering development in identified hazard areas, including:

- a) Consider programs to manage stormwater runoff as a means to address flood and landslide hazards,
- b) Consider non-regulatory approaches to help implement the goal,
- c) When reviewing development requests in high hazard areas, require site specific reports, appropriate for the level and type of hazards. Site specific reports should evaluate the risk to the site, as well as the risk the proposed development may pose to other properties.
- d) Consider measures exceeding the National Flood Insurance Program.

Housing

In addition to location, the characteristics of the housing stock affect the level of risk posed by natural hazards. The table below identifies the types of housing most common throughout the county. Of particular interest are mobile homes, which account for about 7.4% of the housing in Polk County. Mobile homes are particularly vulnerable to certain natural hazards, such as windstorms, and special attention should be given to securing the structures, because they are more prone to wind damage than wood-frame construction. In other natural hazard events, such as earthquakes and floods, moveable structures like

mobile homes are more likely to shift on their foundations and create hazardous conditions for occupants.

Table B-19 Housing Profile

	Housing Units	Single Family		Multi-Family		Mobile Homes*	
		Estimate	Percent	Estimate	Percent	Estimate	Percent
Polk County	30,651	21,971	71.7%	6,425	21.0%	2,255	7.4%
Dallas	5,907	4,014	68.0%	1,528	25.9%	365	6.2%
Falls City	393	284	72.3%	2	0.5%	107	27.2%
Independence	3,200	1,912	59.8%	1,091	34.1%	197	6.2%
Monmouth	3,687	2,279	61.8%	1,249	33.9%	159	4.3%

Source: Social Explorer, Table 97, U.S. Census Bureau, 2011-2015 American Community Survey

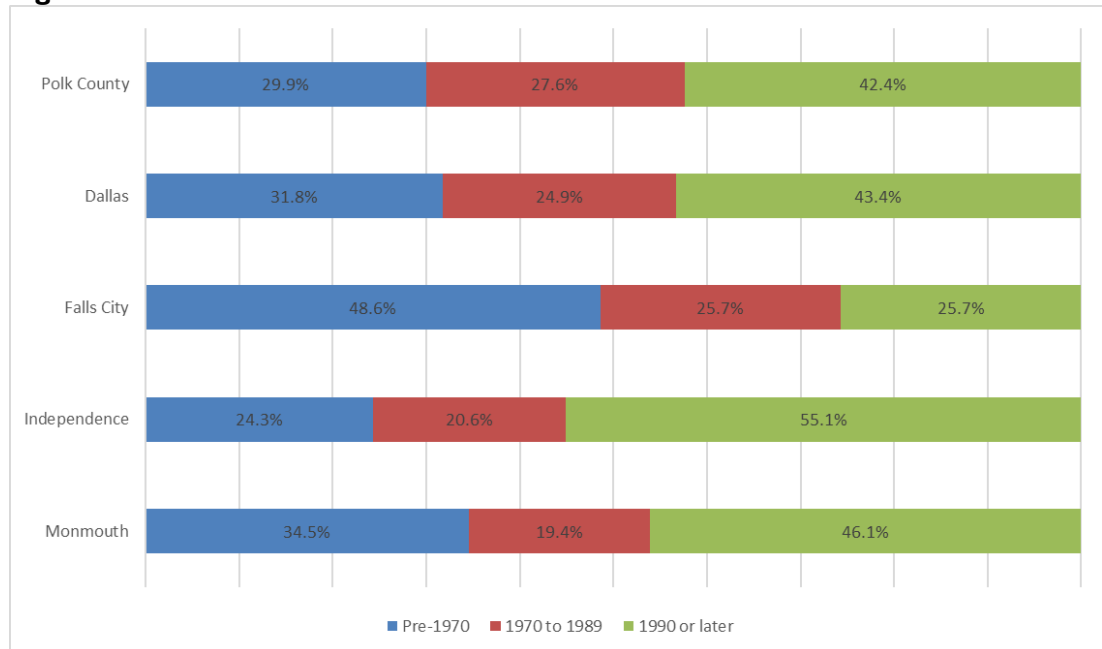
* Also includes boats, RVs, vans, etc. that are used as a residence.

Aside from location and type of housing, the year structures were built has implications. Seismic building standards were codified in Oregon building code starting in 1974; more rigorous building code standards were passed in 1993 that accounted for the Cascadia earthquake fault.¹⁹ Therefore, homes built before 1993 are more vulnerable to seismic events. Also in the 1970's, FEMA began assisting communities with floodplain mapping as a response to administer the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Upon receipt of floodplain maps, communities started to develop floodplain management ordinances to protect people and property from flood loss and damage.

As Figure B-5 shows, regionally, 29.9% of the county housing stock was built prior to 1970, before the implementation of floodplain management ordinances; however, Falls City has about one-half of its housing units built prior to 1970. Countywide, 57.5% of the housing stock was built before 1990 and the codification of seismic building standards.

¹⁹ State of Oregon Building Codes Division. *Earthquake Design History: A summary of Requirements in the State of Oregon*, February 7, 2012. http://www.oregon.gov/OMD/OEM/ossprac/docs/history_seismic_codes_or.pdf

Figure B-5 Year Structure Built



Source: U.S. Census Bureau, 2011-2015 American Community Survey Estimates, Table DP04

The National Flood Insurance Program’s (NFIP’s) Flood Insurance Rate Maps (FIRMs) delineate flood-prone areas. They are used to assess flood insurance premiums and to regulate construction so that in the event of a flood, damage minimized. The initial FIRMs for the county were created in 1978 (1981 for Falls City, 1988 for Dallas, Independence, and Monmouth), while the current FIRMs effective date for Polk County and cities is December 19, 2006. For more information about the flood hazard, NFIP, and FIRMs, please refer to Flood Hazard section of the Risk Assessment.

Infrastructure Profile

Infrastructure and critical facilities are vital to the continued delivery of key governmental and private services as well as recovery efforts. The loss of these services may cause serious secondary impact as well as significantly hamper the public’s ability to recover from a disaster event. Homeland Security Presidential Directive 7 calls out seventeen sectors as Critical Infrastructure and Key Resources that are “essential to the nation’s security, public health and safety, economic vitality, and way of life.” This section identifies critical infrastructure and key resources in Polk County. The sectors include:

Agriculture and food: This is a primarily private sector industry but includes both imported / exported food as well and what is grown in the county.

Banking and finance: For Polk County, this sector would include not only accounts payable /receivable and payroll, but social services provided to residents through community welfare programs.

Chemical: Manufacturing and agricultural processes can often require the use of chemicals and substances that would harm residents if air or water resources were contaminated.

Communications and Information technology: Phone lines, cell towers, broadcast internet, and radio and television signals are mediums for interpersonal connection, economic vitality, and emergency communications in the county. Additionally, and of importance to the region as much as to the county, weather stations such as the Valsetz site in the Coast Range of Polk County, can be quickly cut off by fire or earthquake. In the case of a crisis, the ability to transmit information between responders and to residents can mean the difference between life and death.

National Guard: The Oregon Military Department (Oregon National Guard) maintains the Polk County Readiness Center (12835 Westview Drive, Dallas - unincorporated Polk County).

Emergency services: 911 call centers and police and fire stations provide first responders for most hazard events and often become the base of response operations during prolonged hazard events. Population distribution and service areas as well as the availability and duplication of resources at each station can play a role in determining how, where, and when response and recovery are effective.

Table B-20 Critical Facilities: Emergency Response

Facility Name	Address/ City
<i>Polk County</i>	
Rickreall Fire Station	275 N Pacific Highway W, Rickreall
<i>Dallas</i>	
Dallas Police Department	187 SE Court Street, Dallas
Dallas Fire Department	910 SE Shelton, Dallas
Dallas Ambulance Service	SE Washington, Dallas
Polk County Sheriff's Office Headquarters	850 Main St, Dallas
Polk County Jail	884 SE Jefferson St, Dallas
Southwest Polk Rural Fire District	915 SE Shelton St, Dallas
<i>Falls City</i>	
Falls City Fire and Police Department	320 N Main Street, Falls City
<i>Independence</i>	
Independence Police Department	555 S Main St., Independence
Polk County Fire District #1 (Administration)	1800 Monmouth St, Independence
Polk County Fire District #1 (Station 40)	5979 Main St, Independence
<i>Monmouth</i>	
Monmouth Police Department	238 W Jackson Street, Monmouth
Oregon State Police	550 Monmouth Ave N, Monmouth
<i>Other</i>	
West Valley Fire District Station 8	825 NE Main St, Willamina

Note: Table is organized by location not by owner/ operator (except as noted). See Jurisdictional Addenda for additional detail.

Energy: In Polk County, electrical and gas utilities are provided by both private companies and some smaller cooperatives. Organizing mitigation across these diverse organizational structures and philosophies will ensure that services are provided equitably, even if a hazard incident stresses the supply or demand. Critical infrastructure includes power substations, gas-lines, and both underground and above ground transmission lines.

Governmental facilities: Every day, community leaders and residents rely on the buildings that house essential governmental functions: City Halls, Court Houses, public works buildings and more. Protecting and reinforcing these facilities will facilitate the return to “business as usual” after a hazard event. The following government buildings are considered critical facilities:

Table B-21 Critical Facilities: Government

Facility Name	Address/ City
Polk County	
Polk County Fairgrounds	520 S Pacific Highway, Rickreal
Polk County Human Services (W. Salem)	1520 Plaza Street NW, Salem
Dallas	
Dallas City Hall/ Civic Center/ Police Department	187 SE Court St, Dallas
Polk County Courthouse/Sheriff’s Office	850 Main St, Dallas
Polk County Public Works	820 SW Ash St, Dallas
Polk County Human Services/ Extension Services	182 SW Academy St, Dallas
Agricultural, Polk Soil, Farm Home Administration/ USDA	289 E Ellendale, Dallas
Oregon Volunteer Services	177 SW Oak, Dallas
Adult and Family Services	77 SW Clay, Dallas
Falls City	
City Hall	299 Mill Street, Falls City
Independence	
Independence City Hall/ Police Station	240 Monmouth St, Independence
Public Works	160 G Street, Independence
Monmouth	
Monmouth City Hall	151 W Main Street , Monmouth
Monmouth Public Works / Public Utilities	401 N Hogan Road, Monmouth
Polk County Human Services (Monmouth)	1310 Main Street East, Monmouth

Note: Table is organized by location not by owner/ operator (except as noted). See Jurisdictional Addenda for additional detail.

Schools: Schools are occupied by vulnerable younger populations and may also be used as emergency shelters during hazard events. The following school districts are within the county (for a list of locations see the Earthquake profile within Section 2, *Risk Assessment*).²⁰:

- Dallas School District 2 (6 schools)
- Falls City School District 57 (2 schools)
- Central School District 13J (5 schools)
- Willamina School District 30J (2 schools)

²⁰ "School District Maps." *Polk County Oregon Official Website*. Polk County, n.d. Web. 10 Aug. 2016.

- Perrydale School District 21 (3 schools)
- Charter Schools

Healthcare and public health: Hospitals, clinics, and shelters often play a critical role in the immediate aftermath of a hazard incident in saving lives and keeping residents safe. In addition to satellite clinics, doctors’ offices, and urgent care facilities. The following healthcare, care facilities are considered critical:

Table B-22 Critical Facilities: Healthcare/ Care Facilities

Facility Name	Address/ City
Polk County	
None noted	
Dallas	
Hospital: Salem Health West Valley	525 SE Washington Street, Dallas
Oregon Adult and Family Services	770 SW Clay Street, Dallas
Dallas Retirement Village	340 NW Brentwood Ave, Dallas
Falls City	
See city addendum.	
Independence	
See city addendum.	
Monmouth	
See city addendum.	

Note: Table is organized by location not by owner/ operator (except as noted). See Jurisdictional Addenda for additional detail.

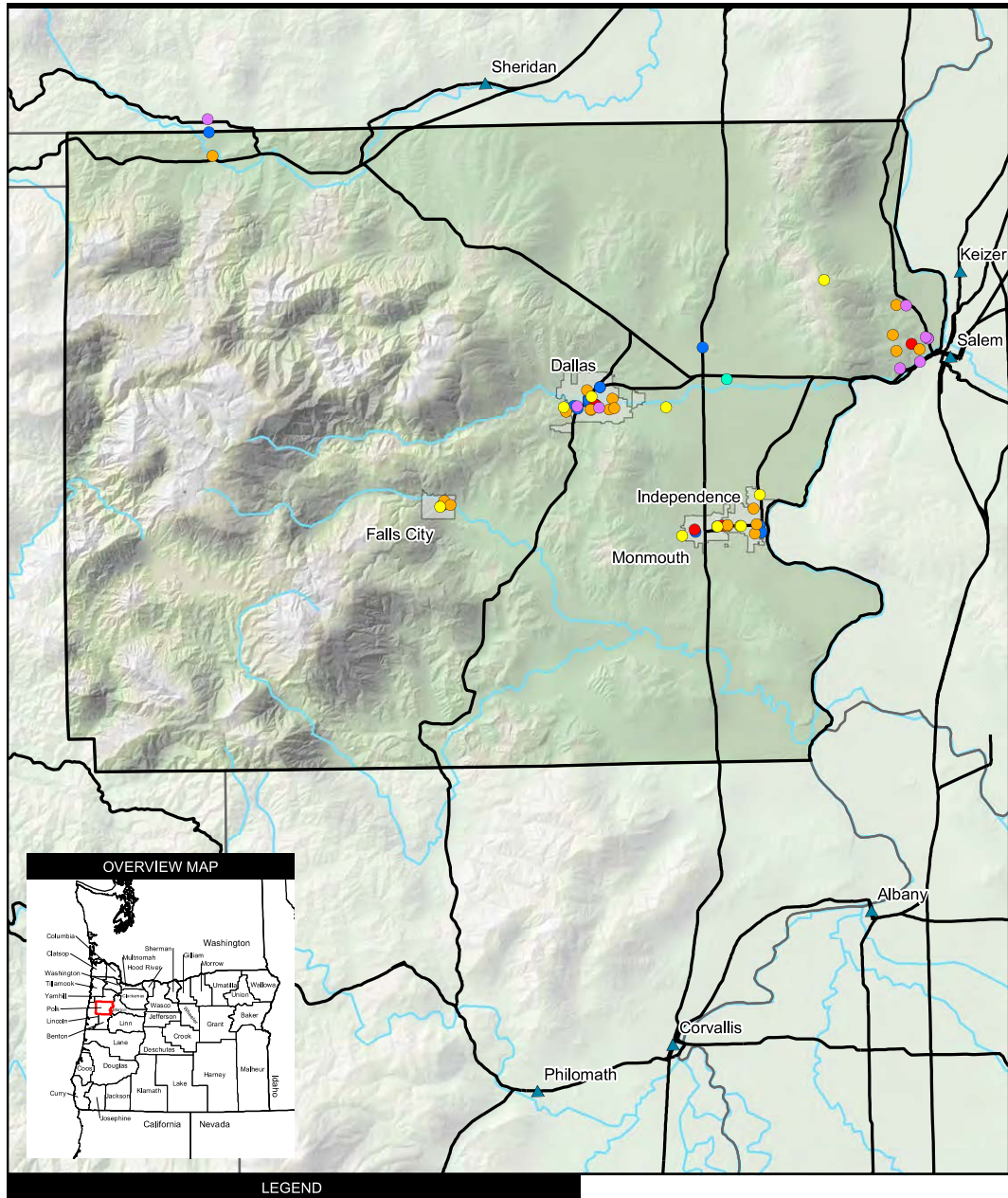
Transportation systems: Urban Polk County meets its current transportation needs through a mixture of municipal road systems, county roads, and state and federal highways. Major highways in the county include Oregon Route 99W, which runs from north to south, linking the cities of McMinnville and Corvallis, and Oregon Route 22, running east to west and connecting Salem to the coast. Oregon Route 223 branches west from Rickreall and connects Dallas to Wren along Interstate 20 to the south. Oregon Route 194 spans a 7.5-mile connection from east to west between Monmouth and Oregon Route 223.

Cycling / pedestrian paths are used both for commuting and recreation and their bridges and overpasses connect communities in crucial ways. Through Salem-Keizer Transit, the CARTS program (Chemeketa Area Regional Transportation System) connects rural Marion and Polk counties across five bus lines. The CARTS 40 bus line connects to the cities of Dallas, Independence and Monmouth while CARTS 50 connects to Rickreall and Dallas. Falls City is not directly serviced by any routes within the Salem-Keizer Transit system²¹.

In Polk County, rail lines and bridges are more vulnerable to impacts from flood and earthquake as even minor shifts in their alignment can render them unusable and stop the flow of civilian and emergency service traffic on either side of the affected area.

²¹ "CARTS: Connecting Rural Marion and Polk Counties." CARTS. Salem-Keizer Transit, n.d. Web. 10 Aug. 2016.

Map B-3 Critical Facilities



Source: Polk County NHMP (2009).

Utilities/ Water: In Polk County, water resources are abundant yet fragile and can even be dangerous. Water resources are susceptible to pollution from runoff or toxic spills. Low rain years can increase the risk of drought in the summer while intense periods of rain can bring

floods or landslides. Rivers and their tributaries can only be managed so much by dams and culverts. Responsible development in the floodplain and throughout the county that maintains and supports and natural drainage system can help protect water resources.

A major valuable asset within the county is the series of water treatment plants. Many of these facilities rely on power to pump and purify water or have storage tanks that sit vulnerable to earthquakes without retrofit or on unstable soil. Additionally, the vulnerability of septic systems may be heightened in more rural areas due to power failures, severe weather, and earthquake.

Physical infrastructure such as dams, levees, roads, bridges, railways and airports support Polk County communities and economies. Due to the fundamental role that physical infrastructure plays both in pre- and post-disaster, they deserve special attention in the context of creating resilient communities.

Utility systems such as potable water, wastewater, natural gas, telecommunications, and electric power are all networked systems. That is, they consist of nodes and links. Nodes are centers where something happens - such as a pumping plant, a treatment plant, a substation, a switching office and the like. Links are the connections (pipes or lines) between nodes. The following utilities are considered critical:

Table B-23 Critical Facilities/ Infrastructure: Utilities

Facility Name	Address/ City
Polk County	
Polk County Communications Sites/ Towers	-
Dallas	
Pacific Power and Light	583 SE Jefferson, Dallas
Dallas Sewer Lagoon	Bowersville Road, Dallas
Dallas Water Reservoir	Reservoir Road, Dallas
Falls City	
See city addendum	
Independence	
Independence Water Tower	1180 Monmouth Street, Independence
Pacific Power & Light Sub Station	1150 Monmouth Street, Independence
Independence Water Wells	off Hannah Road, Independence
Sewage Lagoon and Pump Station	Riverside Park, Independence
Monmouth	
Monmouth Water Tower	Cupids Knoll, Monmouth
Monmouth Power (Bonneville sub.)	Monmouth
Monmouth Public Works/Public Utilities	401 N Hogan Rd, Monmouth
Monmouth Water Wells	Across Independence Bridge (Marion Co.)

Note: Table is organized by location not by owner/ operator (except as noted). See Jurisdictional Addenda for additional detail.

Dams: These critical infrastructure pieces not only protect water resources that are used for drinking, agriculture, and recreation, but they protect downstream development from inundation. Dams may also be multifunction, serving two or more of these purposes.

The National Inventory of Dams, NID, which is maintained by the United States Army Corps of Engineers, is a database of approximately 76,000 dams in the United States. The NID does not include all dams in the United States. Rather, the NID includes dams that are deemed to have a high or significant hazard potential and dams deemed to pose a low hazard if they meet inclusion criteria based on dam height and storage volume. Low hazard potential dams are included only if they meet either of the following selection criteria:

- exceeds 25 feet in height and 15 acre-feet of storage, or
- exceeds 6 feet in height and 50-acre feet of storage.

There are many thousands of dams too small to meet the NID selection criteria. However, these small dams are generally too small to have significant impacts if they fail and thus are generally not considered for purposes of risk assessment or mitigation planning.

This NID potential hazard classification is solely a measure of the probable impacts if a dam fails. Thus, a dam classified as High Potential Hazard does not mean that the dam is unsafe or likely to fail. The level of risk (probability of failure) of a given dam is not even considered in this classification scheme. Rather, the High Potential Hazard classification simply means that there are people at risk downstream from the dam in the inundation area, if the dam were to fail.

Dams assigned the low hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the dam owner's property.

Dams assigned to the significant hazard potential classification are those where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, or disruption of lifeline facilities. Significant hazard potential dams are often located in predominantly rural or agricultural areas.

Dams assigned to the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life. Failure of dams in the high classification will generally also result in economic, environmental or lifeline losses, but the classification is based solely on probable loss of life.

The Oregon Water and Resources Department maintains an inventory of all dams located in Oregon. There are two dams categorized as high hazard in Polk County Croft Reservoir located on Gibson Gulch, and Mercer Reservoir located on Rickreall Creek. There are also seven (7) dams categorized as significant hazard and 52 low hazard dams.

Table B-24 Polk County Dam Inventory

Threat Potential	Number of	
	Dams	River (Dam)
High	2	Gibson Gulch (Croft Reservoir); Rickreall Creek (Mercer Reservoir)
Significant	7	Gooseneck Creek (Mt. Springs Ranch Dam); Berry Creek (Kennel Reservoir); Ash Swale (Olson Reservoir, Deraeve Reservoir #1); Tributary to Ash Creek (Koning "E" Reservoir); Tributary to King Creek (Eola Hills Reservoir); Tributary to South Yamhill River (Shaffer Reservoir)
Low	52	-
Total	61	

Source: Oregon Water Resources Department, "Dam Inventory Query"

Dam failures can occur at any time in a dam’s life; however, failures are most common when water storage for the dam is at or near design capacity. At high water levels, the water force on the dam is higher and several of the most common failure modes are more likely to occur. Correspondingly, for any dam, the probability of failure is much lower when water levels are substantially below the design capacity for the reservoir.

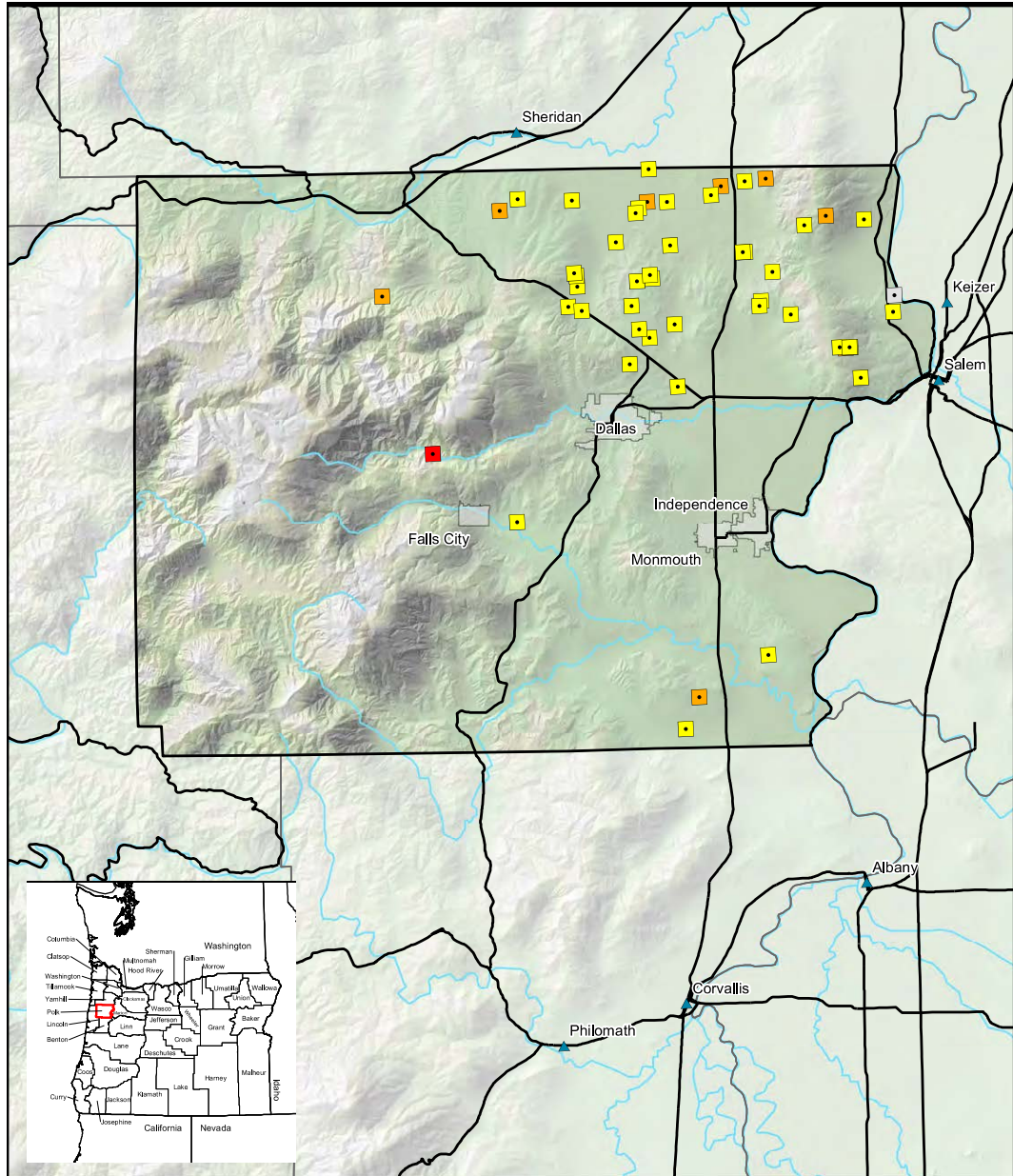
For embankment dams, the most common failure mode is erosion of the dam during prolonged periods of rainfall and flooding. When dams are full and water inflow rates exceed the capacity of the controlled release mechanisms (spillways and outlet pipes), overtopping may occur. When overtopping occurs, scour and erosion of either the dam itself and/or of the abutments may lead to partial or complete failure of the dam. Especially for embankment dams, internal erosion, piping or seepage through the dam, foundation, or abutments can also lead to failure. For smaller dams, erosion and weakening of dam structures by growth of vegetation and burrowing animals is a common cause of failure.

For embankment dams, earthquake ground motions may cause dams to settle or spread laterally. Such settlement does not generally lead, by itself, to immediate failure. However, if the dam is full, relatively minor amounts of settling may cause overtopping to occur, with resulting scour and erosion that may progress to failure. For any dam, improper design or construction or inadequate preparation of foundations and abutments can also cause failures. Improper operation of a dam, such as failure to open gates or valves during high flow periods can also trigger dam failure. For any dam, unusual hydrodynamic (water) forces can also initiate failure. Landslides into the reservoir, which may occur on their own or be triggered by earthquakes, may lead to surge waves which overtop dams or hydrodynamic forces which cause dams to fail under the unexpected load. Earthquakes can also cause seiches (waves) in reservoirs that may overtop or overload dam structures. In rare cases, high winds may also cause waves that overtop or overload dam structures.

Concrete dams are also subject to failure due to seepage of water through foundations or abutments. Dams of any construction type are also subject to deliberate damage via sabotage or terrorism. For waterways with a series of dams, downstream dams are also subject to failure induced by the failure of an upstream dam. If an upstream dam fails, then downstream dams also fail due to overtopping or due to hydrodynamic forces.

Dam failures can occur rapidly and with little warning. Fortunately, most failures result in minor damage and pose little or no risk to life safety. However, the potential for severe damage still exists.

Map B-4 Dam Location



Source: Polk County NHMP (2009).

Bridges: Because of earthquake risk, the seismic vulnerability of the county’s bridges is an important issue. Non-functional bridges can disrupt emergency operations, sever lifelines, and disrupt local and freight traffic. These disruptions may exacerbate local economic losses if industries are unable to transport goods. The county’s bridges are part of the state and interstate highway system that is maintained by the Oregon Department of Transportation (ODOT) or that are part of regional and local systems that are maintained by the region’s counties and cities.

The bridges in Polk County require ongoing management and maintenance due to the age and types of bridges. Modern bridges, which require minimum maintenance and are designed to withstand earthquakes, consist of pre-stressed reinforced concrete structures set on deep steel piling foundations.

The table below shows the structural condition of bridges in the region. A distressed bridge is a condition rating used by the Oregon Department of Transportation (ODOT) indicating that a bridge has been identified as having a structural or other deficiency, while a deficient bridge is a federal performance measure used for non-ODOT bridges; the ratings do not imply that a bridge is unsafe.²² The table shows that the county has a lower percentage of bridges that are distressed and/ or deficient (19.6%), than does the state (21.3%). About 12.5% of the county and 30.8 % of the city owned bridges within Polk county are distressed, compared to 28.0% of State Owned (ODOT) bridges.

Table B-25 Bridge Inventory

	Bridge Condition	Oregon	Region 3	Polk
State Owned	Distressed	610	118	14
	Sub-total	2,718	610	51
	Percent Distressed	22.4%	19.3%	28.0%
County Owned	Deficient	633	194	11
	Sub-total	3,420	942	88
	Percent Distressed	18.5%	20.6%	12.5%
City Owned	Deficient	160	44	4
	Sub-total	614	208	13
	Percent Deficient	26.1%	21.2%	30.8%
Other Owned	Deficient	40	6	1
	Sub-total	115	24	2
	Percent Deficient	34.8%	25.0%	50.0%
Area Total (All Owners)	Deficient	1,443	362	30
	Sub-total	6,769	1,741	153
	Percent Deficient	21.3%	20.8%	19.6%
Historic Covered		334	71	6

Source: Oregon Department of Transportation, 2014; Oregon Department of Transportation (2013), Oregon’s Historic Bridge Field Guide

²² Oregon. Bridge Engineering Section (2012). 2012 Bridge Condition Report. Salem, Oregon: Bridge Section, Oregon Department. of Transportation.

Note: ODOT bridge classifications overlap and sub-total is not used to calculate percent distressed, calculation for ODOT distressed bridges accounts for this overlap.

Utility lifelines: are the resources that the public relies on daily, (i.e., electricity, fuel and communication lines). If these lines fail or are disrupted, the essential functions of the community can become severely impaired. Utility lifelines are closely related to physical infrastructure, (i.e., dams and power plants) as they transmit the power generated from these facilities.

Most of the natural gas Oregon uses originates in Alberta, Canada. Northwest Natural Gas owns the main natural gas transmission pipeline. The network of transmission lines running through the county may be vulnerable to severe, but infrequent natural hazards, such as windstorm, winter storms, and earthquakes.

Seismic lifeline routes help maintain transportation facilities for public safety and resilience in the case of natural disasters. Following a major earthquake, it is important for response and recovery agencies to know which roadways are most prepared for a major seismic event. The Oregon Department of Transportation has identified lifeline routes to provide a secure lifeline network of streets, highways, and bridges to facilitate emergency services response after a disaster.²³

System connectivity and key geographical features were used to identify a three-tiered seismic lifeline system. Routes identified as Tier 1 are considered the most significant and necessary to ensure a functioning statewide transportation network. The Tier 2 system provides additional connectivity to the Tier 1 system, it allows for direct access to more locations and increased traffic volume capacity. The Tier 3 lifeline routes provide additional connectivity to the systems provided by Tiers 1 and 2.

The Lifeline Routes in the Valley Geographic Zone (which includes Polk County) consist of the following:

- Tier I: none in Polk County
- Tier II: OR 99W
- Tier III: OR 22 from OR 99W to Salem

Confederated Tribes of Grande Ronde

Confederated Tribes of Grande Ronde maintain their own services that are on tribal trust lands. Their facilities include the Confederated Tribes of the Grand Ronde Governness Building (9615 Grand Ronde Road, Grand Ronde) and Spirit Mountain Casino (27100 Salmon River Hwy, Grand Ronde).

Synthesis

The planning considerations seemingly most significant for the county are contingency planning for medical resources and lifeline systems due to the imminent need for these resources. As mentioned above, functionality of hospitals and dependent care facilities are a

²³ CH2MHILL, Prepared for Oregon Department of Transportation. Oregon Seismic Lifeline Routes Identification Project, *Lifeline Selection Summary Report*, May 15 2012.

significant priority in providing for Polk County residents. One factor that is critical to consider in planning is the availability of medical beds in local hospitals and dependent care facilities. In the event of a disaster, medical beds may be at a premium providing not just for the growing elderly population, but the entire county. Some of these facilities may run at almost full capacity on a daily basis, hospitals should consider medical surge planning and develop memorandums with surrounding counties for medical transport and treatment. Other facilities to consider are utility lifelines and transportation lifelines such as, airports, railways, roads and bridges with surrounding counties to acquire utility service and infrastructure repair.

While these elements are traditionally recognized as part of response and recovery from a natural disaster, it is essential to start building relationships and establishing contractual agreements with entities that may be critical in supporting community resilience.

Community Connectivity Capacity

Community connectivity capacity places strong emphasis on social structure, trust, norms, and cultural resources within a community. In terms of community resilience, these emerging elements of social and cultural capital will be drawn upon to stabilize the recovery of the community. Social and cultural capitals are present in all communities; however, it may be dramatically different from one city to the next as these capitals reflect the specific needs and composition of the community residents.

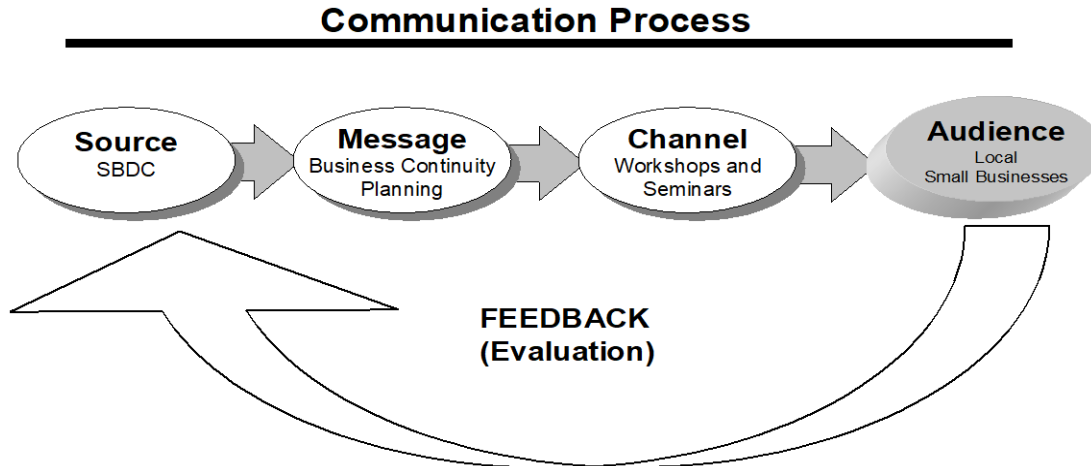
Social Systems and Service Providers

Social systems include community organizations and programs that provide social and community-based services, such as employment, health, senior and disabled services, professional associations and veterans' affairs for 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, etc.). 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 presence of these services are more predominantly located in urbanized areas of the county, this is synonymous with the general urbanizing trend of local residents.

The following is a brief explanation of how the communication process works and how the community's existing social service providers could be used to provide natural hazard related messages to their clients.

- There are five essential elements for communicating effectively to a target audience:
- The source of the message must be credible,
- The message must be appropriately designed,
- The channel for communicating the message must be carefully selected,
- The audience must be clearly defined, and
- The recommended action must be clearly stated and a feedback channel established for questions, comments and suggestions.

Figure B-6 Communication Process



Source: Adapted from the U.S. Environmental Protection Agency Radon Division’s outreach program

The following table provides a list of existing social systems within Polk County. The table provides 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 identified in the table 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.

The information provided in the table can also be used to complete action item worksheets by identifying potential coordinating agencies and internal and external partners.

Civic Engagement

Civic engagement and involvement in local, state and national politics are important indicators of community connectivity. Those who are more invested in their community may have a higher tendency to vote in political elections. The 2016 Presidential General Election resulted in 80.2% voter turnout in the county.²⁴ These results are relatively equal to voter participation reported across the State (80.3%).²⁵ Other indicators such as volunteerism, participation in formal community networks and community charitable contributions are examples of other civic engagement that may increase community connectivity.

²⁴ Oregon Blue Book, Voter Participation, <http://sos.oregon.gov/elections/Documents/statistics/participation-stats-11-2016.pdf>

²⁵ Ibid.

Cultural Resources: The cultural and historic heritage of a community is more than just tourist charm. For families that have lived in the county for generations and new resident alike, it is the unique places, stories, and annual events that make Polk County an appealing place to live. The cultural and historic assets in the county are both intangible benefits and obvious quality-of-life- enhancing amenities. Mitigation actions to protect these assets span many of the other systems already discussed. Some examples of that overlap could be seismic retrofit (preserving historic buildings and ensuring safety) or expanding protection of wetlands (protect water resources and beautify the county).

As part of the public outreach survey, county residents catalogued numerous cultural and historic assets including:

Parks and recreational facilities: Ballston Park, Buell Park, Buena Vista Park, Eola Heights Park, Mill Creek Park, Nesmith Park, Ritner Creek Park, Ritner Creek Bridge, Social Security Fishing Hole, Dallas Aquatic Center.

Environmental attractions: Valley of the Giants Nature Preserve, Baskett Slough National Wildlife Refuge.

Historic buildings and places: Beulah Methodist Episcopal Church; Brunk, Harrison, House; Cooper, James s. and Jennie M., House; Craven, Joseph and Priscilla, House; Davidson, Dr. John E. and Mary D., House; Domes, Walter J., House; Eldridge, Kersey C., House; Fort Yamhill Site; Graves-Fisher-Strong House; Harritt, Jesse and Julia, House; Howell, John W., House; Independence Historic District; Independence National Bank (Citizens Valley Bank); Parker School; Phillips, John, House; Polk County Bank; Pumping Station Bridge; Riley-Cutler House; Ritner Creek Bridge; Saint Patrick’s Roman Catholic Church (Methodist Episcopal Church, South); Sherman, Eleanor, House; Spring Valley Presbyterian Church; Well, George A., Jr., House; West Salem City Hall, Old (West Salem Library Building); Wheeler, J. A., House; Wilson, A.K., Building (Stafrin Drug Store/Greenwood Building)²⁶.

Public gathering places: Rock Creek campus, Cedar Mill library, Rock Creek Tavern.

Community Stability

Community stability is a measure of rootedness in place. It is hypothesized that resilience to a disaster stems in part from familiarity with place, not only for navigating the community during a crisis, but also accessing services and other supports for economic or social challenges.²⁷

Residential Geographic Stability

The table below estimates residential stability across the region. It is calculated by the number of people who have lived in the same house and those who have moved within the same county a year ago, compared to the percentage of people who have migrated into the region. Polk County overall has a geographic stability rating of about 89.2% (i.e., 89.2% of the population lived in the same house or moved within the county). Falls City has the

²⁶ "Oregon Historic Sites Database." Oregon Historic Sites Database. Accessed August 10, 2016. <http://heritagedata.prd.state.or.us/historic/>.

²⁷ Cutter, Susan, Christopher Burton, Christopher Emrich. "Disaster Resilience Indicators for Benchmarking Baseline Conditions". Journal of Homeland Security and Emergency Management.

highest geographic stability (92.8%) while Monmouth has the lowest (76.8%, due in large part to Western Oregon University). Countywide, about 11% of residents in 2015 lived outside of Polk County one year before.

Table B-26 Regional Residential Stability

Jurisdiction	Population	Geographic Stability	Same House	Moved Within Same County
Polk	76,484	89.2%	80.9%	8.3%
Dallas	14,631	90.7%	77.7%	13.0%
Falls City	988	92.8%	87.6%	5.2%
Independence	8,631	89.2%	77.8%	11.4%
Monmouth	9,823	76.8%	61.5%	15.3%

Source: Social Explorer, Table 130, U.S. Census Bureau, 2011-2015 American Community Survey Estimates

Homeownership

Housing tenure describes whether residents rent or own the housing units they occupy. Homeowners are typically more financially stable but are at risk of greater property loss in a post-disaster situation. People may rent because they choose not to own, they do not have the financial resources for home ownership, or they are transient.

Collectively, about 64.3% of the occupied housing units in Polk County are owner-occupied; about 35.7% are renter occupied. Falls City (82.9%) has the highest rate of owner-occupied units. Monmouth (51.7%) and Independence (45.1%) have the highest rate of renter-occupied households. Falls City (9.2%) and Independence (8.4%) have the highest vacancy rates within the county. In addition, seasonal or recreational housing accounts for approximately 11% of the county's vacant housing stock.²⁸

Table B-27 Housing Tenure and Vacancy

	Housing Units	Owner-occupied		Renter-occupied		Vacant [^]	
		Estimate	Percent	Estimate	Percent	Estimate	Percent
Polk County	30,651	18,292	64.3%	10,166	35.7%	1,944	6.3%
Dallas	5,907	3,595	63.4%	2,072	36.6%	228	3.9%
Falls City	393	296	82.9%	61	17.1%	36	9.2%
Independence	3,200	1,610	54.9%	1,322	45.1%	268	8.4%
Monmouth	3,687	1,690	48.3%	1,810	51.7%	172	4.7%

Source: Social Explorer, Table 94, U.S. Census Bureau, 2011-2015 American Community Survey Estimates

* = Functional vacant units, computed after removing seasonal, recreational, or occasional housing units from vacant housing units.

According to Cutter, wealth increases resiliency and recovery from disasters. Renters often do not have personal financial resources or insurance to assist them post-disaster. On the other hand, renters tend to be more mobile and have fewer assets at risk of natural

²⁸ U.S. Census Bureau, 2011-2015 American Community Survey Estimates, Table B25004.

hazards.²⁹ In the most extreme cases, renters lack sufficient shelter options when lodging becomes uninhabitable or unaffordable post-disaster.

Synthesis

Polk County has distinct social and cultural resources that work in favor to increase community connectivity and resilience. Sustaining social and cultural resources, such as social services and cultural events, may be essential to preserving community cohesion and a sense of place. The presence of larger communities makes additional resources and services available for the public. However, it is important to consider that these amenities may not be equally distributed to the rural portions of the county and may produce implications for recovery in the event of a disaster.

In the long-term, it may be of specific interest to the county to evaluate community stability. A community experiencing instability and low homeownership may hinder the effectiveness of social and cultural resources, distressing community coping and response mechanisms.

²⁹ Cutter, S. L. (2003). Social Vulnerability to Environmental Hazards. *Social Science Quarterly*.

Political Capacity

Political capacity is recognized as the government and planning structures established within the community. In terms of hazard resilience, it is essential for political capital to encompass diverse government and non-government entities in collaboration; as disaster losses stem from a predictable result of interactions between the physical environment, social and demographic characteristics and the built environment.³⁰ Resilient political capital seeks to involve various stakeholders in hazard planning and works towards integrating the Natural Hazard Mitigation Plan with other community plans, so that all planning approaches are consistent.

Regulatory Context: Oregon Statewide Planning Goal 7

Since 1973, Oregon has maintained a strong statewide program for land use planning. The foundation of that program is a set of 19 statewide planning goals that express the state's policies on land use and on related topics, such as citizen involvement, land use planning, and natural resources.

Most of the goals are accompanied by "guidelines," which are suggestions about how a goal may be applied. Oregon's statewide goals are achieved through local comprehensive planning. State law requires each city and county to adopt a comprehensive plan and the zoning and land-division ordinances needed to put the plan into effect. The local comprehensive plans must be consistent with the statewide planning goals. Plans are reviewed for such consistency by the state's Land Conservation and Development Commission (LCDC). When LCDC officially approves a local government's plan, the plan is said to be "acknowledged." It then becomes the controlling document for land use in the area covered by that plan.

Statewide Planning Goal 7

Goal 7: Areas Subject to Natural Disasters and Hazards has the overriding purpose to "protect people and property from natural hazards." Goal 7 requires local governments to adopt comprehensive plans (inventories, policies and implementing measures) to reduce risk to people and property from natural hazards. Natural hazards include floods, landslides, earthquakes, tsunamis, coastal erosion, and wildfires.

To comply with Goal 7, local governments are required to respond to new hazard inventory information from federal or state agencies. The local government must evaluate the hazard risk and assess the:

- frequency, severity, and location of the hazard;
- effects of the hazard on existing and future development;
- potential for development in the hazard area to increase the frequency and severity of the hazard; and
- types and intensities of land uses to be allowed in the hazard area.

³⁰ Mileti, D. 1999. *Disaster by Design: a Reassessment of Natural Hazards in the United States*. Polk D.C.: Joseph Henry Press.

Local governments must adopt or amend comprehensive plan policies and implementing measures to avoid development in hazard areas where the risk cannot be mitigated. In addition, the siting of essential facilities, major structures, hazardous facilities and special occupancy structures should be prohibited in hazard areas where the risk to public safety cannot be mitigated. The state recognizes compliance with

Goal 7 for coastal and riverine flood hazards by adopting and implementing local floodplain regulations that meet the minimum National Flood Insurance Program (NFIP) requirements.

Goal 7 Planning Guidelines

- In adopting plan policies and implementing measures for protection from natural hazards, local governments should consider:
 - the benefits of maintaining natural hazard areas as open space, recreation, and other low density uses;
 - the beneficial effects that natural hazards can have on natural resources and the environment; and
 - the effects of development and mitigation measures in identified hazard areas on the management of natural resources.
- Local governments should coordinate their land use plans and decisions with emergency preparedness, response, recovery and mitigation programs.

Goal 7 Implementation Guidelines

Goal 7 guides local governments to give special attention to emergency access when considering development in identified hazard areas.

- Consider programs to manage stormwater runoff to address flood and landslide hazards.
- Consider non-regulatory approaches to help implement the goal.
- When reviewing development requests in high-hazard areas, require site-specific reports, appropriate for the level and type of hazard. Reports should evaluate the risk to the site, as well as the risk the proposed development may pose to other properties.
- Consider measures exceeding the National Flood Insurance Program.

Existing Plans and 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.³¹

The Polk County NHMP includes a range of recommended action items that, when implemented, will reduce the county's vulnerability to natural hazards. Many of these

³¹ Burby, Raymond J., ed. 1998. Cooperating with Nature: Confronting Natural Hazards with Land-Use Planning for Sustainable Communities.

recommendations are consistent with the goals and objectives of the county’s existing plans and policies. Linking existing plans and policies to the NHMP 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. In addition to the plans listed below the county and incorporated cities also have zoning ordinances (including floodplain development regulations) and building regulations.

Existing plans that can incorporate mitigation actions include (for more information on these plans see the county [website](#)):

Table B-28 Legal and Regulatory Resources Available for Hazard Mitigation (Polk County)

Regulatory Tool	Name	Effect on Hazard Mitigation
Plans	Comprehensive Plan Maps	The Comprehensive Plan map, goals and policies are intended to serve as a guide for land use planning and development in Polk County.
	Natural Hazards Mitigation Plan (2017 – pending)	Directed mitigation activities for the planning cycle.
	Emergency Operations Plan (2017)	Identifies emergency planning, policies, procedures, and response to extraordinary emergency situations associated with natural disasters, technological incidents, and national security emergencies.
	2001 Flood Hazard Plan Appendix 1	Directed floodplain development and land use.
	Transportation Systems Plan, 2009	This plan provides a balanced transportation system that includes the automobile, bicycle, rail, transit, air, walking, and transmission systems (for example, pipelines). It reflects existing land use plans, policies and regulations that affect the transportation system and includes a finance element.
	Corridor Refinement Plan (Highway 18)	The Corridor Refinement Plan shows that fatal crashes are a major highway problem and traffic volumes along this section of highway have more than doubled since 1994. The highway is expected to have an additional 50% increase in traffic over the next 20 years. Conditions that presently exist on summer weekends will expand and will occur on weekdays from spring to fall.
Programs	National Flood Insurance Program (NFIP)	Directed floodplain development and land use and provides flood insurance for residential, business, and public entities.
	Code Compliance	Building, zoning, and other nuisance violations.

Regulatory Tool	Name	Effect on Hazard Mitigation
	Program	
	Economic Development Program	Coordination of economic development and infrastructure development activities and administering grant programs.
	Polk County Water Needs Assessment Report, 2005	The objective of this report is to provide an analysis of future water supply strategies for the citizens of Polk County. Elements of this objective include the following: <ul style="list-style-type: none"> - Identify the county's future needs for water - Identify the most viable long term drinking water source - Develop a preliminary plan for production and delivery - Estimate the financial impacts - Discuss potential administrative options required for financing and operation
Policies (Municipal Codes)	Polk County Zoning Ordinances	http://www.co.polk.or.us/cd/planning/polk-county-zoning-ordinance
	Polk County Floodplain Zone, Zoning Ordinance, Chapter 178	Guides land use and development within the floodplain

Table B-29 Administrative and Technical Resources for Hazard Mitigation (Polk County)

Staff/Personnel Resources	Department/Division Position
Planner(s) or engineer(s) with knowledge of land development and land management practices	County Engineer: Ken Husby County Planning: Sidney Mulder Planning Director: Austin McGuigan
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	County Engineer: Ken Husby
Planner(s) or engineer(s) with an understanding of manmade or natural hazards	County Planning: Sidney Mulder Planning Director: Austin McGuigan
Floodplain manager	Austin McGuigan
Personnel skilled in GIS and/or HAZUS-MH	Dan Anderson
Director of Emergency Services	Dean Bender
Finance (grant writers, purchasing)	Austin McGuigan
Public Information Officers	Dean Bender

Table B-30 Financial Resources for Hazard Mitigation (Polk County)

Financial Resources	Effect on Hazard Mitigation
General funds	Available for mitigation projects
Authority to levy taxes for specific purposes	(Measure 5) w/ a cap w/ voter approval (cannot exceed cap)
Incur debt through general obligation bonds	No
Incur debt through special tax and revenue bonds	Yes
Incur debt through private activity bonds	Yes

Note: See Appendix D – Grant Programs for additional financial resources.

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 Military Department – 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 an 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, law enforcement, 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.

Mitigation Strategy Economic Analyses Approaches

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 Oregon Military Department – 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 city board of commissioners, 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.

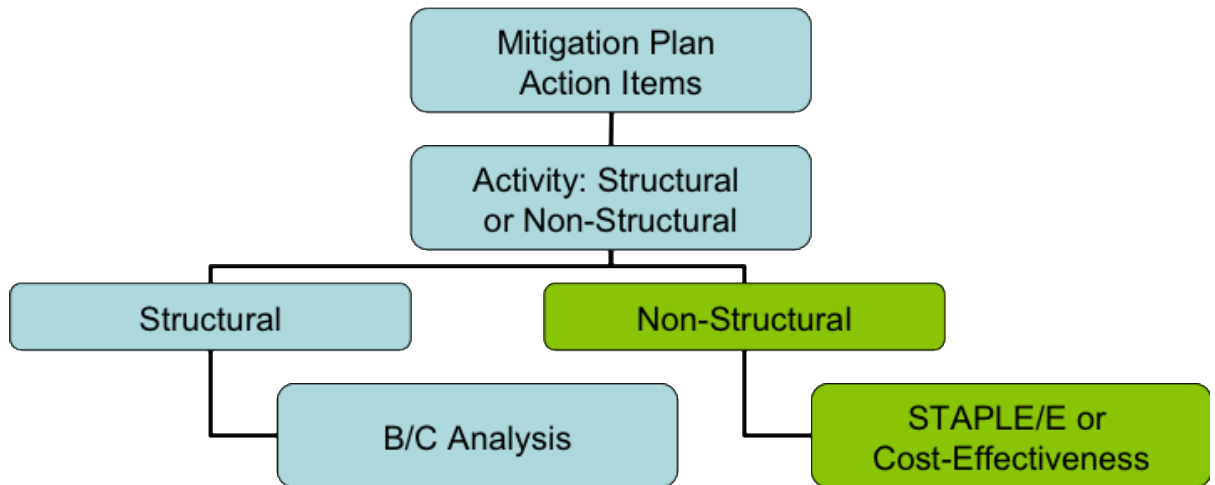
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

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 C-1 Economic Analysis Flowchart



Source: Oregon Partnership for Disaster Resilience. 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.

I. 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, October 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 Military Department – 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.

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APPENDIX D: GRANT PROGRAMS AND RESOURCES

Introduction

There are numerous local, state and federal funding sources available to support natural hazard mitigation projects and planning. The Oregon Natural Hazard Mitigation Plan includes a comprehensive list of funding sources (refer to Oregon NHMP Chapter 2 Section F(1)). The following section includes an abbreviated list of the most common funding sources utilized by local jurisdictions in Oregon. Because grant programs often change, it is important to periodically review available funding sources for current guidelines and program descriptions.

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/hazard-mitigation-grant-program>

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/category/navigation-structure/loans-grants/small-business-loans/disaster-loans>

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/pre-disaster-mitigation-grant-program>

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/flood-mitigation-assistance-program>

Detailed program and application information for federal post-disaster and pre-disaster programs can be found in the FY13 Hazard Mitigation Assistance Unified Guidance, available at: <https://www.fema.gov/media-library/assets/documents/33634>. Note that guidance regularly changes. Verify that you have the most recent edition.

For Oregon Military Department, Office of Emergency Management (OEM) grant guidance on Federal Hazard Mitigation Assistance, visit:

http://www.oregon.gov/OMD/OEM/pages/all_grants.aspx - Hazard_Mitigation_Grants

Contact: Angie Lane, angie.lane@mil.state.or.us

State Programs

Seismic Rehabilitation Grant Program

The Seismic Rehabilitation Grant Program (SRGP) provides state funds to strengthen public schools and emergency services buildings so they will be less damaged during an earthquake. Reducing property damage, injuries, and casualties caused by earthquakes is the goal of the SRGP. <http://www.orinfrastructure.org/Infrastructure-Programs/Seismic-Rehab/>

Community Development Block Grant Program

The 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 natural hazards 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://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/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. More information at: <http://www.oregon.gov/OWEB/Pages/index.aspx>

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

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/national-flood-insurance-program-flood-hazard-mapping>

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/standards.html>

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/printed_surveys/

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, US Department of Housing and Urban Development

Provides grants to entitled cities and urban counties to develop viable communities (e.g., decent housing, a suitable living environment, expanded economic opportunities), principally for low- and moderate- income persons.
http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs/entitlement

National Fire Plan (DOI – USDA)

The NFP provides technical, financial, and resource guidance and support for wildland fire management across the United States. This plan addresses five key points: firefighting, rehabilitation, hazardous fuels reduction, community assistance, and accountability.
<http://www.forestsandrangelands.gov/>

Assistance to Firefighters Grant Program, FEMA

FEMA AFGM 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.fema.gov/welcome-assistance-firefighters-grant-program>

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/wps/portal/nrcs/main/national/programs/landscape/ewpp>

Rural Development Assistance – Utilities, USDA

Direct and guaranteed rural economic loans and business enterprise grants to address utility issues and development needs.

http://www.rurdev.usda.gov/Utilities_Programs_Grants.html

Rural Development Assistance – Housing, USDA.

The RDA program provides 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/HAD-HCFPGrants.html>

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/public-assistance-local-state-tribal-and-non-profit>

National Flood Insurance Program, FEMA

The NFIP makes available flood insurance to residents of communities that adopt and enforce minimum floodplain management requirements. <http://www.fema.gov/national-flood-insurance-program>

HOME Investments Partnerships Program, HUD

The HOME IPP provides 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

The DRI provides grants to fund gaps in available recovery assistance after disasters (including mitigation).

http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs/dri

Emergency Management Performance Grants, FEMA

EMPG grants help state and local governments to sustain and enhance their all-hazards emergency management programs. <http://www.fema.gov/fy-2012-emergency-management-performance-grants-program>

Partners for Fish and Wildlife, DOI – FWS

The PFW program provides 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

NAWC fund provides cost-share grants to stimulate public/private partnerships for the protection, restoration, and management of wetland habitats.

<http://www.fws.gov/birdhabitat/Grants/index.shtm>

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/nrcr/programs/flp/index.htm>

Wetlands Reserve program, USDA-NCRS

The WR program provides financial and technical assistance to protect and restore wetlands through easements and restoration agreements.

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/wetlands>

Secure Rural Schools and Community Self-Determination Act of 2000, US Forest Service.

Reauthorized for FY2012, 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.usda.gov/pts/>