City of Salem
Natural Hazards Mitigation Plan

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Volume I: Basic Plan

Prepared for:

City of Salem Emergency Management

Prepared by:

University of Oregon
Community Service Center
Oregon Partnership for Disaster Resilience

This Natural Hazard Mitigation Plan was prepared by:

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Special thanks to Roger Stevenson, City of Salem Emergency Manager for his leadership in convening the committee.

City of Salem NHMP Update Steering Committee

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- Mark Beeletel, Public Works
- Pamela Cole, Community Development
- Clint Dameron, Urban Development
- Glenn Davis, Public Works
- Carl DeCarlo, Salem Fire
- Ed Flick, Marion County
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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 City of Salem in the plan template.

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PLAN SUMMARY

City of Salem updated this Natural Hazards Mitigation Plan (NHMP 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 city 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 City of Salem NHMP is the result of a collaborative effort between the city, special districts, citizens, public agencies, non-profit organizations, the private sector and regional organizations. The city's steering committee guided the plan development process.

The Steering Committee included representatives from the following jurisdictions and agencies:

- Emergency Management
- Community Development
- Public Works
- Urban Development
- Salem Electric
- Salem Health
- Salem Fire
- Salem Police
- Marion County Emergency Management

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 Salem Emergency Manager convened the planning process and will take the lead in implementing, maintaining, and updating the plan. Salem is dedicated to directly involving the public in the continual review and update of the natural hazards mitigation plan. Although members of the Steering Committee represent the public to some extent, the public will also have the opportunity to continue to provide feedback about the plan throughout the implementation and maintenance period.

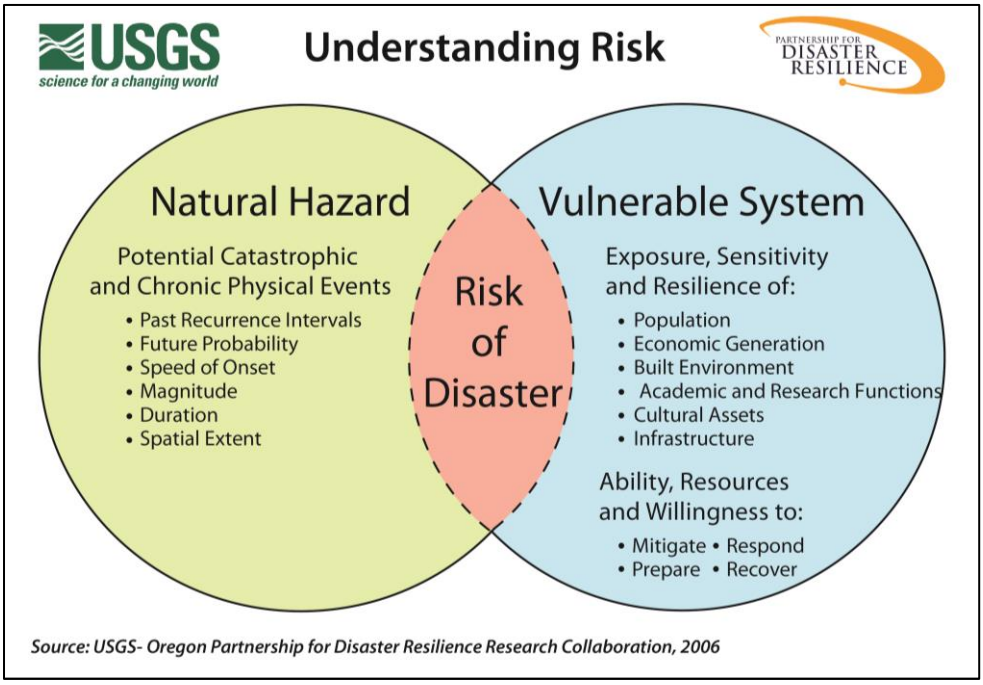
How Does this Mitigation Plan Reduce Risk?

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

The NHMP is intended to assist Salem 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 city. A risk assessment consists of three phases: hazard identification, vulnerability assessment, and risk analysis, as illustrated in the following graphic (Figure PS-1).

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

Figure PS-1 Understanding Risk



What is Salem's Overall Risk to Hazards?

Salem 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 City of Salem Hazard Analysis submitted to the Oregon Office of Emergency Management (2012) and updated by the steering committee in 2017. Table PS-1 below summarizes hazard probability and vulnerability as determined by the steering committee (for more information see Section 2, Risk Assessment).

Table PS-1 Risk Assessment Summary

Hazard	Probability	Vulnerability	Total Threat Score	Hazard Rank
Drought	High	Moderate	185	# 6
Earthquake - Cascadia (3-5min)	High	High	222	# 4
Earthquake - Crustal (1 min)	Moderate	Moderate	176	# 7
Extreme Heat Event	High	High	192	# 5
Flood	High	High	230	# 2
Landslide	High	Moderate	140	# 9
Volcanic Event	Low	Low	79	# 10
Wildfire	Moderate	Low	70	# 11
Windstorm	High	Moderate	225	# 3
Winter Storm	High	High	240	# 1
Hazardous Materials Incident	Moderate	High	171	# 8

Source: Salem NHMP Steering Committee

To align the plans risk assessment to the Marion County NHMP's risk assessment the Salem steering committee converted their HVA scores using the Calculated Risk Priority Index (CPRI) methodology (made available via BOLDplanning) as shown in Table PS-2.

Table PS-2 Calculated Risk Priority Index (BOLDplanning Tool)

Hazard Profile Summary for Salem Using Bold Planning Analysis Scoring							
Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	Local Planning Significance	County Planning Significance
Weight Factor	0.45	0.3	0.15	0.1			
Earthquake*	4	4	4	4	4.00	High	High
Severe Weather/Storm**	4	1	3	3	2.85	Moderate	High
Flood	3	2	3	4	2.80	Moderate	High
Drought	3	1	3	4	2.50	Moderate	High
Extreme Weather - High	3	1	2	3	2.25	Moderate	Moderate
Wildland Interface Fire	1	4	2	2	2.15	Moderate	Moderate
Dam or Levee Failure	1	2	4	4	2.05	Moderate	Moderate
Landslide	1	2	2	2	1.55	Low	High
Volcanic Eruption	1	1	1	4	1.30	Low	Low

Source: City of Salem NHMP Steering Committee, Boldplanning Tool

What is the Plan's Mission?

The mission of the Salem NHMP is to:

Mission: *Reduce or eliminate long-term risk to people and their property from hazards and their effects.*

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: Develop and implement mitigation activities to protect human life.

Goal 2: Protect existing buildings and infrastructure as well as future development from the impacts of natural hazards.

Goal 3: Strengthen communication and coordination of public and private partnerships and emergency services among local, county and regional governments and the private sector.

Goal 4: Enhance economic resilience to reduce the impact on the local economy.

Goal 5: Preserve and rehabilitate natural systems to serve natural hazard mitigation functions and protect natural resources.

How are the Action Items Organized?

The action items are organized within an action matrix included within Section 3, Mitigation Strategy (full descriptions are provided in Appendix A-1, *Priority Actions*, and Appendix A-2, *Action Item Pool*).

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 items portray the overall mitigation strategy and identifies linkages between the plan goals and actions.

Comprehensive Action Plan

Table PS-3 summarizes specific **priority** NHMP actions. Refer to the Mitigation Strategy section for a complete list of actions. Volume II, Appendices A-1 and A-2 contain detailed information for all action items, including potential partners, implementation ideas, proposed timeline, and estimated budget.

Table PS-3 City of Salem High Priority NHMP Actions

Action Item ID	Mitigation Action Item
Priority Actions	
Multi-Hazard	
MH #1	Identify and Designate Priority Transportation Routes.
Earthquake	
EQ #1	Develop an inventory of un-reinforced masonry structures and develop appropriate mitigation action items to reduce the impacts of seismic events.
EQ #2	Identify, inventory, and mitigate (as prioritization and resources allow) critical facilities and utilities that require seismic retrofit (consider structural and non-structural retrofit options).
EQ #3	Create a bridge prioritization inventory based on major lifeline routes including state highways, routes, and major road arteries.
EQ #4	Collaborate with SEDCOR to develop relevant public-private partnerships with businesses that can contribute to mitigation, response, and recovery.

Source: Salem NHMP Steering Committee (2017)
Action ID Key: MH = Multi-Hazard, EQ = Earthquake

How will the plan be implemented?

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 . . .

The plan maintenance section details the formal process that will ensure that the Salem NHMP remains an active and relevant document. The plan will be implemented, maintained, and updated by a designated convener. The Salem Emergency Manager is the designated convener (Plan Convener) and is responsible for overseeing the review and implementation processes. 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.

Plan Adoption

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] . . .

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 city formally adopts the plan via resolution. The Plan Convener will be responsible for ensuring local adoption of the Salem 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 city will re-establish eligibility for the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program funds, and the Flood Mitigation Assistance program funds.

The accomplishment of the NHMP goals and actions depends upon regular Steering Committee participation and adequate support from 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 Committee for Salem met to review the plan update process and their City Council adopted the NHMP on **[DATE], 2017.**

FEMA Region X approved the City of Salem NHMP on **[DATE], 2017**. With approval of this Plan, Salem is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **[DATE], 2022**.

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SECTION I: INTRODUCTION

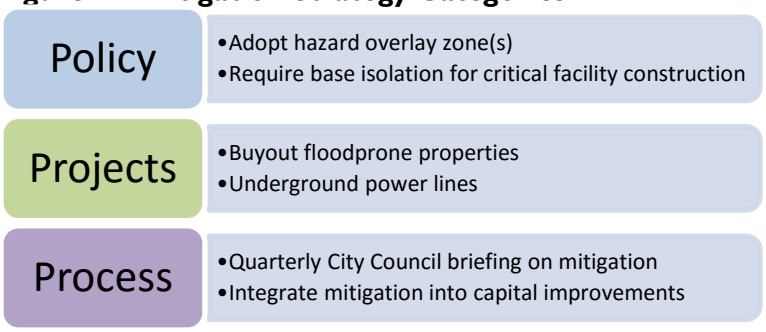
Section I: Introduction provides a general introduction to natural hazard mitigation planning in Salem. In addition, it addresses the planning process requirements contained in 44 CFR 201.6(b) thereby meeting the planning process documentation requirement contained in 44 CFR 201.6(c)(1). The section 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."

Hazards mitigation uses long and short-term strategies and actions to reduce the effects of hazards on the lives, property, and critical infrastructure and facilities in a community. This can be achieved through **policies**, such as adjustments to land use designation within floodplains; **projects**, such as seismic retrofits to critical facilities; and **process**, such as quarterly reporting to the Salem City Council on mitigation activities (see Figure 1-1). It is the role of communities, private businesses and industries, nonprofits, school districts, and more to work with the local, state, and federal government to prepare their community for threats and hazards.

Figure 1-1 Mitigation Strategy Categories



Source: Oregon Partnership for Disaster Resilience

Hazard mitigation also incorporates a "Whole Community" approach to planning, in which all parts of the community are engaged and empowered in the development and implementation of a NHMP. This process positions the planning team to better understand and comprehensively approach the actual needs of a community. To work well, this approach requires a diverse array of community members at the table. Stakeholders can include social and community service groups and institutions, faith-based groups, school districts, organization that work with those who have intellectual and physical disabilities, academia, professional associations, non-profit and private sectors, Native American tribes, and other indigenous populations, among others.

Why Develop a Mitigation Plan?

Salem 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 city will remain eligible for pre- and post-disaster mitigation project grants.

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.[1] 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.[2] 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.[3] 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.[4] 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.

[1] Code of Federal Regulations, Chapter 44. Section 201.6, subsection (a), 2015

[2] ibid, subsection (b). 2015

[3] ibid, subsection (c). 2015

[4] ibid, subsection (d). 2015

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.

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 the 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 Salem Natural Hazard Mitigation Plan Steering Committee. The Salem Steering Committee formally convened on three occasions to discuss and revise the plan. Steering Committee members contributed data, maps (where applicable), 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.[5] OPDR provided a publicly accessible project website for the general public to provide feedback on the draft NHMP via a web form. In addition, Salem provided a press release on their websites to encourage the public to offer feedback on the plan update.

In addition, OPDR administered a community survey to obtain input from the public regarding the city's risks, vulnerabilities, hazards history, and mitigation strategies. See Appendix G for more information. The city website continues to be a focal point for distribution natural hazard information through the use of hazard viewers, emergency alerts, and hazard preparation.

[5] Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

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 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.

Section 1: Introduction

The Introduction briefly describes the citywide 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 C, which contains an overall description of Salem. This section includes a brief description of community sensitivities and vulnerabilities. The Risk Assessment allows readers to gain an understanding of the city'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
- Extreme Heat
- Flood
- Landslide
- Volcano
- Wildfire
- Windstorm
- Winter Storm
- Hazardous Materials Incident

Additionally, this section provides information on the city's 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.

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: Appendices

The appendices are designed to provide the users of the 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: Action Items

This appendix contains the detailed action item forms for each of the mitigation strategies identified in this Plan. Appendix A-1 includes the priority actions for the city, while Appendix A-2 provides a listing of the non-priority actions. Appendix A-3 is a blank action item form to be used as new actions are identified.

Appendix B: Planning and Public Process

This appendix includes documentation of all the citywide 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 C: Community Profile

The community profile describes the city from a number of perspectives in order to help define and understand the city'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 D: 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 E: Grant Programs and Resources

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

Appendix F: Lifeline Sector Assessment

This appendix describes the findings from the 2016 Marion County Lifeline Sector Assessment. In 2015, a University of Oregon Community Planning Workshop student team assessed lifeline sectors identified by Marion County – transportation, energy, communication, and water. The assessment focused on review of each sector's adaptive capacity and vulnerabilities, as well as critical interdependencies.

Appendix G: Community Survey

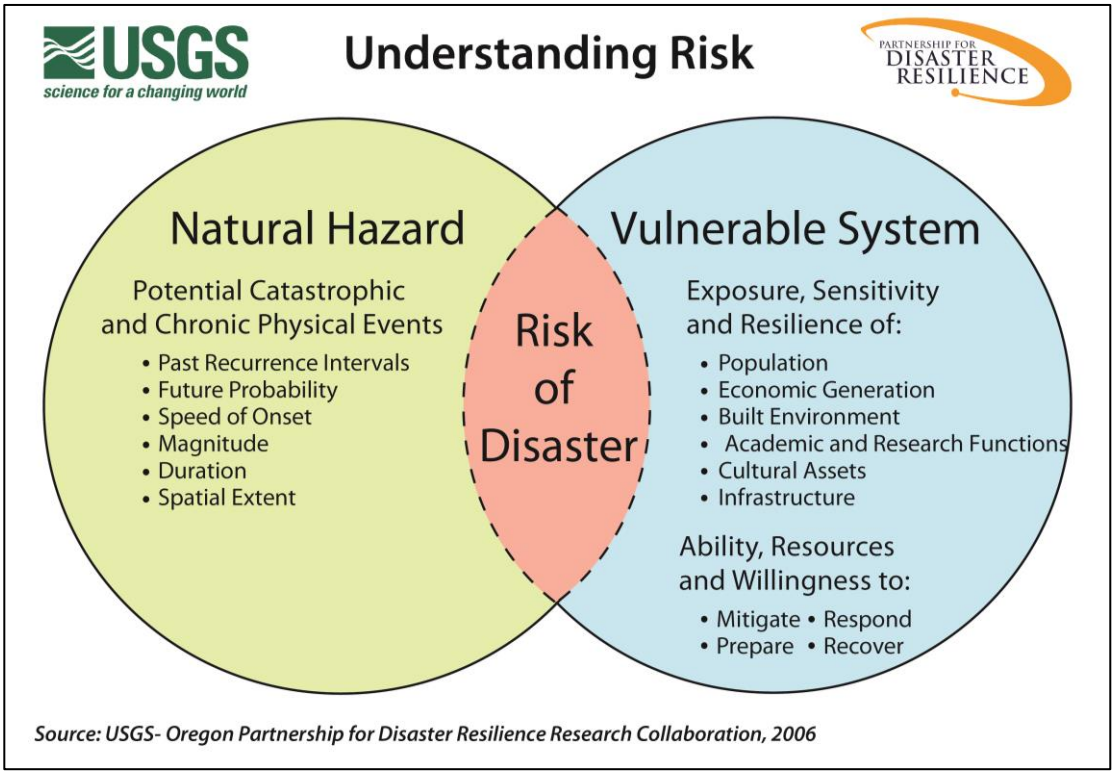
Appendix G includes the survey instrument and results from the community preparedness survey implemented by OPDR.

SECTION 2:
RISK ASSESSMENT

This section of the NHMP addresses 44 CFR 201.6(b)(2) - Risk Assessment. 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. 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.

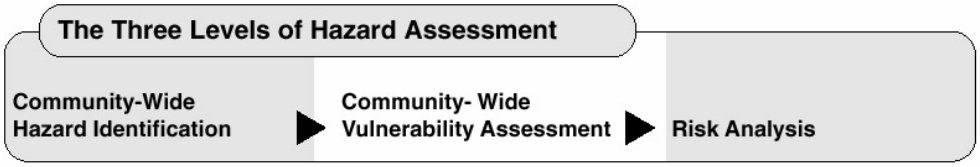
What is a Risk Assessment?

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.

Figure 2-2 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 and Assessment

Salem identifies nine natural hazards and one non-natural hazard that could have an impact on the city. 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 Hazard Mitigation Plan Region 3 Risk Assessment. Table 2-1 lists the hazards identified in the city in comparison to the hazards identified in the Marion County NHMP and State of Oregon NHMP for the Mid/Southern Willamette Valley (Region 3), which include Salem.

Table 2-1 Salem Hazard Identification

Salem	Marion County	Oregon NHMP Region 3: Mid/Southern Willamette Valley
Drought	Drought	Drought
Earthquake	Earthquake	Earthquake
Extreme Heat	Extreme Weather - High Temperature	
Flood	Flood	Flood
Landslide	Landslide	Landslide
	Tornado	
Volcanic Eruption	Volcanic Eruption	Volcano
Wildland Interface Fire	Wildland Interface Fire	Wildfire
Windstorm	Severe Weather/Storm	Windstorm
Winter Storm		Winter Storm
Non-Natural Hazards		
	Dam or Levee Failure	
Hazardous Materials Incident	Hazardous Materials Incident	

Source: Salem NHMP Steering Committee (2017), Marion County NHMP (2017), and State of Oregon NHMP (2015)

Risk Assessment Approach

A risk assessment is intended to provide the, "factual basis for activities proposed in the strategy to reduce loses from identified hazards."[1] To complete the risk assessment, the steering committee first updated the description, type, location, and extent of each hazard. Next, the team updated the vulnerability information based on each hazard's potential impact on the community.

For this update, the risk assessment also focusses on four key lifeline sectors: transportation, water, communication, and energy. The lifeline sector risk assessment process included assessing each sector's existing infrastructure, determining potential impacts and sensitivity to specific hazards, and developing risk reduction recommendations for each sector.

Risk Assessment Summary

Salem is vulnerable to a wide range of hazards that threaten its population, businesses, and environment. To determine the hazards that pose the greatest threat, Salem has prepared a hazard vulnerability assessment. In addition, Marion County collaborated with BOLDplanning[2] to document and maintain the county's comprehensive risk assessment; Salem incorporated the methodology provided by BOLDplanning into their risk assessment to align their risk assessment with the county's.

Salem developed this assessment from historical data of events that have occurred. The assessment specifically examines:

[1] 44 CFR 201.6(2)(i)

[2] BOLD Planning is a consulting firm specializing in the development of actionable emergency plans. For more information, visit: http://www.boldplanning.com/

1. Probability (frequency) of event
2. Magnitude of event
3. Expected warning time before event
4. Expected duration of event

Table 2-2 below shows the scoring values for each ranking category.

Table 2-2 Risk Assessment Hazard Ranking Scoring Values

Score	Probability	Warning Time	Magnitude	Severity
4	Highly Likely	Less than 6 hours	Catastrophic	More than 1 week
3	Likely	6-12 hours	Critical	Less than 1 week
2	Possible	12-24 hours	Limited	Less than 1 day
1	Unlikely	24+ hours	Negligible	Less than 6 hours

Source: BOLDplanning, Calculated Priority Risk Index (CPRI)

For emergency management planning purposes, the critical analysis that must be undertaken is an assessment of the consequences of each hazard, including potential area of impact, population exposed and impacted, duration of the hazard, and potential economic consequences. These rankings utilize the criteria laid out in THIRA to weight them proportionally through historic data as well as future projections based on economic, demographic, the critical infrastructure information.

The assessment identifies three levels of risk: High, Moderate, and Low.

High - High probability of occurrence; at least 50 percent or more of population at risk from hazard; significant to catastrophic physical impacts to buildings and infrastructure; major loss or potential loss of functionality to all essential facilities (hospital, police, fire, EOC and shelters).

Moderate - Less than 50 percent of population at risk from hazard; moderate physical impacts to buildings and infrastructure; moderate potential for loss of functionality to essential facilities.

Low - Low probability of occurrence or low threat to population; minor physical impacts.

A summary of the Salem's risk assessment findings and rankings is presented in Table 2-3.

Table 2-3 Hazard and Vulnerability Assessment Summary

Hazard Profile Summary for Salem Using Bold Planning Analysis Scoring						
Natural Hazard	Probability	Warning Time	Magnitude	Duration	CPRI	Local Planning Significance
Weight Factor	0.45	0.3	0.15	0.1		
Earthquake*	4	4	4	4	4.00	High
Severe Weather/Storm**	4	1	3	3	2.85	Moderate
Flood	3	2	3	4	2.80	Moderate
Drought	3	1	3	4	2.50	Moderate
Extreme Weather - High	3	1	2	3	2.25	Moderate
Wildland Interface Fire	1	4	2	2	2.15	Moderate
Dam or Levee Failure	1	2	4	4	2.05	Moderate
Landslide	1	2	2	2	1.55	Low
Volcanic Eruption	1	1	1	4	1.30	Low

Source: Salem NHMP Steering Committee, BOLDplanning Calculated Priority Risk Index (CPRI)

Probability and Vulnerability Summary

The table below presents the probability and vulnerability scores for each of the natural hazards present in Salem for which descriptions are provided herein. 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 city in prioritizing resources for mitigation, and can assist in directing damage assessment efforts after a hazard event has occurred. The exposure of city 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. Salem evaluated the best available vulnerability data to develop the vulnerability scores presented below. For the purposes of this NHMP, the city utilized the Oregon Military Department – Office of Emergency Management (OEM) Hazard Analysis methodology vulnerability definitions to determine hazard probability.

As shown in Table 2-4 with **bold text**, several hazards are rated with high probabilities and vulnerabilities. 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.

Table 2-4 Natural Hazard Probability and Vulnerability Assessment Summary

Hazard	Probability	Vulnerability
Drought	**High**	Moderate
Earthquake - Cascadia (3-5min)	**High**	**High**
Earthquake - Crustal (1 min)	Moderate	Moderate
Extreme Heat Event	**High**	**High**
Flood - Riverine	**High**	**High**
Landslide	**High**	Moderate
Volcano	Low	Moderate
Wildfire (WUI)	Moderate	Low
Windstorm	**High**	Moderate
Winter Storm	**High**	**High**
Hazardous Materials/ Transportation	Moderate	**High**

Source: Salem NHMP Steering Committees 2017.

Hazard Analysis Matrix

The hazard analysis matrix involves estimating the damage, injuries, and costs likely to be incurred in a geographic area over 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 methodology for the hazard analysis was first developed by FEMA and refined by the Oregon Military Department's Office of Emergency Management, the methodology is presented at the end of this report section for your reference.

Table 2-5 presents the entire updated hazard analysis matrix for Salem. The hazards are listed in rank order from high to low. The table 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 hazard event occurring, the vulnerability to the community, and the maximum threat or worst-case scenario, winter storm, flood, windstorm, and earthquake (Cascadia) events rank as the top hazard threats to the city (top tier). Extreme heat, drought, earthquake (crustal), hazardous materials incidents, and landslide events rank in the middle (middle tier). Volcano (volcanic ash) and wildfire events comprise the lowest ranked hazards in the city (bottom tier).

Table 2-5 Hazard Analysis Matrix – Salem

Hazard	History	Vulnerability	Maximum Threat	Probability	Total Threat Score	Hazard Rank	Hazard Tiers
Winter Storm	20	50	100	70	240	# 1	*Top Tier*
Flood - Riverine	20	40	100	70	230	# 2	
Windstorm	20	35	100	70	225	# 3	
Earthquake - Cascadia (3-5min)	16	50	100	56	222	# 4	
Extreme Heat Event	16	40	80	56	192	# 5	*Middle Tier*
Drought	14	35	80	56	185	# 6	
Earthquake - Crustal (1 min)	6	35	100	35	176	# 7	
Hazardous Materials/ Transportation	2	80	49	40	171	# 8	
Landslide	20	20	30	70	140	# 9	
Volcano	2	20	50	7	79	# 10	*Bottom Tier*
Wildfire (WUI)	2	10	30	28	70	# 11	

Source: Salem NHMP Steering Committees 2017.

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 section has been reformatted and updated to include new history.

Table 2-6 Drought Summary

Hazard	Drought
Type	Climatic
Speed of Onset	Slow
Location	Varies, Citywide
Extent	Moderate to Severe Drought*
Prior Occurance	Five > 6 months duration since 1982
Probability	~13% annual

Sources: Oregon NHMP; NRCS; analysis by OPDR
* Defined as between -2 and -4 on the National Resource Conservation Service (NRCS) Surface Water Supply Index (SWSI)

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 or county.

The National Drought Mitigation Center and the National Center for Atmospheric Research define drought by categorizing it according the "type of drought." These types include the following:

- **Meteorological drought** happens when abnormally dry weather patterns dominate an area. This can include above average air temperatures in addition to low precipitation.
- **Hydrological drought** occurs when low water supply becomes evident, especially in streams, reservoirs, and groundwater levels, usually after many months of meteorological drought. Meteorological drought can begin and end rapidly, while hydrological drought takes much longer to develop and then recover.
- **Socioeconomic drought** relates the supply and demand of various goods (e.g., agricultural commodities) and services (e.g., outdoor recreation) to drought. Sometimes "agricultural drought" is defined separately; however, for this DCP it is included under socioeconomic drought. Likewise, environmental concerns may also be included here.
- **Regulatory drought** relates to water shortages to specific water users as a result of water laws and regulations prioritizing water usage to what are deemed higher

priority uses. Higher priority uses often include in-stream uses (i.e., leaving the water in the stream) to maintain environmental conditions for sensitive aquatic life. When regulatory drought occurs, those with junior water rights typically lose the use of their water first, with senior rights holders the last to be affected.

Location and Extent

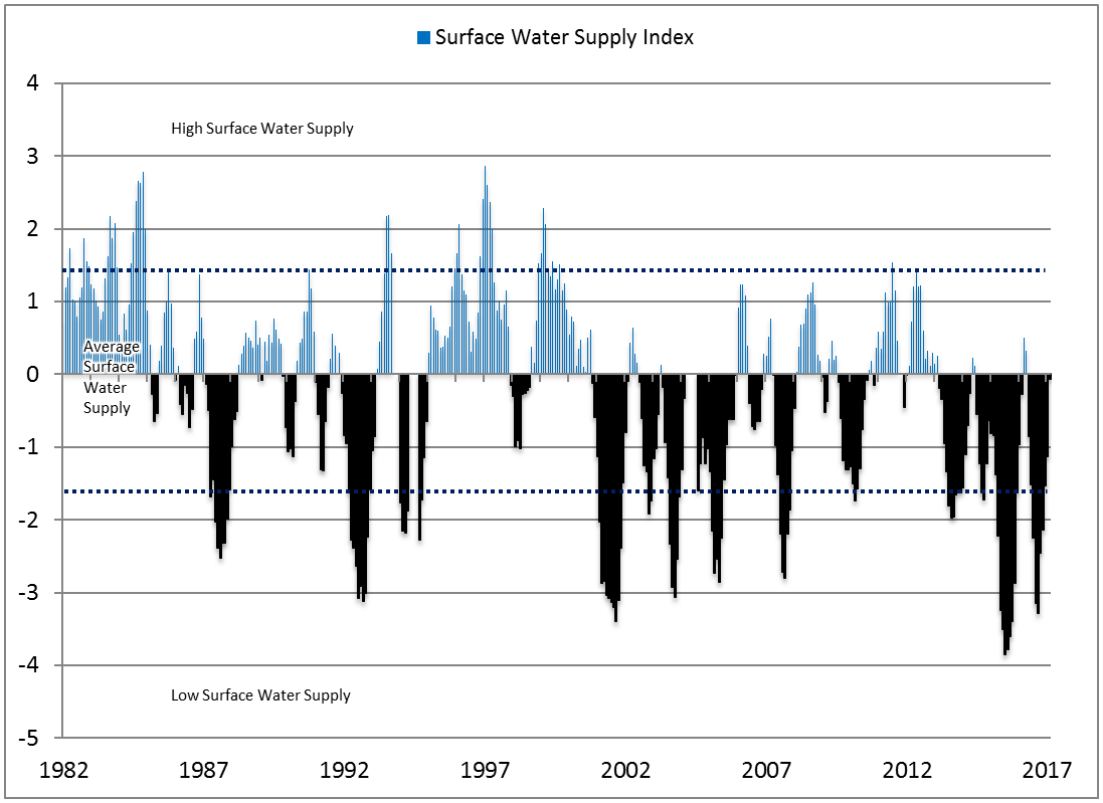
Droughts occur in every climate zone, and can vary from region to region. Drought may occur throughout Salem and may have profound effects on the economy. Drought is typically measured in terms of water availability in a defined geographical area. It is common to express drought with a numerical index 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). Moderate droughts are classified at SWSI values between -2.0 and -4.0, while severe drought is classified at SWSI values of -4.0 and below. Figure 2-3 below shows the monthly history of SWSI values from February 1982 to March 2017 for the Willamette Basin which includes Salem. Research shows that the periods of drought have fluctuated; recent moderate drought periods occurred in 1987, 1992, 1994, 2001, 2003, 2005, 2015, and 2016.

Notably, the governor signed a drought declaration for Marion County covering the period from September 18 – December 31, 2015; a period which came close to reaching the severe drought SWSI classification.[3]

[3] Oregon Water Resources Department, Public Declaration Status Report http://apps.wrd.state.or.us/apps/wr/wr_drought/declaration_status_report.aspx.

Figure 2-3 SWSI Values for the Willamette Basin (1982-2017)



Source: Department of Agriculture-Natural Resources Conservation Service, "Surface Water Supply Index, Willamette Basin" www.or.nrcs.usda.gov. Accessed May 2017.

Additional information pertaining to the drought hazard in Salem will be available upon adoption of the North Santiam Drought Contingency Plan, currently in development. Additional information related to Salem's Drought Contingency Planning efforts is discussed later in this section.

History

Although Salem is spared from most droughts because of its location east of the ocean and west of the Cascades, it has been affected by droughts in the past. The broader region surrounding the City of Salem experiences dry conditions annually during the summer months from June to September. The Drought Severity Index shows episodes of drought within the past five years occurring during the summer through the fall.[4] Periodically, this region experiences more significant drought conditions that affect the region or the state.

Between 1928 and 1941, there was a statewide drought. Low stream flows prevailed in western Oregon during the period from 1976-81, with 1976-77 being the driest year of the century. The 1985-94 drought was not as severe as the 1976-77 drought in any single year, but the cumulative effect of ten consecutive years with mostly dry conditions caused statewide problems. The peak year of the drought was 1992, when a drought emergency

[4] National Weather Service Climate Prediction Center. Drought Severity Index by Division (Long-Term Palmer) Archive.

was declared for all of Oregon.[5] There have been two drought events since the previous version of the Salem NHMP (2015 and 2016; see Figure 2-3).

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. 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.

Future Climate Variability[6]

In Oregon, 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.

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 Salem the NHMP Steering Committee assessed the **probability of experiencing a locally severe drought as "high,"** meaning one incident is likely within the next 35-year period; *this rating has increased since the previous plan*.

Vulnerability Assessment

Droughts in the past have caused no personal injury or death. The potential for future injuries or deaths is anticipated to remain similar to historic events. Salem estimates that

[5] Taylor, George H. and Chris Hannan. 1999. The Oregon Weather Book. Corvallis, OR. Oregon State University Press.

[6] Oregon Climate Change Research Institute (OCCRI), Oregon Climate Assessment Report (2010) and Northwest Climate Assessment Report (2013). http://occri.net/reports

less than 10% of the city's population could be physically impacted by a drought, and there would be little or no impact on community social networks.

Facilities throughout the city anticipate little or no damage due to a drought, estimated at less than $1 million for hazard response, structural repairs and equipment replacement. In terms of commercial business, it is likely less than 10% of businesses located in the city and surrounding area could experience commerce interruption for a period of days. The agricultural sector could suffer the greatest impact from a drought in comparison to other types of business. Lastly, drought would likely have moderate impacts on more than 75% of the city's ecological systems, including, clean water, wildlife habitat, and parks. Also, domestic water-users may be subject to stringent conservation measures (e.g., rationing) as per the city's water conservation plan.

The NHMP Steering Committee rated the city as having **a "moderate" vulnerability to drought hazards**, meaning between 1-10% of the city's population or assets would be affected by a major drought emergency or disaster; *this rating has not changed since the previous plan*.

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

Earthquake

Significant Changes Since Previous Plan:

The Earthquake Hazard section was reformatted since the previous plan. There has not been any new data, or history, as such the material has remained largely the same. 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.

Table 2-7 Earthquake Summary - Crustal

Hazard	Earthquake - Crustal
Type	Geologic
Location	Multiple active faults; Willamette Valley
Speed of Onset	Rapid
Extent	Very Strong to Severe shaking ~ 500 yrs
Prior Occurance	One over Magnitude 5 last 100 yrs*
Probability	Approximately 1% annual

Sources: DOGAMI - Oregon HazVu; Oregon NHMP; Pacific Northwest Seismic Network
* 1993 Scotts Mills, just north of Marion County

Table 2-8 Earthquake Summary – Cascadia Subduction

Hazard	Earthquake - Cascadia
Type	Geologic
Location	Primarily west of the Cascades; CA - BC
Speed of Onset	Rapid
Extent	Catastrophic
Prior Occurance	One over Magnitude 9 last 500 yrs
Probability	Magnitude 9+ is 7% - 12% over 50 yrs*

Sources: DOGAMI - Oregon HazVu; Oregon NHMP; Pacific Northwest Seismic Network
* Oregon NHMP, analysis by Department of Geology and Mineral Industries

Characteristics

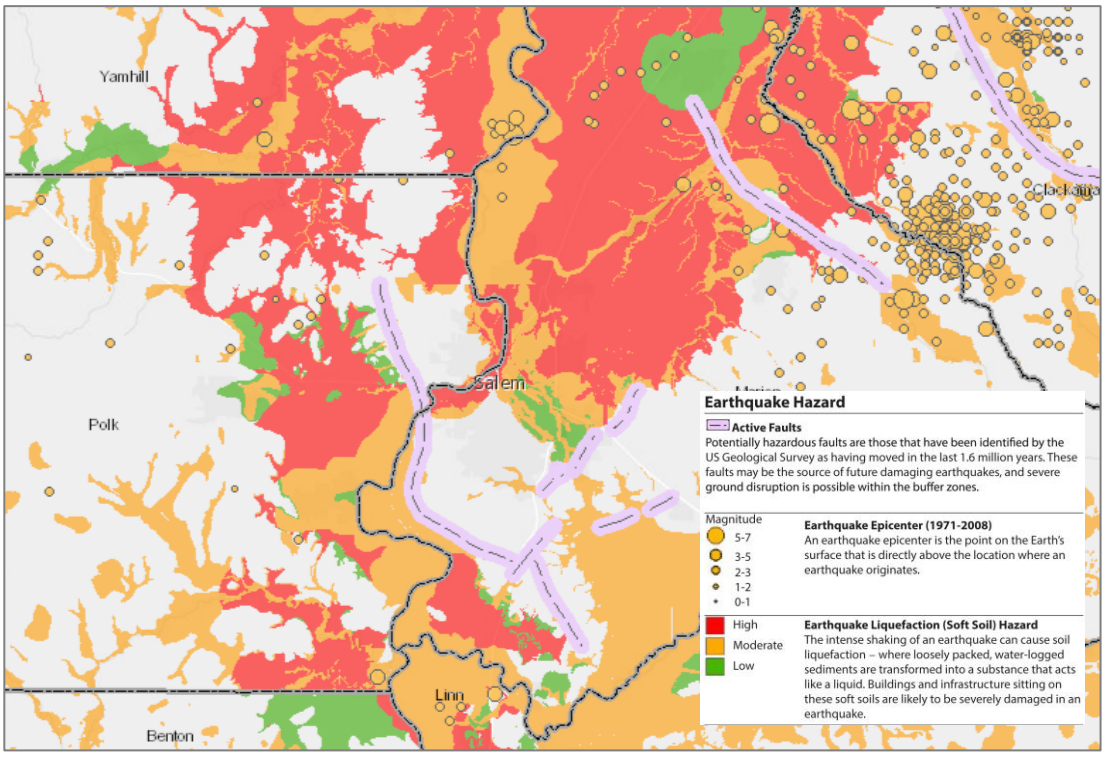
The Pacific Northwest in general is susceptible to earthquakes from four sources: 1) the offshore Cascadia Subduction Zone; 2) deep intraplate events within the subducting Juan de Fuca Plate; 3) shallow crustal events within the North American Plate, and 4) earthquakes associated with volcanic activity.

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

Figure 2-4 shows a generalized geologic map of Salem and includes the Mount Angel, Canby-Mollala, and Newberg faults. Within the Salem Urban Growth Boundary (UGB), the area south of the Willamette River and west of River Road has the highest risk of earthquakes. Other small areas with high earthquake risk exist to the east of the city. The areas most susceptible to ground amplification and liquefaction have young, soft alluvial sediments, found in most of the Willamette Valley and are along stream channels.[7] The extent of the damage to structures and injury and death to people will depend upon the type of earthquake, proximity to the epicenter and the magnitude and duration of the event.

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



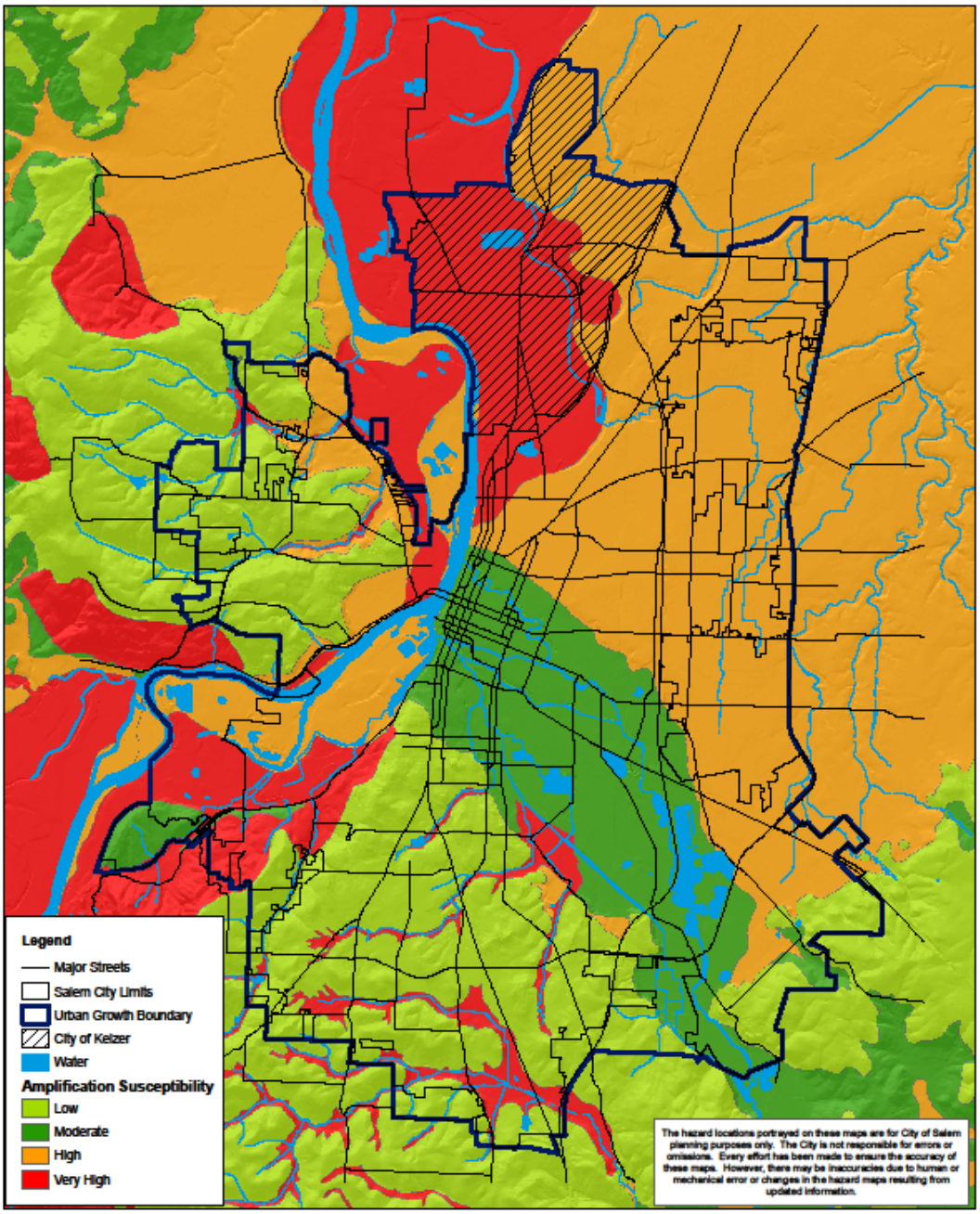
Source: Oregon HazVu: Statewide Geohazards Viewer (HazVu)

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 ground motion amplification (Figure 2-5), liquefaction (Figure 2-6), landslide susceptibility, and relative earthquake hazards. OPDR used the DOGAMI Statewide

[7] Burns, William, John 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, 2008

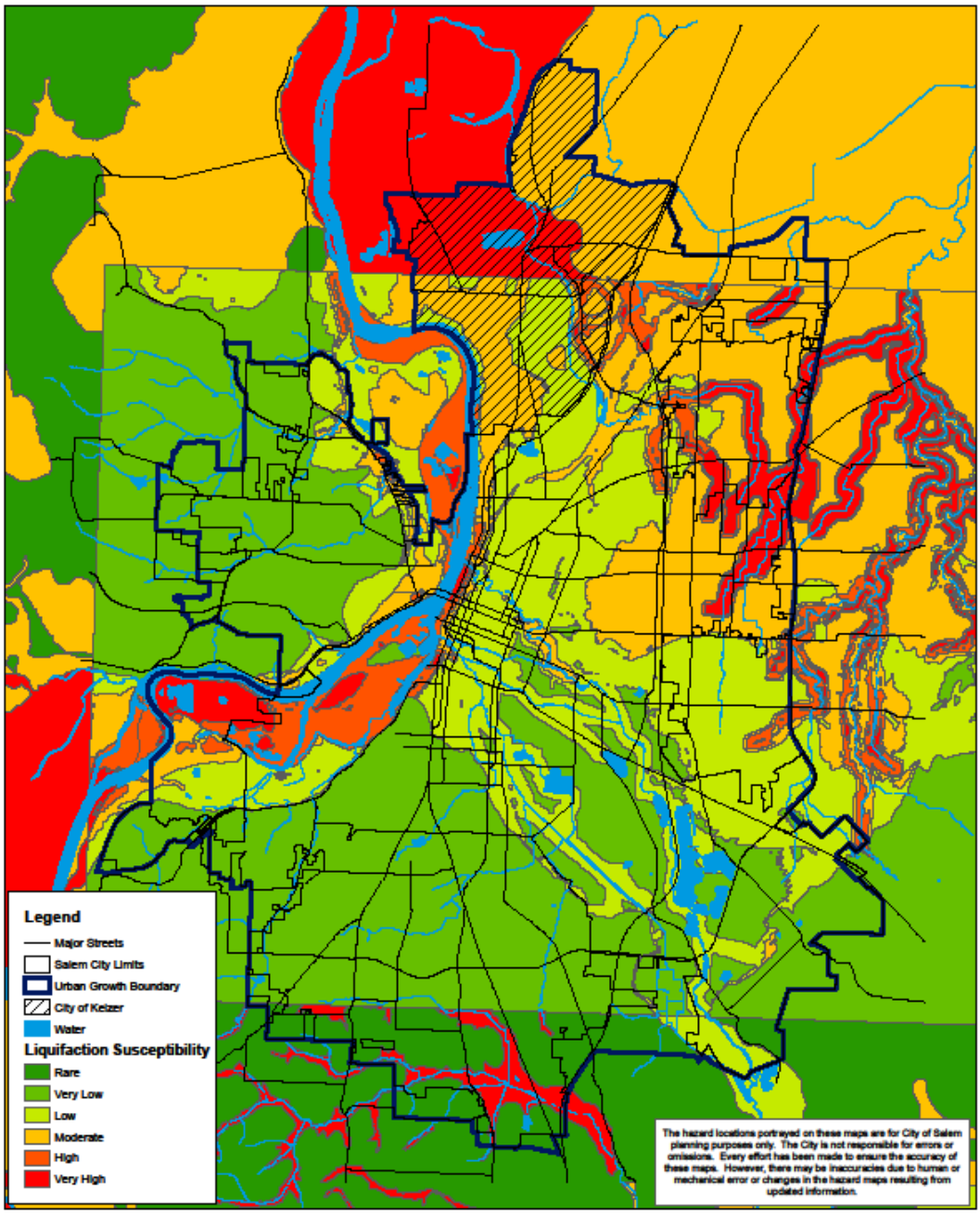
Geohazards Viewer to present a visual map of recent earthquake activity, active faults, and liquefaction; ground shaking is generally expected to be higher in the areas marked by soft soils in the map above. The severity of an earthquake is dependent upon a number of factors including: 1) the distance 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.

Figure 2-5 Earthquake Amplification Susceptibility



Source: City of Salem, DOGAMI

Figure 2-6 Earthquake Liquefaction Susceptibility



Source: City of Salem, DOGAMI

For more information, see the following reports:

Geologic Map Series: GMS-105 - Relative earthquake hazard maps of the Salem East and Salem West quadrangles, Marion and Polk Counties, Oregon by Yumei Wang and William J. Leonard, 1996, 10 p., 1:24,000.

Interpretive Map Series: IMS-006 - Water-induced landslide hazards, western portion of the Salem Hills, Marion County, Oregon by Andrew F. Harvey and Gary L. Peterson, 1998, 13 p., 1:24,000.

Interpretive Map Series: IMS-017 - Earthquake-induced slope instability; relative hazard map, western portion of the Salem Hills, Marion County, Oregon by R. Jon Hofmeister, Yumei Wang, and David K. Keefer , 2000, 1:24,000

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

Salem has been shaken historically by crustal and intraplate earthquakes and prehistorically by subduction zone earthquakes centered off the Oregon coast. There have been multiple moderate earthquakes in Salem and greater Marion County in the past 100 years. Earthquakes with magnitudes of 5.0 and 4.6 occurred in Salem in 1957 and 1963 respectively. Minor damage was reported following both events. The most significant event in the region occurred near Scotts Mills in March of 1993. This magnitude 5.7 event resulted in damage throughout Marion County. In Salem, the rotunda of the state Capitol cracked, and the Golden Pioneer statue nearly rocked off its base.[8]

Salem 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 Salem.

[8] Statesman Journal. March 26, 1993.

Probability Assessment

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

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%.

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 Salem. 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. For more information see DOGAMI reports linked above.

Based on the available data and research for Salem the NHMP Steering Committee determined the **probability of experiencing a Cascadia Subduction Zone (CSZ) earthquake is "high",** meaning one incident is likely within the next 35-year period and that the **probability of experiencing a crustal earthquake is "moderate",** meaning one incident is likely within the next 75-year period. *The previous NHMP rated the earthquake probability as "high" but did not distinguish between the crustal and CSZ events.*

Vulnerability Assessment

The local faults, the city's proximity to the Cascadia Subduction Zone, potential slope instability, and the prevalence of certain soils subject to liquefaction and amplification combine to give the city 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 Salem predominately within the "Willamette Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades).[9] Within the Valley Zone damage and shaking is expected to be widespread but moderate, an event will be disruptive to daily life and commerce, and the main priority is expected to be restoring services to business and residents.[10]

Earthquakes in the past caused no injuries regarding the health and safety of residents. However, the potential for injuries or deaths from past events or from similar events in other communities could escalate resulting in multiple deaths and major injuries. It is estimated that 50-75% of the city's population would be physically displaced by an

[9] Oregon Seismic Safety Policy Advisory Commission, Oregon Resilience Plan (2013)

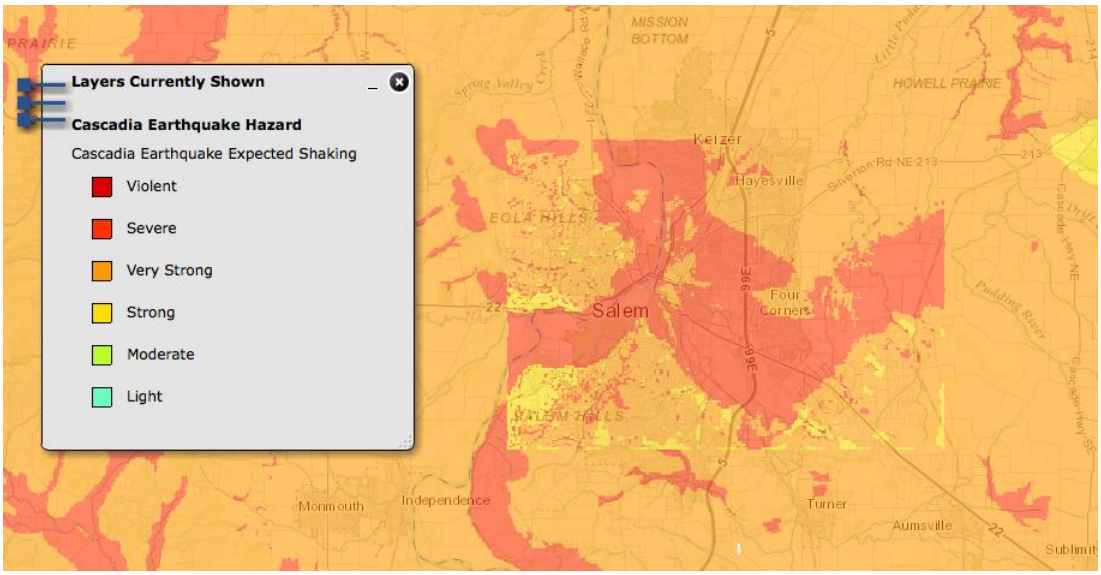
[10] Ibid.

earthquake, accounting for the number of homes that would be damaged from seismic activity, and there would be extensive impact on community social networks.

Most facilities throughout the city anticipate extensive damage due to an earthquake, estimated at more than $1 billion for hazard response, structural repairs and equipment replacement. In terms of commercial business, it is likely more than 75% of businesses located in the city and surrounding area would experience commerce interruption for a period of a year or longer. Earthquakes have the potential to inflict widespread damage to not only buildings but also the transportation network that may inhibit access to businesses. Lastly, earthquakes would likely have extensive impacts on more than 75% of the city's ecological systems, including, clean water, wildlife habitat, and parks.

Figure 2-7 below shows the expected shaking/ damage potential for Salem as a result of a Cascadia Subduction Zone (CSZ) earthquake event. The figure shows that the city will experience "very strong" to "severe shaking" that will last two to four minutes. The strong shaking will be extremely damaging to lifeline transportation routes including Interstate-5. For more information on expected losses due to a CSZ event see the Oregon Resilience Plan.

Figure 2-7 Cascadia Subduction Zone Damage Potential



Source: Oregon HazVu: Statewide Geohazards Viewer (HazVu)

The NHMP Steering Committee rated the city as having a **"high" vulnerability to the Cascadia Subduction Zone (CSZ) earthquake hazard**, meaning that more than 10% of the city's population or assets would be affected by a major CSZ emergency or disaster and a **"moderate" vulnerability to crustal earthquakes**, meaning that less than 10% of the city's population or assets would be affected by a major crustal earthquake emergency or disaster. *The previous NHMP rated the earthquake vulnerability as "high" but did not distinguish between the crustal and CSZ events.*

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 78 buildings in Salem. Buildings with a 'high' or 'very high' potential for collapse are listed in Table 2-9.

Table 2-9 City of Salem Building Collapse Potential[11]

Level of Collapse Potential			
Low (<1%)	Moderate (1-10%)	High (>10%)	Very High (100%)
29	9	33	7

Source: DOGAMI 2007. Open File Report 07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment

Of the facilities evaluated by DOGAMI using RVS: seven schools, seven government buildings and emergency services facilities (including the State Capital, Salem City Hall, and Oregon State Police), and 11 Chemeketa Community College buildings have a high collapse potential. The seven buildings with very high collapse potential are all School District 24-J buildings.[12]

Mitigation Successes

Salem fire stations 1, 2, 4, and 6 were seismically retrofitted (structural) per FEMA grant funds. Fire stations 5, 7, 10, and 11 are built under the latest building code seismic standards. Fire stations 3, 8, and 9 have been modernized, but have not been seismically retrofitted (structural).

Seismic retrofit grant awards per the Seismic Rehabilitation Grant Program[13] have been funded to retrofit: Richmond Elementary (2013-2014 grant award, $1,500,000; total project cost $2.7 million), and Four Corner Elementary (Phase Two of 2015-2017 grant award, $1,492,268).

[11] DOGAMI 2007. Open File Report 07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment
[12] Ibid.
[13] 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.

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)

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

Extreme Heat

Significant Changes Since Previous Plan:

There have not been significant changes to this hazard since the previous plan, however, this section has been reformatted.

Table 2-10 Extreme Heat Summary

Hazard	Extreme Heat
Type	Climatic
Speed of Onset	Slow to moderate
Location	Citywide
Extent	Minor to severe
Prior Occurance	Minor events occur almost annually.
Probability (annual)	100% for minor events, <10% for moderate to severe events

Sources: Salem NHMP Steering Committee (2017)

Characteristics

The definition of extreme heat varies by region; however, in general a heat wave is a prolonged period of extreme heat for several days to several weeks. High temperatures are also often combined with excessive humidity.[14] Heat is the number one weather-related killer in the United States, resulting in hundreds of fatalities each year. In fact, on average, excessive heat claims more lives each year than floods, lightning, tornadoes and hurricanes combined.[15]

North American summers are hot; most summers see heat waves in one or more parts of the United States. East of the Rockies, they tend to combine both high temperature and high humidity; although some of the worst heat waves have been catastrophically dry.[16]

NOAA's heat alert procedures are based mainly on Heat Index Values. The Heat Index, sometimes referred to as the apparent temperature is given in degrees Fahrenheit. The Heat Index is a measure of how hot it really feels when relative humidity is factored with the actual air temperature.

To find the Heat Index temperature, look at the Heat Index chart below. As an example, if the air temperature is 96°F and the relative humidity is 65%, the heat index--how hot it feels--is 121°F. The Weather Service will initiate alert procedures when the Heat Index is

[14] FEMA. Are You Ready? Extreme Heat.
[15] National Oceanic Atmospheric Administration. Heat Wave: A Major Summer Killer. http://www.nws.noaa.gov/om/brochures/heat_wave.shtml. Accessed June 1, 2012.
[16] Ibid.

expected to exceed 105˚-110˚F (depending on local climate) for at least two consecutive days.[17]

Location and Extent

The most severe impact of extreme heat affects peoples' health directly. Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat.[18]

According to the Federal Emergency Management Agency, "conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality. Consequently, people living in urban areas may be at greater risk from the effects of a prolonged heat wave than those living in rural areas. Also, asphalt and concrete store heat longer and gradually release heat at night, which can produce higher nighttime temperatures known as the "urban heat island effect."[19]

History

In July 2009 heat advisories were issued across the Pacific Northwest, with record highs of 107 degrees Fahrenheit in Salem, 106 in Portland and over 100 in Seattle. The heat wave lasted several days, which is unusual. Many homes and buildings throughout Northern Oregon and Washington do not have air-conditioning, because temperatures are generally moderate in this region. Cooling centers for the elderly were open late in Portland as well as in other communities throughout the Pacific Northwest. Extreme also affected Salem in June 2015, additional minor occurrences of extreme heat occur annually.

Probability Assessment

Based on the available data and research for Salem the NHMP Steering Committee determined the **probability of experiencing an extreme heat event is "high",** meaning one incident is likely within the next 35-year period; *this rating has not changed since the previous plan*.

Vulnerability Assessment

Extreme heat events in the past caused few minor injuries to the health and safety of residents. However, the potential for injuries or deaths from past events or from similar events in other communities could escalate resulting in multiple major injuries or possible death. It is estimated that less than 10% of the city's population would be physically displaced by an extreme heat, likely accounting for those individuals who seek refuge in a cooling center, and there would be mild impact on community social networks.

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[17] National Oceanic Atmospheric Administration. Heat Wave: A Major Summer Killer. http://www.nws.noaa.gov/om/brochures/heat_wave.shtml. Accessed June 1, 2012.
[18] FEMA. Are You Ready?. Extreme Heat.
[19] Ibid.

Facilities throughout the city are anticipated to reflect little to no damage due to extreme heat, estimated at less than $1 million for hazard response, structural repairs and equipment replacement. In terms of commercial business, it is likely 10-30% of businesses located in the City and surrounding area would experience commerce interruption for a period of at least a few days. Extreme heat has the potential to overload the electric grid and result in widespread power outages. Lastly, extreme heat would likely have mild impacts on 10-25% of the city's ecological systems, including, clean water, wildlife habitat, and parks.

As such, the NHMP Steering Committee rated the city as having a **"high" vulnerability to extreme heat hazards**, meaning that more than 10% of the city's population or assets would be affected by a major disaster; *this rating has not changed since the previous plan*.

Flood

Significant Changes Since Previous Plan:

There have not been significant changes to this hazard since the previous plan, however, this section has been reformatted.

Table 2-11 Flood Summary

Hazard	Flood
Type	Climatic
Speed of Onset	Slow to moderate
Location	Mapped flood zones, floodplain
Extent	Moderate to severe
Prior Occurance	Nine significant events since 1964
Probability	~18% overall; 1% annual within SFHA

Sources: DOGAMI - Oregon HazVu; Oregon NHMP; FEMA NFIP; Oregon Risk Map

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.[20] The principal types of flood that occur in Salem include: riverine floods, shallow area floods, and urban floods.

Location and Extent

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 streamflow gages, 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 probability of occurrence of 1 percent 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 NFIP. The FIRMs show 100-year floodplain boundaries for identified flood hazards. These areas are also referred to as

[20] Taylor, George H. and Chris Hannan. *The Oregon Weather Book*. Corvallis, OR: Oregon State University Press. 1999

Special Flood Hazard Areas (SFHAs) and are the basis for flood insurance and floodplain management requirements.

The city has more than 4,000 acres of floodplain and approximately 3,000 individual parcels that are partially or entirely located within the floodplain.[21] The most significant of the FEMA-determined floodplains and floodways either surround the southern side of the Willamette River west of Salem, or are within the greater Mill Creek/Pringle Creek watershed.[22]

Properties in and near the floodplains in the City of Salem are subject to frequent flooding events. Since flooding is such a pervasive problem throughout the city, many residents have purchased flood insurance to help recover from losses incurred from flooding events.

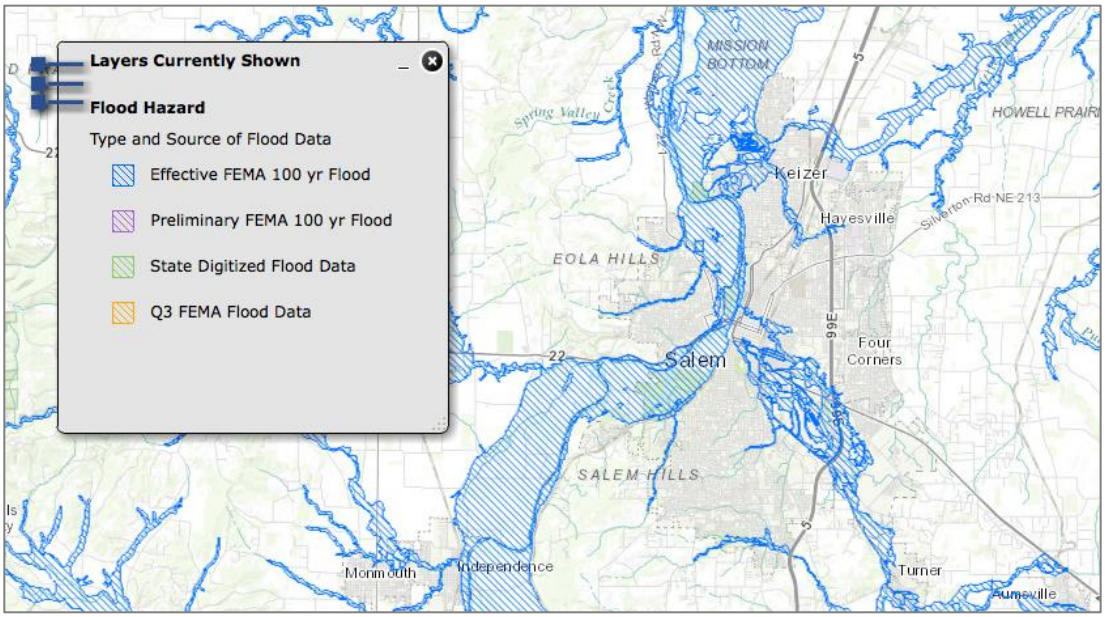
For more information, refer to the following Flood Insurance Study (FIS) and associated Flood Insurance Rate Maps (FIRM):

- Marion County Flood Insurance Study (January 2, 2003)

Additional reports are 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 2-8 and Figure 2-9.

Figure 2-8 Special Flood Hazard Area

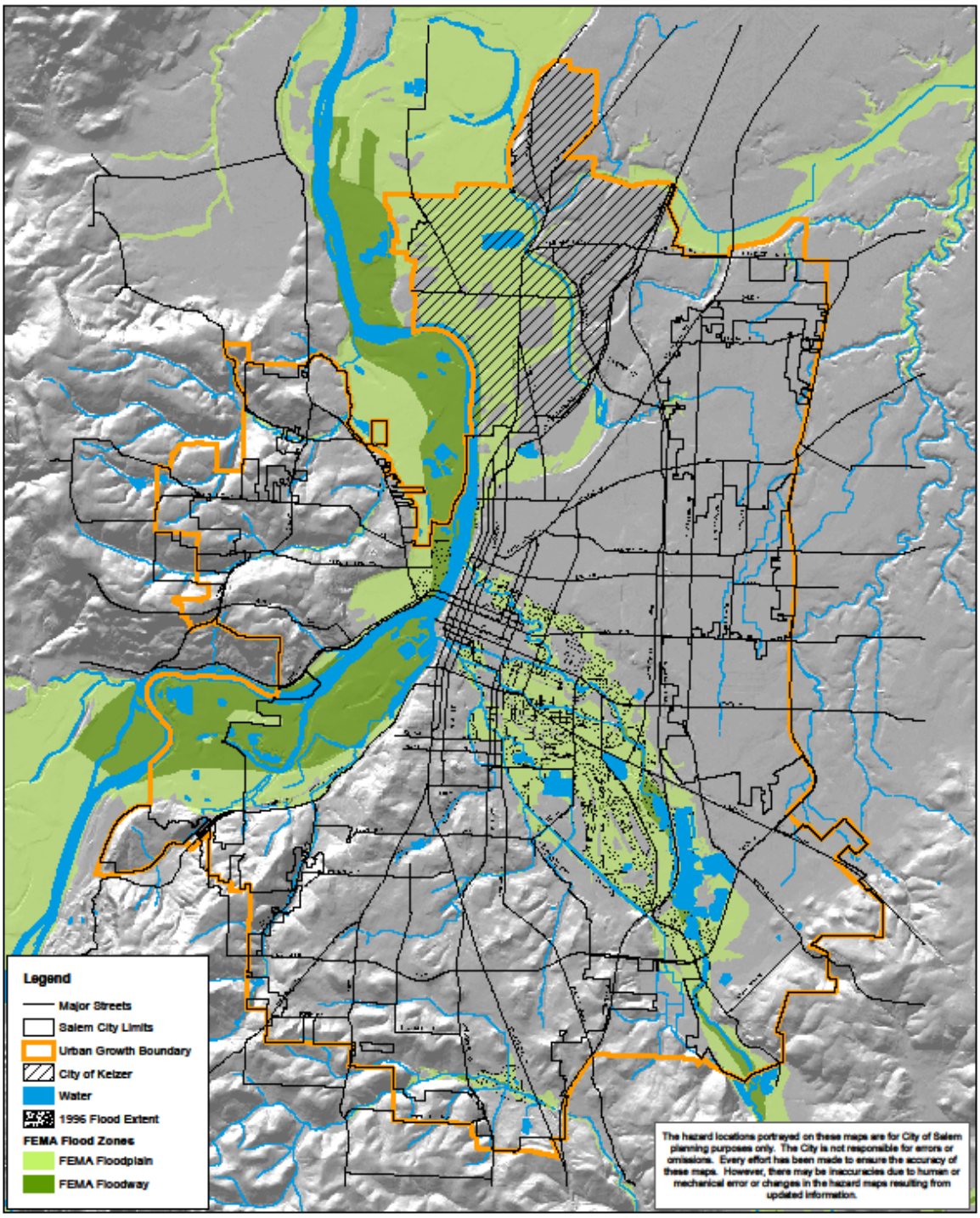


Source: Oregon HazVu: Statewide Geohazards Viewer (HazVu)

[21] City of Salem. Floodplain Information. http://www.cityofsalem.net/Departments/PublicWorks/Administration/DevelopmentServices/Pages/FloodplainInformation.aspx

[22] City of Salem Geographic Information Systems. Natural Hazard Mitigation Plan. Map FL.1. 2008.

Figure 2-9 Salem Special Flood Hazard Areas



Source: City of Salem

History

Salem has more than 4,000 acres of floodplain and approximately 3,000 individual parcels that are partially or entirely located within the floodplain. In Salem, flooding generally occurs when: (1) unusually warm weather mixed with heavy rain melts snow in the higher elevations and flood local streams, and/or (2) ongoing development within the City continues to displace natural areas that have historically functional as flood storage.

The Willamette River basin has a long history of flooding. The largest flood on record on the Willamette River occurred in 1861. In 1861, town of Champoeg disappeared in the flood. Since then, however, the construction of flood control dams in the 1940s and 1950s has changed the pattern of flooding significantly. Salem has experienced four major floods and five lesser floods during the last 48 years. One of the most memorable floods during this time period, the “Christmas” flood of 1964, was rated "approximately a 100-year flood", and was probably the most damaging in Oregon’s history. Floods occurring since the 2012 NHMP are discussed in more detail below.

Heavy rains from the January 2012 storm caused extensive flooding throughout Salem, with an estimated $10.3 million in overall damage of city facilities.[23] Twelve Counties, including Marion and Polk counties (including Salem), have been designated as adversely affected by the January disaster.[24] During a five-day period starting January 16, the hills in South Salem received as much as nine (9) inches of rain. Runoff from the heavy rainfall was intensified by the melting of three- to six-inches of snow that had fallen in higher elevations a week earlier.[25] The President issued a major disaster declaration under the authority of the Robert T. Stafford Disaster Relief and Emergency Assistance Act *(FEMA-4055-DR-OR)*.

In February 2014 *(FEMA-4169-DR-OR)* and December 2015 *(FEMA-4258-DR-OR)* floods occurred in Salem which impacted roads and other city infrastructure.

Probability Assessment

The Federal Emergency Management Agency (FEMA) has mapped the 10, 50, 100, and 500-year floodplains in portions of Salem (see Figure 2-8 and Figure 2-9, 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 National Flood Insurance Program (NFIP) is based.

Based on the available data and research for Salem the NHMP Steering Committee determined the **probability of experiencing a flood is “high”,** meaning one incident is likely within the next 10-year period; *this rating has not changed since the previous plan*.

Vulnerability Assessment

Floods in the past caused multiple major injuries or death. The potential for future injuries or deaths is anticipated to remain similar to historic events. It is estimated that 10-25% of the city’s population would be physically displaced by a flood, accounting for the number of

[23] Statesman Journal. “Pricey Flood Repairs Needed at Salem Parks”. February 29, 2012.
[24] FEMA. Oregon Disaster History. Major Disaster Declaration
[25] Statesman Journal. “Salem Hosts Flood Meetings Starting Tonight”. March 19, 2012.

homes located in or near floodplains, and there would be moderate impact on community social networks.

Multiple facilities throughout the city anticipate severe damage due to a flood, estimated between $10 million and $100 million for hazard response, structural repairs and equipment replacement. In terms of commercial business, it is likely 10-30% of businesses located in the city and surrounding area would experience commerce interruption for a period of a months. Floods have the potential to inflict widespread damage to not only buildings but also the transportation network that may inhibit access to businesses. Lastly, floods would likely have extensive impacts on more than 75% of the city's ecological systems, including, clean water, wildlife habitat, and parks.

Changes to development patterns have the potential to incur increased risk of flooding. However, city development regulations restrict, but do not prohibit, new development in areas identified as floodplain. This reduces the impact of flooding on future buildings. As new land has been brought into the regional Urban Growth Boundary the applicable development codes have been written to prevent the siting of new structures in flood prone areas.

As such, the NHMP Steering Committee rated the city as having a **"high" vulnerability to flood hazards**, meaning that more than 10% of the city's population or assets would be affected by a major flood event; *this rating has not changed since the previous plan*.

Floodplain Management Plan

Salem has a Floodplain Management Plan. The Plan identifies flood hazards, establishes a program of activities to mitigate the hazards, and coordinates mitigation activities to prevent conflicts with other community needs.[26]

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

[26] City of Salem. Floodplain Committee Information. Accessed August 28, 2012. http://www.cityofsalem.net/DEPARTMENTS/PUBLICWORKS/ADMINISTRATION/DEVELOPMENTSERVICES/Pages/FloodplainInformation.aspx

Hazardous Materials Incident

Significant Changes Since Previous Plan:

There have not been significant changes to this hazard since the previous plan, however, this section has been reformatted.

Table 2-12 Hazardous Materials Summary

Hazard	Hazardous Materials Event
Type	Technological
Speed of Onset	Rapid
Location	Specific area
Extent	Minor to severe
Prior Occurance	Minor events occur almost annually.
Probability	100% for minor events, <10% for moderate to severe events

Sources: Salem NHMP Steering Committee (2017)

Characteristics

For the purposes of mitigation planning, hazardous materials releases are considered a secondary hazard derived from the impact of a natural hazard event (i.e. flooding in a chemical storage area could result in toxic levels of chemicals in water or air). Hazardous materials may be defined simply as any materials that may have negative impacts on human health. That is, exposure to hazardous materials may result in injury, sickness, or death. They may also include materials that may cause negative impacts on the environment or on animal or plant species.

Hazardous chemicals are widely used in heavy industry, manufacturing, agriculture, mining, the oil and gas industry, forestry, and transportation as well as in medical facilities and commercial, public, and residential buildings. There are literally hundreds of thousands of chemicals that may be hazardous to human health, at least to some extent. A typical single family home may contain dozens of potentially hazardous materials including fuels, paints, solvents, cleaning chemicals, pesticides, herbicides, medicines and others. However, for mitigation planning purposes, small quantities of slightly or moderately hazardous materials being used by end users are rarely the focus of interest. Rather, interest is focused primarily on larger quantities of hazardous materials in industrial use and on hazardous materials being transported, where the potential for accidental spills is high. Situations involving extremely hazardous materials or large quantities of hazardous materials in locations where accidents or malevolent actions (terrorism or sabotage) may result in significant public health risk are of special concern for planning purposes.

The severity of any hazardous material release incident for an affected community depends on several factors, including the toxicity, quantity, and dispersal characteristics of the hazardous material; local conditions such as wind direction, topography, soil and ground water characteristics; proximity to drinking water resources and populations.

There are three principal modes of human exposure to hazardous materials, **inhalation** of gaseous or particulate materials via the respiratory (breathing) process; **ingestion** of hazardous materials via contaminated food or water; and **direct contact** with skin or eyes.

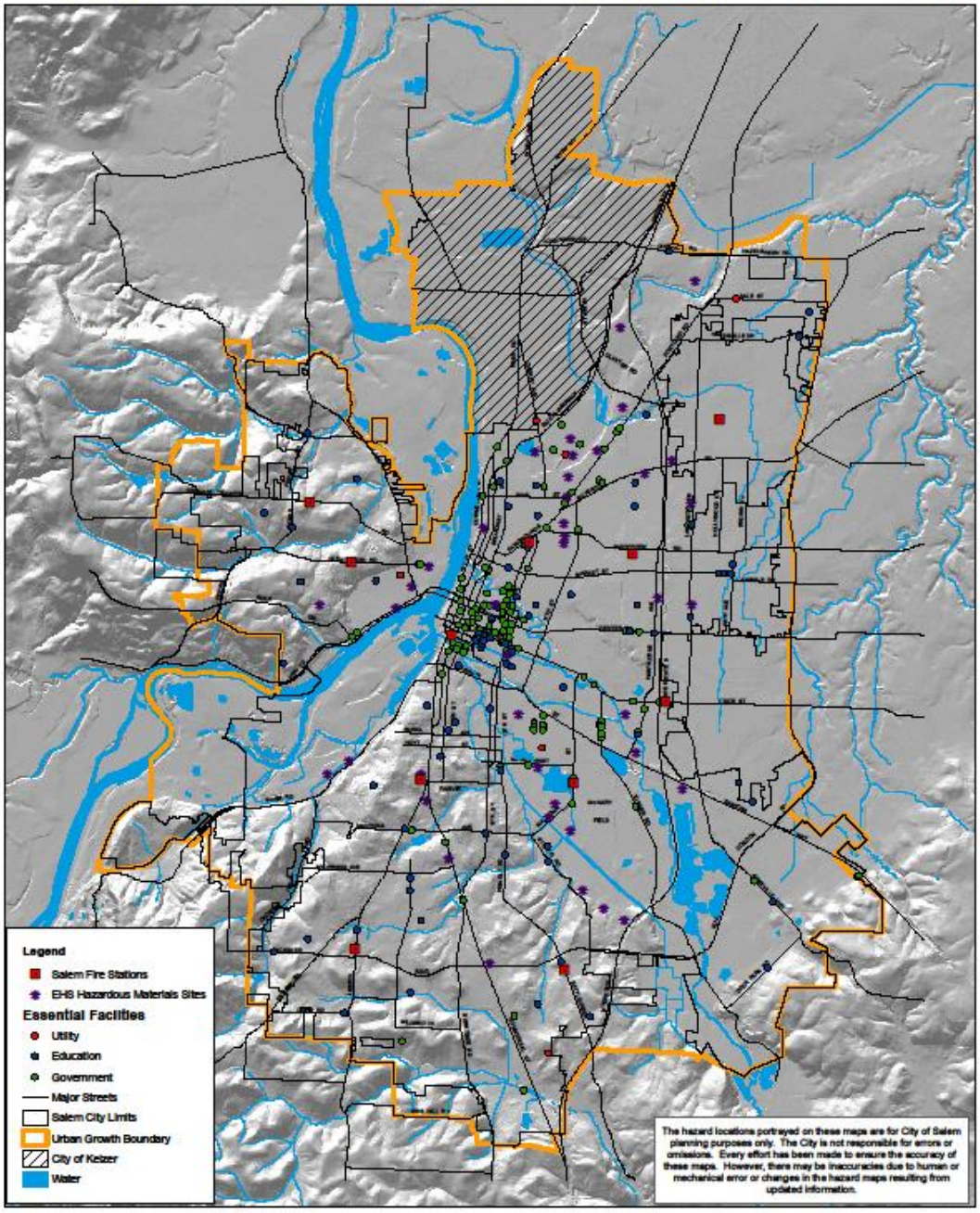
Location and Extent

Hazardous materials incidents would likely be localized near the source of the incident, but major incidents could have extensive evacuation zones and affect a significant portion of Salem. The potential for casualties, including death and injury, is dependent on the location of incident, time of day, effectiveness of evacuation and materials involved.

The Office of State Fire Marshal maintains a hazardous materials database provided to city Fire Departments. The database includes information on chemicals stored by address with name, and phone number. Salem Environmental Services maintains a vast database (e.g., underground fuel tanks, waste generators, contaminated properties, etc.). These and other databases are linked to addresses of sites that use/generate hazardous materials/waste. The Salem Fire Department and Public Works have utilized the information in these databases and have a full-capacity hazmat response team to respond to hazardous materials incidents.

In Salem, specific places have higher than average risks for hazardous material releases. In particular, trucking routes along I-5 and Highway 22 that run through Salem are vulnerable because of the quantity of materials transported along these routes. Also, the railroad lines that run through downtown Salem near the Capitol area are a concern because they carry significant quantities of hazardous materials transported through Salem each year. Figure 2-10 identifies important facilities and hazardous materials locations.

Figure 2-10 Important Facilities and Hazardous Materials Locations



Source: City of Salem

History

Between 2013 and May 2017, there have been 102 (20 involving hazmat teams) reported hazardous materials incidents, most of which have been negligible.[27] Gas leaks are reported as the most common type of hazardous materials incident reported in the city. Most incidents are reported as unintentional accidents, but there are a few incidents of intentional hazardous materials release and/or exposure, all of which were effectively and safety managed.

Probability Assessment

Based on the available data and research for Salem the NHMP Steering Committee determined the **probability of experiencing a hazardous materials event is "moderate",** meaning one incident is likely within the next 35 to 75 year period; *this rating has not changed since the previous plan*.

Vulnerability Assessment

Hazardous materials events in the past caused multiple minor injuries or a major injury impacting the health and safety of residents. However, the potential for injuries or deaths from past events or from similar events in other communities could escalate resulting in multiple deaths and major injuries. It is estimated that less than 10% of the city's population would be physically displaced by a hazardous materials incident, likely the result of a minor spill or leak, and there would be mild impact on community social networks.

Facilities throughout the city are anticipated to reflect minor damage to several facilities due to hazardous materials, estimated between $1 million to $10 million for hazard response, structural repairs and equipment replacement. In terms of commercial business, it is likely 10-30% of businesses located in the city and surrounding area would experience commerce interruption for a period of at least a few days. Hazardous materials can be extremely dangerous and businesses will be forced to closed if they are within the incident impact radius. Lastly, extreme heat would likely have extensive impacts on more than 75% of the city's ecological systems, including, clean water, wildlife habitat, and parks.

Many facilities throughout the city hold and store hazardous materials, the areas surrounding these facilities and the adjacent transport network that carry the substances are especially vulnerable. As such, the NHMP Steering Committee rated the city as having a **"high" vulnerability to hazardous materials hazards**, meaning that more than 10% of the city's population or assets would be affected by a major disaster; *this rating has not changed since the previous plan*.

[27] Oregon.gov. Hazardous Substances Incidents, 2013-2017; http://www.oregon.gov/osp/SFM/pages/cr2k_infoavailable.aspx#Hazardous_Substance_Incidents .

Landslide

Significant Changes Since Previous Plan:

The occurrence history for this hazard has been updated as well as the probability rating, new landslide susceptibility information based on updated Lidar data provided by DOGAMI (O-16-02). This section has also been reformatted.

Table 2-13 Landslide Summary

Hazard	Landslide
Type	Climatic/Geologic
Speed of Onset	Slow to rapid
Location	Steep slopes, weak geology (west Salem)
Extent	Minor to severe, but localized
Prior Occurance	Landslides occur annually
Probability	100% for minor events, ~10-20% for severe events

Sources: DOGAMI - Oregon HazVu; Oregon NHMP

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.

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

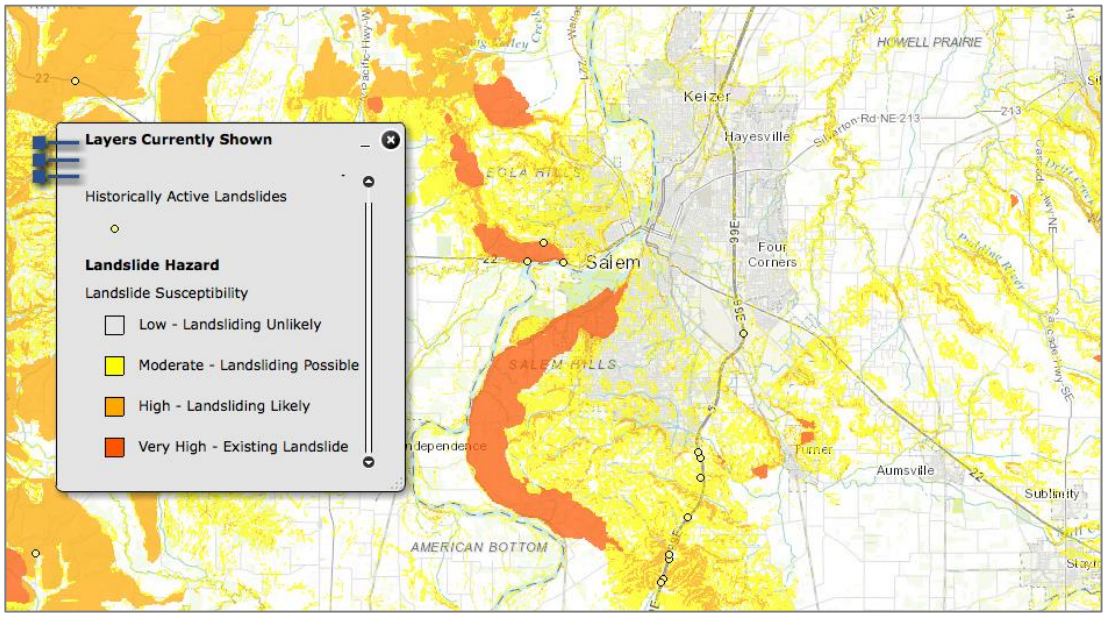
The characteristics of the minerals and soils present in Salem indicate the potential types of hazards that may occur. Rock hardness and soil characteristics can determine whether or not an area will be prone to geologic hazards such as landslides.

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

Natural conditions and human activities can both play a role in causing landslides. The incidence of landslides and their impact on people and property can be accelerated by development.

Landslides and debris flows are possible in any of the higher slope portions of Salem, including much of the western portion of the city (see Figure 2-11).

Figure 2-11 Landslide Susceptibility Exposure



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

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 2-14 shows landslide susceptibility exposure for Salem. Approximately 7% of the city land has High or Very High landslide susceptibility exposure. Note that even if a city 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.

Table 2-14 Landslide Susceptibility Exposure

Jurisdiction	Area, ft^2	Low	Moderate	High	Very High
Salem	1,368,874,853	69.3%	23.3%	3.5%	3.9%

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-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 may happen at any time of the year. In addition to landslides triggered by a combination of slope stability and water content, earthquakes may also trigger landslides. Areas prone to seismically triggered landslides are generally the same as those prone to ordinary (i.e., non-seismic) landslides. As with ordinary landslides, seismically triggered landslides are more likely for earthquakes that occur when soils are saturated with water.

Debris flows and landslides are a very common occurrence in hilly areas of Oregon, including portions of Salem. Many landslides occur in undeveloped areas and thus may go unnoticed or unreported. For example, DOGAMI conducted a statewide survey of landslides from four winter storms in 1996 and 1997 and found 9,582 documented landslides, with the actual number of landslides estimated to be many times the documented number. For the most part, landslides become a problem only when they impact developed areas and have the potential to damage buildings, roads, or utilities.

In February 1996, November 1996, and December 1996/January 1997 the Willamette Valley experienced heavy rainfall and snowmelt which led to widespread landslide events throughout the state. Disaster declarations were issued for Marion County for the February

1996 and December 1996/January 1997 storms.[28] During these storms, many landslides occurred in the eastern portion of the state, and are too numerous to list here. In 2000, DOGAMI mapped the historical instances of landslide events throughout the Willamette Valley for the 1996-1997 storms, including Salem.[29] Landslides also occurred with heavy rain events in January 2012 (FEMA-4055-DR-OR), February 2014 (FEMA-4169-DR-OR), and December 2015 (FEMA-4258-DR-OR).

The geologic setting of the Salem Hills illustrates a historic pattern of landslides. Many prominent features that help identify the ancient landslide terrain are hummocky topography, disrupted drainage patterns, sag ponds, springs, back-tilted bedrock blocks, and subdued head scarps. In 2005, a landslide blocked traffic to the Salem along South River Road, near South Owen Street. The 2005 Slide did not damage any homes. Another landslide occurred in January of 2011 on South River Road between Owens Street and Croissan Creek. The slide brought down a boulder that blocked thoroughfare.

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. There is a strong correlation between intensive winter rainstorms and the occurrence of rapidly moving landslides (debris flows). Given the correlation between precipitation 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 Salem 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; *this rating has increased since the previous plan*.

Vulnerability Assessment

Landslides can affect utility services, transportation systems, and critical lifelines. 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 landslide movements as small as an inch or two.

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[28] Oregon State Archives, Governor's Executive Orders, *EO-96-12, EO-97-9,* http://arcweb.sos.state.or.us/governors/Kitzhaber/web_pages/governor/legal/execords.htm, accessed September 28, 2010.

[29] Harvey, Andrew F. and Gary L. Peterson. 1998. Water-Induced Landslide Hazards, Western Portion of the Salem Hills, Marion County, Oregon.

Roads and bridges are subject to closure during landslide events. Because many Salem residents are dependent on roads and bridges for travel to work, delays and detours are likely to have an economic impact on city 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 road use for commercial traffic or emergency access.

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.

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).

Currently, data does not allow for specific estimates of life and property losses during a given scenario.

Landslides in the past caused few minor injuries. However, the potential for injuries or deaths from past events or from similar events in other communities could escalate resulting in multiple minor injuries and a possible major injury. Salem estimates that less than 10% of the city's population could be physically displaced by a landslide, considering landslide events tend to have localized impacts; and there would be little to no impact on community social networks.

Multiple facilities throughout the city anticipate moderate damage due to a landslide, estimated at less than $1 million for hazard response, structural repairs and equipment replacement. In terms of commercial business, it is likely that less than 10% of businesses located in the city and surrounding area could experience commerce interruption for a period of days. Landslide hazards have the potential to affect transportation and may inhibit access to businesses until roadways can be cleared. Lastly, landslides would likely have mild impacts on 10-25% of the City's ecological systems, including, clean water, wildlife habitat, and parks.

As such, the NHMP Steering Committee rated the city as having a **"moderate" vulnerability to landslide hazards**, meaning that between 1 to 10% of the city's population or assets would be affected by a major disaster; *this rating has not changed since the previous plan*.

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

Volcano

Significant Changes Since Previous Plan:

There have not been significant changes to this hazard since the previous plan, however, this section has been reformatted.

Table 2-15 Volcano Summary

Hazard	Volcano
Type	Geologic
Speed of Onset	Slow to rapid
Location	Cascade Mountains
Extent	Moderate to severe
Prior Occurance	One significant event since 1916 (Mount St. Helens)
Probability	<1% annual

Sources: Oregon NHMP (2015)

Characteristics

The Pacific Northwest, lie 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 Salem, as there are no active volcanoes within the city. 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, and collapse roofs.

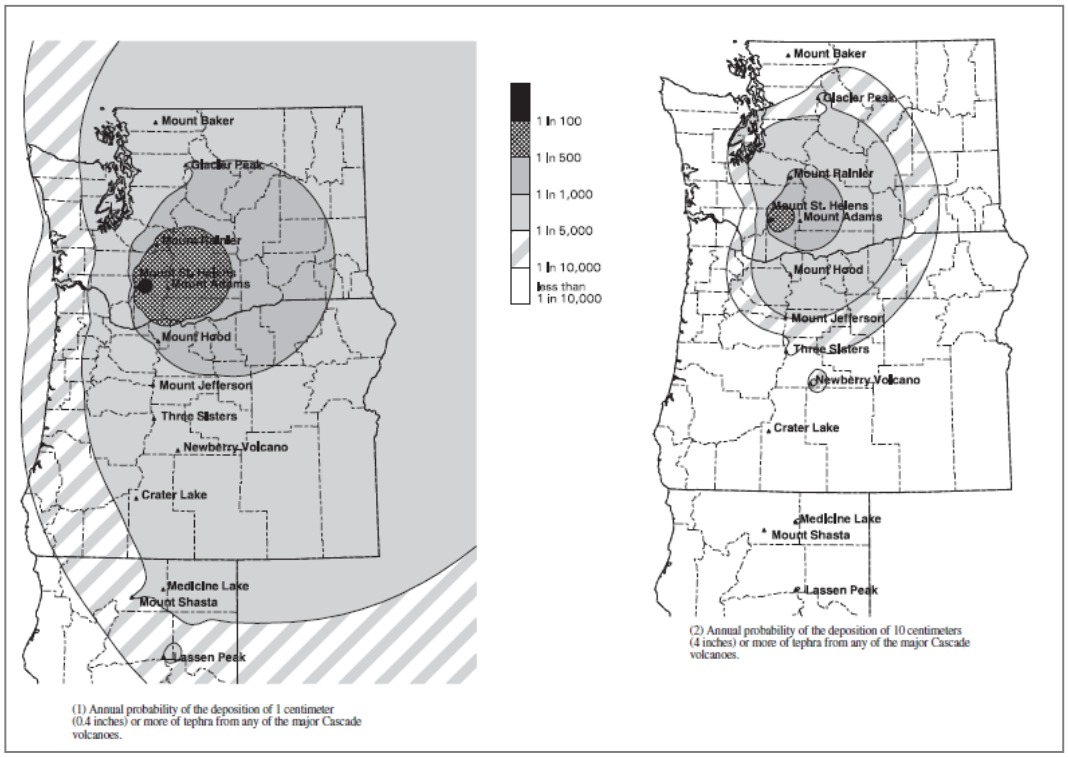
Salem is located on the Pacific Rim. Tectonic movement within the earth's crust can renew nearby dormant volcanoes resulting in ash fallout. Volcanic activity is possible from Mount Hood, Mount Saint Helens, Three Sisters, Mount Bachelor, and the Newberry Crater areas. Because the distance to these potentially active volcanic areas is so great, the only adverse effect that would impact areas of Salem 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 2-12 depicts the potential and geographical extent of volcanic ash fall in excess of ten centimeters from a large eruption of Mount St. Helens.

Figure 2-12 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 Salem. Mount Hood is northeast of the city 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. 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 city. 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.

Probability Assessment

Based on the available data and research for Salem the NHMP Steering Committee determined the **probability of experiencing volcanic activity is "low",** meaning one incident is likely within the next 100-year period; *this rating has not changed since the previous plan*.

Vulnerabilities

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 Salem 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 Salem. This is small when compared to other risks faced by the city. The USGS map on the previous page illustrates potential tephra fall in the region.

Risks for Salem associated with regional volcanic activity would be ash fall, air quality, and possible economic or social disruption due to air traffic issues due to the ash cloud.

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 city.

Volcanic eruptions in the past caused multiple minor injuries or a major injury to the health and safety of residents. The potential for future injuries or deaths is anticipated to remain similar to historic events. It is estimated that less than 1% of the City's population would be physically displaced by a volcanic eruption, considering the primary volcanic hazard that could impact the City is ash fallout, and there would be moderate impact on community social networks.

Several facilities throughout the City anticipate mild damage due to a volcanic eruption, estimated between $1 million and $10 million for hazard response, structural repairs and equipment replacement. In terms of commercial business, it is likely more than 75% of businesses located in the City and surrounding area would experience commerce interruption for a period of several weeks. Ash fall from volcanic eruptions has the potential to impact a wide region, inflicting damage to building circulation systems and road surface conditions. Lastly, volcanic eruptions would likely have extensive impacts on more than 75% of the City's ecological systems, including, clean water, wildlife habitat, and parks.

As such, the NHMP Steering Committee rated the city as having a **"moderate" vulnerability to volcanic activity**, meaning that between 1 to 10% of the city's population or assets would be affected by a major disaster (volcanic ash); *this rating has not changed since the previous plan*.

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:

There have not been significant changes to this hazard since the previous plan, however, this section has been reformatted.

The existing Marion County Community Wildfire Protection Plan was updated in 2017 and incorporated where applicable in this plan.

Table 2-16 Wildfire Summary

Hazard	Wildfire
Type	Climatic, Human Caused
Speed of Onset	Moderate to rapid
Location	Citywide, Wildland Urban Interface
Extent	Minor to extreme
Prior Occurance	171 from 2000-2009* (countywide)
Probability	100% for minor events, ~1% for extreme events

Source: Marion County Community Wildfire Protection Plan (DRAFT, 2017)

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.

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 and low humidity, can lead to extreme Wildfire activity. By contrast, cooling and higher humidity 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. 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. The interface is the urban-rural fringe where homes and other structures are built into a densely forested or natural landscape. If left unchecked, it is likely that fires in these areas will threaten lives and property. One challenge Salem 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 city 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 wildfire. In addition, common causes of Wildfires include arson and negligence from industrial and recreational activities.

While Salem does not have a specific wildfire management plan, the city is included in the Marion County Community Wildfire Protection Plan (CWPP) and the Polk County CWPP. One of the core elements of a CWPP is developing an understanding of the risk of potential losses to life, property, and natural resources during a wildfire. This risk assessment adopts the approach produced by Oregon Department of Forestry (ODF) under the National Association of State Foresters (NASF) guidance which includes the following three risk objectives:

- Identify Communities-at-Risk and the Wildland-Urban Interface
- Develop and conduct a wildfire risk assessment of all land in Marion County, surrounding the City of Salem.
- Identify and prioritize hazardous fuels treatment projects for all land in Marion County.

The Marion County wildfire risk assessment is the analysis of the potential losses to life, property, and natural resources. The analysis takes into consideration a combination of factors defined below:

Risk: the potential and frequency for wildfire ignitions (based on past occurrences).

Hazard: the conditions that may contribute to wildfire (fuels, slope, aspect, elevation and weather).

Values: the people, property, natural resources and other resources that could suffer losses in a wildfire event.

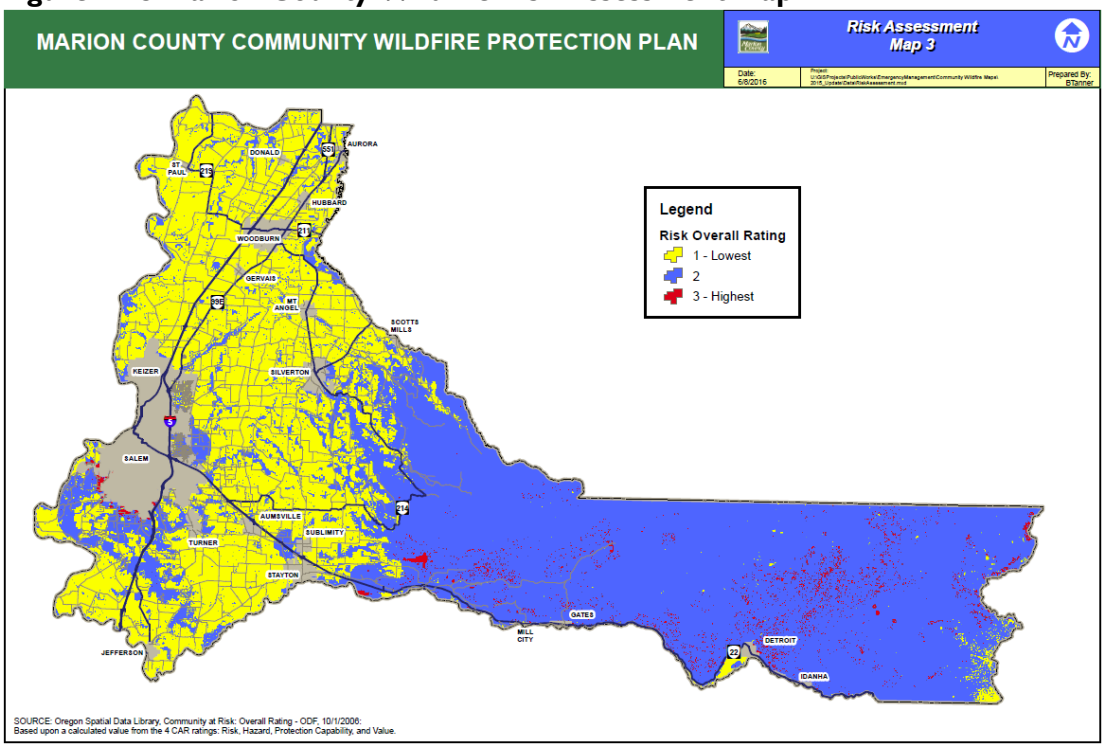
Protection Capability: the ability to mitigate losses, prepares for the hazard, responds to and suppresses wildland and structural fires.

Structural Vulnerability: the elements that influence the level of exposure of the hazard to the structure (roof type and building materials, access to the structure, and whether there is defensible space or fuels reduction around the structure.[30]

The Marion County CWPP identifies Salem (south and east) as an at-risk community based upon residential density and Fire District serviceability. The extent of damage to Salem from WUI fires is dependent on many factors, including temperature, wind speed and direction, humidity, proximity to fuels, and steepness of slopes. WUI fires can be intensified by development patterns, vegetation, and natural fuels, and can merge into unwieldy and unpredictable events. Figure 2-13 shows the overall risk rating for Marion County.

[30] Marion County. Community Wildfire Protection Plan (2017)

Figure 2-13 Marion County Wildfire Risk Assessment Map



Source: Marion County CWPP (2017)

Updated wildfire risk assessment information is now available through the West Wide Wildfire Risk Assessment (WWA).[31] This multi-state assessment provides multiple data sets that can be used to evaluate and weight the relative risk of various factors that contribute to wildfire risk. Because of the scale, modeling and assumptions that went into creating the WWA, caution is needed when interpreting the data at the local level. The ongoing CWPP update process will assess this new data and determine its relevance to wildfire risk and mitigation strategies in Marion County. Initial analysis of the WWRA data does not indicate a significant variance from the analysis used in the Marion and Polk CWPPs.[32]

History

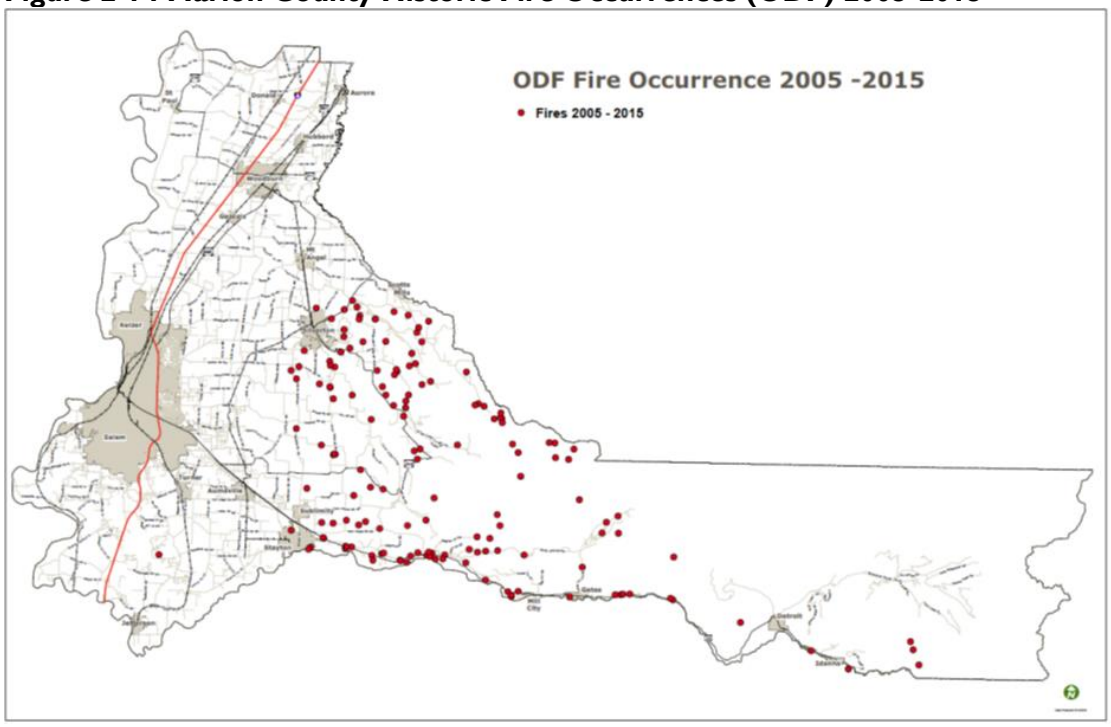
Salem has had relatively few occurrences of WUI Fire hazards that have resulted in minimal dollar losses. The majority of fire incidents are human caused and include vegetation fires, forest/wood fires, brush and grass fires. In July 2014, a four-alarm grassfire just West of Salem caused at least two homes to be evacuated. The location of the grassfire was off Highway 22 between Doaks Ferry Road NW and College Drive NW. In July 2015, a 15-acre wildfire threatened 15-20 homes on SE Macleay Road between 74th and 78th avenues

[31] The Oregon Department of Forestry (ODF and Agency), on behalf of the Council of Western State Foresters (CWSF) and the Western Forestry Leadership Coalition (WFLC), has conducted a wildfire risk assessment and report for the 17 western states and selected U.S. affiliated Pacific Islands. At the highest level, this assessment is known as the West Wide Wildfire Risk Assessment, or WWA.

[32] Marion County CWPP (2017)

around 2pm. One hundred firefighters responded to the fire and could contain the burn within about an hour. No damage to life or property was reported. Figure 2-14 shows the countywide wildfire history from 2005 to 2015 per the Marion County CWPP.

Figure 2-14 Marion County Historic Fire Occurrences (ODF) 2005-2015



Source: Marion County CWPP (2017)

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 Salem the NHMP Steering Committee determined the **probability of experiencing a Wildfire is "moderate",** meaning one incident is likely within the next 35 to 75-year period; *this rating has not changed since the previous plan*.

Vulnerability Assessment

Wildfires are a natural part of forest and grassland ecosystems. Past forest practices included the suppression of all forest and grassland fires. This practice, coupled with hundreds of acres of dry brush or trees weakened or killed through insect infestation, has fostered a dangerous situation. Present state and national forest practices include the reduction of understory vegetation through thinning and prescribed (controlled) burning.

Each year a significant number of people build homes within or on the edge of the forest (urban/wildland interface), thereby increasing wildfire hazards. Many Oregon communities (incorporated and unincorporated) are within or abut areas subject to serious wildfire hazards, complicating firefighting efforts and significantly increasing the cost of fire suppression.

Wildfires in the past have caused no personal injury or death. However, the potential for injuries or deaths from past events or from similar events in other communities could escalate resulting in multiple minor injuries or possible major injury. Salem estimates that less than 10% of the city's population could be physically displaced by a wildfire, considering the proximity of residential housing to WUI vulnerable areas; and there would be mild impact on community social networks. The west and south areas of the city are considered to be the most vulnerable, particularly the residential areas along Eola Ridge.

Multiple facilities throughout the city anticipate moderate damage due to wildfires, estimated at less than $1 million for hazard response, structural repairs and equipment replacement. In terms of commercial business, it is likely that less than 10% of businesses located in the city and surrounding area could experience commerce interruption for a period of hours. The businesses most impacted are those in close proximity to WUI areas. Lastly, wildfires could likely have mild impacts on 10-25% of the city's ecological systems, including, clean water, wildlife habitat, and parks.

The Marion County CWPP (2017) identifies the City of Salem as a community with **moderate/low** WUI fire risk priority based on three risk factors: fire behavior, values, and infrastructure.[33] West Salem is in Polk County and is included within Zone 2 of the Polk County CWPP (an area covering a large section of the county east of the coast mountains), which has a **high** overall risk rating.[34]

As such, the NHMP Steering Committee rated the city as having a **"low" vulnerability to Wildfire hazards**, meaning that less than 1% of the city's population or assets would be affected by a major disaster; *this rating has not changed since the previous plan*.

More information on this hazard can be found in the Risk Assessment for Region 3, Mid-Willamette Valley, of the Oregon NHMP (2015) and the Marion County CWPP.

[33] Ibid.

[34] Polk County Community Wildfire Protection Plan (2009).

Windstorm

Significant Changes Since Previous Plan:

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

Table 2-17 Windstorm Summary

Hazard	Windstorm
Type	Climatic
Speed of Onset	Slow to moderate
Location	Citywide
Extent	Minor to severe
Prior Occurance	Minor events occur annually; ~30 moderate to severe events over the past 130 years
Probability	100% for minor events, 23% for moderte to severe events

Source: Oregon NHMP (2015)

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 Salem is straight-line winds, which originate as a downdraft of rain-cooled air, and reach the ground and spread out rapidly. Straight-line winds can produce gusts of up to 100 mph. For Salem, the wind hazard levels are generally highest near the Willamette River and then fairly uniform across most of the rest of the city. 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 entirety of the city, 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 tons of storm related debris.

History

In 2009, just outside of Salem on Highway 22, winds and a thunderstorm brought down several trees. In January 2012, severe winds accompanied a winter storm with gusts measuring 59 knots a causing multiple power outages (FEMA-4055-DR-OR). In March/April of 2012 Severe winds and storm conditions impacted a large multi-county region of Western Oregon, with considerable damage sustained in Salem. Disaster response efforts focused on debris removal, repair of heavily-wooded transmission line, and restoration of flood-damaged structures. In March 2015, strong winds were measured at the Salem airport.

The most significant recent storm occurred in December of 2010 culminating in an EF2 tornado touching down in the City of Aumsville (17 miles SE of Salem) with wind speeds between 110 and 120 mph. This was the largest tornado recorded in Marion County to date and the second largest in the state since 1950. According to a December 23, 2010 NOAA storm survey report, the tornado traveled in a northeasterly direction and had a path length of approximately five-miles. The initial damage assessment estimated total losses at over $1.1 million.[35]

Windstorms occur yearly; more destructive storms occur once or twice per decade, most recently in December 2015. The *Columbus Day Storm*, October 1962, was Oregon's most destructive storm to date with winds approaching 116 mph winds in Willamette Valley. An estimated 84 houses were destroyed, with 5,000 severely damaged and with a total damage estimate of $170 million. More recent storms occurred in January 2012 *(FEMA-4055-DR-OR),* February 2014 *(FEMA-4169-DR-OR), and December 2015 (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 city 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.

[35] December 14, 2010 Aumsville Tornado Initial Damage Assessment Summary Form, Marion County Emergency Management.

Table 2-18 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 the city, can expect to be exposed to 60 mph winds in a 25-year recurrence interval (4% annual probability).

Table 2-18 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 Salem the NHMP Steering Committee determined the **probability of experiencing a windstorm is "high",** meaning one incident is likely within the next 35-year period; *this rating has not changed since the previous plan*.

Vulnerability Assessment

Many buildings, utilities, and transportation systems within Salem 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 Salem, trees are more likely to blow over during the winter (wet season).

Windstorms in the past caused multiple minor injuries or a major injury. However, the potential for injuries or deaths from past events or from similar events in other communities could escalate resulting in multiple major injuries or possible death. Salem estimates that more than 10% of the city's population could be physically displaced by a windstorm, accounting for the number of homes that loose power or properties with downed trees; and there would be mild impact on community social networks.

Several facilities throughout the city anticipate mild damage due to a windstorm, estimated between $1 million and $10 million for hazard response, structural repairs and equipment replacement. In terms of commercial business, it is likely 10-30% of businesses located in the city and surrounding area could experience commerce interruption for a period of a days. Windstorms have the potential to inflict widespread power outages and until power can be restored, business may experience interruption. Lastly, windstorms would likely have

extensive impacts on more than 75% of the city's ecological systems, including, clean water, wildlife habitat, and parks.

As such, the NHMP Steering Committee rated the city as having a **"high" vulnerability to windstorm hazards**, meaning that more than 10% of the city's population or assets would be affected by a major disaster; *this rating has not changed since the previous plan*.

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 Strom hazard has been edited to reference new history since the previous plan. This section has also been reformatted.

Table 2-19 Winter Storm Summary

Hazard	Winter Storm
Type	Climatic
Speed of Onset	Slow to moderate
Location	Citywide
Extent	Minor to severe
Prior Occurance	Minor events occur annually; ~30 moderate to severe events over the past 130 years
Probability	100% for minor events, 23% for moderte to severe events

Source: Oregon NHMP (2015)

Characteristics

Winter storms affecting Salem are generally characterized by a combination of heavy rains and high winds throughout the city, 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 Salem are typically not local events affecting only small geographic areas. Rather, the 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. Freezing rain can be the most damaging of ice formations. While sleet and hail can create hazards for motorists when it accumulates, 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. Salem is located within Zone 2: Willamette Valley (Figure 2-15). The climate in Zone 2 generally consists of cool, wet winters and warm, dry summers.[36] These wet winters result in potentially destructive winter storms that produce heavy snow, ice, rain and freezing rain, and high winds.

Figure 2-15 Oregon Climate Divisions

Source: Oregon Climate Service,

The principal types of winter storms that occur include:

- **Snowstorms:** require three ingredients: cold air, moisture, and air disturbance. The result is snow, small ice particles that fall from the sky. 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 sandwiched by two layers of cold air. Frozen precipitation melts when it hits the warm layer, and refreezes when hitting the cold layer below the inversion. Ice storms can include sleet (when the rain refreezes before hitting the ground) or freezing rain (when the rain freezes once hitting the ground).

[36] Oregon Climate Service, "Climate of Salem"

- **Extreme Cold:** Dangerously low temperatures accompany many winter storms. This is particularly 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 City is susceptible to damaging severe weather. Winter storms that bring snow and ice can impact infrastructure, business, and individuals. Those resources that exist at higher elevations will experience more risk of snow and ice, but the entire city can face damage from winter storms and, for example, the hail or life threateningly cold temperatures that winter storms bring.

History

Winter storms occur yearly; more destructive storms occur once or twice per decade, most recently in December 2015. Over several weeks in early 2008, the foothills of the Cascades received unusually high amounts of snow from a series of storms. Towns east of Salem, including Idanha and Detroit, were buried by 12-feet of snow over these two months. Several local agencies from Marion and Linn Counties, and the City of Salem were sent to assist these communities. Three dozen National Guard soldiers, along with snow removal equipment, inmate crews, and engineers, were sent by the State into the towns to remove snow and help those in need.[37]

Another prolonged snowstorm hit the region during the 2008-2009 winter season. Salem received over a foot of snow and the Portland airport received a record 18.9 inches.[38] This snowstorm resulted in landslides and mudslides and warranted a Presidential Disaster Declaration on March 2, 2009.[39] Ten Oregon Counties were included in this disaster declaration, including Clackamas, Clatsop, Columbia, Hood River, Marion, Multnomah, Polk, Tillamook, Washington, and Yamhill Counties.[40]

In March of 2012, Salem experienced a relatively unusually late snowfall across the Willamette Valley. Salem received two to seven inches of snow, with the highest amounts on the hill in South Salem. This was the biggest snowstorm to strike Salem this late in the winter season. On average Salem receives 0.3 inches of snow in March. Other recorded late snowfalls occurred in March of 1951 totaling 9.6 inches and March of 1960, where Salem received 8.5 inches.[41]

In addition, winter storm events occurred in January 2012 *(FEMA-4055-DR-OR), December 2013, February 2014 (FEMA-4169-DR-OR), and December 2015 (FEMA-4258-DR-OR*).[42]:

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[37] "Oregon National Guard Aids Detroit an Idenha Communities." February 5, 2008. http://salem-news.com/articles/february052008/guard_detroit_2-5-08.php

[38] "Some of Area's Snowstorms." National Weather Service, Portland Office. http://www.wrh.noaa.gov/pqr/paststorms/snow.php

[39] FEMA. Winter Storm Disaster Declaration. http://www.fema.gov/disaster/1824

[40] FEMA. "FEMA Expands Incident Period for December Snow Storm". April 2, 2009. http://www.fema.gov/news/newsrelease.fema?id=47876

[41] National Weather Service. Salem Airport. March 22, 2012.

[42] 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

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. Severe winter storms occur in western Oregon regularly from November through February. Salem experiences winter storms a couple times every year, to every other year.

Based on the available data and research for Salem 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; *this rating has not changed since the previous plan*.

Vulnerability Assessment

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 city from winter storms should remain an ongoing process determined by community characteristics and physical vulnerabilities. Weather forecasting can give city resources (emergency vehicles, warming shelters) time to prepare for an impending storm, but the changing character of the city population and resources will determine the impact of winter storms on life and property in Salem.

The most likely impact of snow and ice events on Salem are road closures limiting access/egress to/from some areas, 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. Many severe winter storm deaths occur as a result of traffic accidents on icy roads, heart attacks may occur from exertion while shoveling snow, and hypothermia from prolonged exposure to the cold. The temporary loss of home heating can be particularly hard on the elderly, young children and other vulnerable individuals.

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

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

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http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms; National Weather Service Forecast Office. Available at http://www.wrh.noaa.gov/pqr/paststorms/wind.php

affected communities, surrounding region, and region. In the rural areas of Oregon severe winter storms can isolate small communities, farms, and ranches.

At the time of this update, sufficient data was not available to determine winter storm vulnerability in terms of explicit types and numbers of existing and future buildings, infrastructure, or critical infrastructure.

Winter storms in the past caused multiple major injuries or death. The potential for future injuries or deaths is anticipated to remain similar to historic events. Salem estimates that less than 10% of the City's population could be physically displaced by a winter storm, accounting for families that may not have access to warm shelter; and there would be moderate impact on community social networks due to poor driving conditions.

Several facilities throughout the City anticipate mild damage due to winter storms, estimated at less than $1 million for hazard response, structural repairs and equipment replacement. In terms of commercial business, it is likely that more than 75% of businesses located in the City and surrounding area could experience commerce interruption for a period of days until driving conditions improve. Winter storms will likely have the greatest impacts on the transportation system, as snow and ice can cause dangerous driving conditions. Lastly, winter storms could likely have extensive impacts on more than 75% of the City's ecological systems, including, clean water, wildlife habitat, and parks.

As such, the NHMP Steering Committee rated the city as having a **"moderate" vulnerability to winter storm hazards**, meaning that between 1 to 10% of the city's population or assets would be affected by a major disaster; *this rating has decreased since the previous plan*.

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 city. Where trends emerge, disaster declarations can help inform hazard mitigation project priorities.

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. Table 2-20 shows that, as of May 2017, FEMA has approved a total of 32 major disaster declarations, 65 fire management assistance declarations, and two (2) emergency declarations in Oregon.[43] 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 2-20 summarizes the major disasters declared in Oregon that affected Salem, since 1955. The table shows that there have been eleven (11) major disaster declarations for the city (two since the previous plan). All of which were related to weather events resulting primarily in flooding, landslides, and wind related damage.

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. Salem has only one recorded Emergency Declaration related to the 2005 Hurricane Katrina evacuation.

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 are no fire management assistance declarations on record for the city.

[43] FEMA, *Declared Disasters by Year or State*, http://www.fema.gov/news/disaster_totals_annual.fema#markS. Accessed May 2, 2017.

Table 2-20 FEMA Major Disaster (DR), and Emergency (EM), and Fire Management Assistance (FMA) Declarations for Salem (Marion and Polk)

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-985^	4/26/1993	3/25/1993	3/25/1993	Earthquake	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
EM-3228	9/7/2005	8/29/2005	10/1/2005	Hurricane Katrina Evacuation	None	B

Source: FEMA, Oregon Disaster History. Major Disaster Declarations.
Note: ^-Declared for Marion County Only, *-Declared for Polk County Only

Vulnerability Summary

Community vulnerabilities are an important component of the NHMP risk assessment. For more in-depth information regarding specific community vulnerabilities, reference Appendix C: Community Profile. Data sources for the following community vulnerability information can be found in Appendix C – *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.[44] 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

- Even though approximately 91% of the city population is reported as proficient in English, approximately 9% of the population is not proficient in English.[45] These populations would serve to benefit from mitigation outreach, with special attention to cultural, visual and technology sensitive materials.
- Salem is experiencing demographic changes in terms of age of the population. From 2010 to 2015 the age group younger than 15 increased by 4.9%, the 15 – 64 age group increased by 5.3%, and the 65 and older age group increased by 7.0%.[46] An aging population requires additional support from the community at large.
- As of 2015, approximately 13% of Salem's population is over the age of 64; that percent is less than the State (15%), Marion County (14%), and Polk County (16%).
- The Salem age dependency ratio[47] is 50.2, which is about the same for Oregon (50.4) but lower than Marion County (54.7) and Polk County (55.4); the age dependency figure for the Marion County is expected to increase to 65.8 by the year 2035.[48]
- Approximately 10% of Salem population over age 64 lives alone.
- Approximately 14% of the Salem population is estimated to have a disability. Of that, 7,181 individuals over 64 (37%) are disabled.
- Salem's real median income ($47,191) is lower than the State ($51,243), Marion County ($48,243), and Polk County ($52,821).
- Approximately 18% of the total Salem population lived at or below the poverty line in 2015, including 25% of children under 18.

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

[45] U.S. Census Bureau, 2011-2015 American Community Survey Estimates, Table DP02.

[46] Social Explorer, Table 17, U.S. Census Bureau, 2006-2010 and 2011-2015 American Community Survey Estimates.

[47] Dependency Ratio: the ratio of population typically not in the work force (less than 15, greater than 64).

[48] Office of Economic Analysis, Long-Term County Population Forecast, 2010-2050 (2013 release)

- Approximately 87% of the population over 25 has graduated high school or higher and about 27% have a bachelor's degree or higher; 13% of the population does not have a High School degree.
- About 50% of Salem renters and 45% of owners with a mortgage 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 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, Salem unemployment has reduced since a high of 11.9% in 2009, to 3.8% in March 2017. In the event of a large—scale disaster, unemployment has the potential to rise when businesses and companies are unable to overcome the ramifications of the hazard event.
- The largest sectors of employment in the Salem Metropolitan Service Area are Trade, Transportation, and Utilities (16%), State Government (13%), Education and Health Services (15%), and Local Government (10%).[49] In the event of a natural disaster, the government sector may not be as vulnerable in the short term as other sectors; however, other large industries such as agriculture, wholesale trade of electronic equipment and manufacturing of food products are industries that may be significantly affected by a disaster as these basic industries tend to rely on sales outside of the community.
- The Construction sector is expected to have the most growth from 2014 to 2024 at 19%. Professional and Business Services (17%) and Education and Health Services (15%) are the next closest growth sectors.
- Two-thirds of Salem's workforce lives outside of the city limits.

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.[50] Natural capital such as wetlands and forested hill slopes play significant roles in protecting communities and the environment

[49] Oregon Employment Department, "2010 and 2016 Employment and Wages by Industry (QCEW) Summary Industry Report Data" and "Industry Employment Forecast 2014-2024, Mid-Valley". http://www.qualityinfo.org. Accessed March 2017.

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

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 ecosystems are vulnerable to drought, wildfire, and severe storm impacts.
- The primary river that flows through Salem is the Willamette River; other important streams that pass through are Mill Creek, the Mill Race, Pringle Creek, and the Shelton Ditch. Smaller streams in the eastern part of the city include Clark Creek, Jory Creek, Battle Creek, Croisan Creek and Clagget Creek, while glen Creek and Brush Creek flow through West Salem. These streams frequently flood, and while this can provide natural benefits, flooding can inflict personal injury and property damage.
- Salem obtains its drinking water from the North Santiam River watershed, located in the Cascade Foothills.[51] As this is the primary source of drinking water for the City, it is imperative to consider the hazards that can affect water quality, including flooding, landslides and drought.
- The combination of a growing population and development intensification can lead to the increasing risk of hazards, threatening loss of life, property and long—term economic disruption if land management is inadequate; such as floodplain development that is common throughout the City of Salem.

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.

Housing Vulnerabilities

- Mobile home and other non-permanent residential structures account for *5*% of the housing in Salem. These structures are particularly vulnerable to certain natural hazards, such as earthquake, windstorms, and heavy flooding events.
- Based on U.S. Census data, approximately two-thirds of the residential housing in Salem was built before the current seismic building standards of 1990.
- Approximately 57% of residential structures were constructed prior to the local implementation of the flood elevation requirements of the 1970's (city Flood Insurance Rate Maps –FIRMs- were not completed until 1979).

[51]City of Salem. Department of Public Works.

Critical Facilities and Infrastructure Vulnerabilities

- Considering, Salem is the State Capital and the second largest city in Oregon, it is critical to maintain the quality of built capacity (transportation networks, critical facilities, utility transmission, etc.) throughout the area, as it is likely that surrounding jurisdictions will seek assistance from Salem.
- Roads and bridges in the City of Salem are highly vulnerable to hazards specifically earthquakes. Because bridges vary in size, materials, siting, and design, any given hazard will affect them differently. Salem must also consider roads and bridges obstructed beyond the City limits, as this will likely have significant impacts on access in and out of Salem.
- Virtually all state and city roads and bridges in Salem are vulnerable to multiple hazards including flood, landslide, and earthquake. 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.
- All of Salem's power is generated outside the region; there is no redundancy in power transmission and only limited redundancy in the power distribution network.

National Flood Insurance Program (NFIP) Vulnerability

FEMA modernized the Salem Flood Insurance Rate Maps (FIRMs) in January 2003. Table 2-21 shows that as of October 2016, Salem has 1,022 National Flood Insurance Program (NFIP) policies in force. Of those, 744 are for properties that were developed before development of the initial FIRM. The last Community Assistance Visit (CAV) for Salem was on May 4, 2005. The city is a member of the Community Rating System (CRS) and has a Class 5 rating. The table shows that the majority of flood insurance policies are for residential structures, primarily single-family homes.

There have been 159 paid claims in the city (including 126 Pre-FIRM claims and six (6) substantial damage claims), totaling just under $3.5 million. In addition, there are five (5) Repetitive Loss (RL) Properties[52] and there are no Severe Repetitive Loss Properties (see Figure 2-16 below for general location of properties with NFIP policies).[53]

[52] 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.

[53] 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.

Table 2-21 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	
Salem	1/2/2003	6/15/1979	1,022	744	700	90	72	160	39

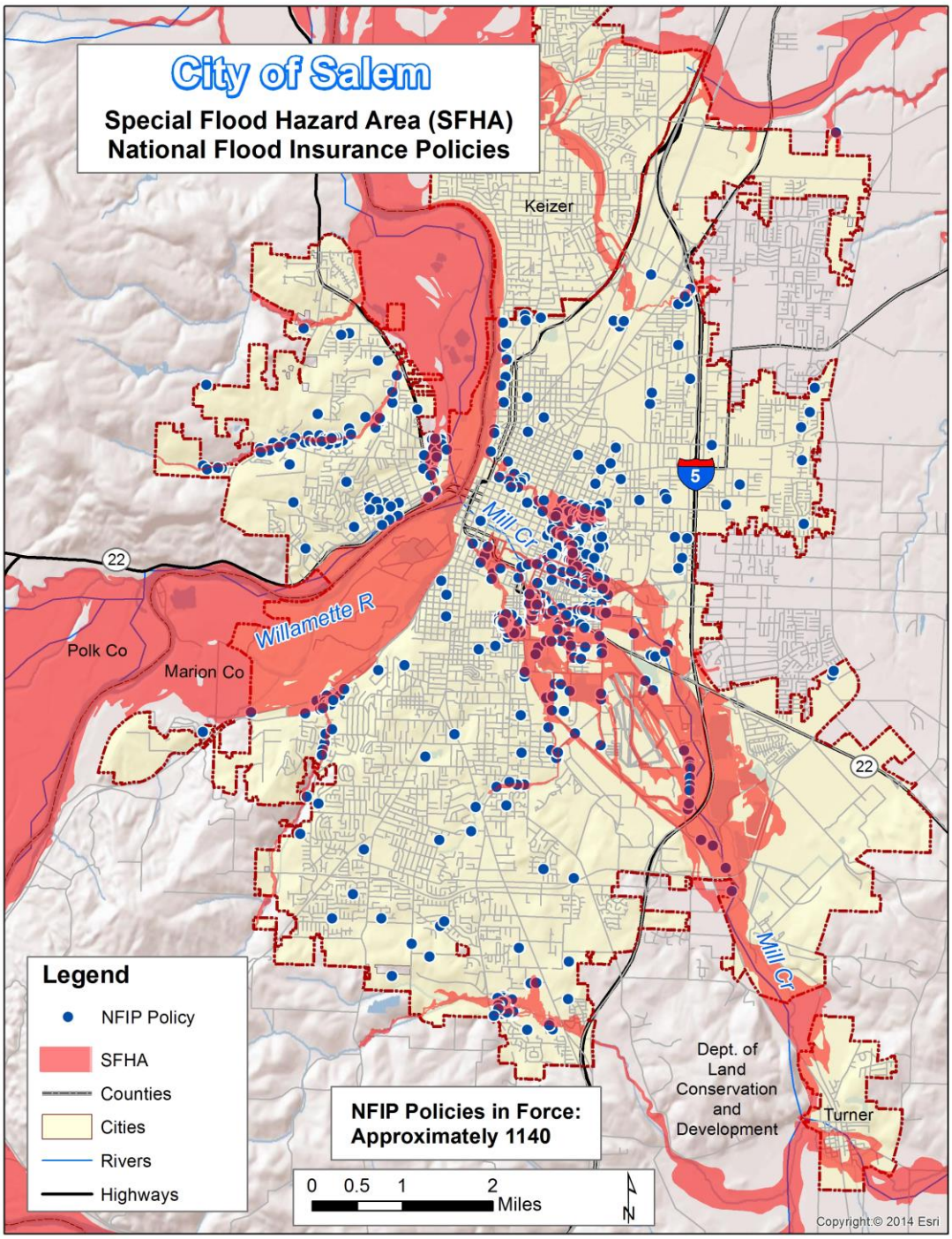
Jurisdiction	Insurance in Force	Total Paid Claims	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Paid Amount	Repetitive Loss Properties	Severe Repetitive Loss Properties	CRS Class Rating	Last CAV
Salem	$233,772,600	159	126	6	$3,449,614	5	0	5	5/4/2005

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

Mitigation Successes

In 2010, the City sold approximately 199 acres within the Minto-Brown Island Park (1,200 acres) to the Natural Resource Conservation Service (NRCS) via the federal floodplain easement program to restore natural habitat and manage flooding.

Figure 2-16 NFIP Policies, Repetitive Loss, & Severe Repetitive Loss Properties



Source: Department of Land Conservation and Development, October 2016 (data collected in 2014)

Lifeline Sector Analysis

The lifeline sector analysis evaluates key resources and facilities within specific sectors through sector stakeholder feedback. Please see **Appendix F** for the full lifeline sector analysis.

Energy

The energy sector is critical to modern life. Electricity is vital for virtually all household, business and emergency operations; liquid fuel is used for transportation, facility construction and repair, and backup power; natural gas is used for electricity generation, heating, cooking, powering vehicles, and other uses. The resilience, redundancy, and interdependencies of the energy sector will largely determine the timeline for emergency response and long-term community recovery. Diverse and redundant energy supply and distribution can significantly increase regional resilience.

Energy Summary Table

<table>
<tr>
<td>Critical Interdependencies:
Systems of all types are dependent on other systems to function. To operate, the communication sector is particularly <u>DEPENDENT ON</u>:
• Transportation
• Communication
Other critical lifeline sectors that <u>DEPEND ON</u> the communication sector to operate include:
• Public Safety and Emergency Management
• Transportation
• Water
• Communication
• Economy</td>
<td>Critical Vulnerabilities:
Each sector is vulnerable to a variety of impacts. The energy sector is particularly vulnerable to the following:
• Consumption consists almost entirely of one of three forms: electricity, liquid fuels, natural gas.
• Dependence on BPA for electric power; Marion County produces very little power locally.
• Lead time for ordering critical system components (e.g. transformers)
• Concentration of liquid fuel storage facilities in Portland; limited local fuel storage and supply.
• Lack of capability to pump fuel locally without power.
• Reliance on supply and distribution facilities located outside Marion County.</td>
</tr>
<tr>
<td colspan="2">Major Findings:
• Generators are co-located by equipment and are used at critical infrastructure throughout the county; however, require various fuel types depending on the unit.
• Oregon’s fuel storage facilities are in Portland and are susceptible to failure due to soil liquefaction. The storage capacity on a normal day is six days; therefore, it is anticipated that fuel will be an undersupplied commodity during a Cascadia event. It will take 3-6 weeks to reacquire fuel.</td>
</tr>
</table>

- Energy is critically interdependent with the transportation, communication, and water sectors. For example, not having access to roads nor having the ability to communicate with responders leaves the energy sector extremely vulnerable. In addition, there is a need for energy in powering water treatment plants. These vulnerabilities are particularly heightened in areas where accesses via bridges or singular roads are susceptible to failure.
- The EPA regulates energy in terms of emissions limiting the capacity to produce additional energy resources.
- Damage assessments will be critical to capture the impacts to this lifeline. Downed trees, accumulating ice, and high winds can impact the resiliency of energy as a lifeline.
- The energy sector also prepares and mitigates against human-made disasters, such as cyberattacks.
- The energy sector grants people with uninterrupted services due to medical status during non-catastrophic events.
- An estimated 1-3 months of electrical service interruption during a Cascadia event.

Communications

The communication sector facilitates the rapid exchange of information across a broad range of systems and technologies. These include: broadcast television and radio, telephone, cellular phone, cable, internet, two-way radio, and Ham (or amateur) radio.

Communication is an essential aspect of virtually all public and private sector activities. The ability to communicate is especially critical during an emergency. Notably, FEMA's Emergency Support Function #2 – Communications specifically supports the restoration of communications infrastructure. The scope of ESF #2 includes, "restoration of public communications infrastructure" and assisting "State, tribal, and local governments with emergency communications and restoration of public safety communications systems and first responder networks."[54]

The assessment focused on (1) the adaptive capacity of the communications sector, (2) hazard-specific vulnerabilities to communication infrastructure, and (3) mitigation opportunities that can support uninterrupted or rapid restoration of communication capability during or following emergency or disaster event.

Communication Sector Summary

Critical Interdependencies:	**Critical Vulnerabilities:**
Systems of all types are dependent on other systems to function. To operate, the communication sector is particularly <u>DEPENDENT ON</u>:	**Each sector is vulnerable to a variety of impacts. The communications sector is particularly vulnerable to the following:**

[54] FEMA, Emergency Support Function #2 – Communications Annex. 2008. https://www.fema.gov/pdf/emergency/nrf/nrf-esf-02.pdf.

• Electricity • Energy (fuel) • Transportation **Other critical lifeline sectors that <u>DEPEND ON</u> the communication sector to operate include:** • Water (SCADA) • Electricity • Public Safety and Emergency Management • Transportation • Economy	• All systems rely on electricity for operation and maintain generators for backup power. Generators rely on fossil fuels to operate leading to questions about what systems and services would be prioritized for gasoline/diesel fuel use if there were a disruption to fuel supply. Also, some generates operate on propane or natural gas, neither of which are included in state or federal energy assurance plans. • All systems rely on infrastructure (towers, antennae) spread across large areas, often in remote locations. Road access to repair equipment is a primary concern • 911 service and other emergency communication relies on line-of-site microwave transmission. Even small changes in antennae alignment can disrupt transmission and require recalibration to re-establish connections between towers. Fiber infrastructure is vulnerable to earthquake damage, where lines are connected to bridge spans.

Major Findings:

- Many providers share infrastructure and or have their infrastructure co-located.
- Stakeholders are well prepared to address winter storms and other disasters if there is access to their facilities. Transportation, water, and energy are equally dependent on communication infrastructure. In addition, trees, wind, and ice are hazards that can impact this lifeline.
- During a power outage, battery and generator backups provide limited power for a varying duration of time depending on the fuel source and capacity. Redundancy is a needed resource for critical infrastructure that requires access and the supply of multiple fuel types, primarily gasoline and diesel. Notably, propane is a fuel source for some generators; however, propane will not be provided through state resources. Some generates operate on propane or natural gas, neither of which are included in state or federal energy assurance plans.
- All providers anticipate a 75-100% shut-down after a Cascadia event. Due to the roads and bridges being impassable, network connections could be severed.
- Largest barriers to respond in a Cascadia event include: staff ability to respond, access to facilities, shortage of supplies to repair infrastructure, time, funding, and political support.
- Stakeholders recognize that their staff and families need to be prepared. To address this need, they are supporting a proactive approach to disasters. The Communications sector is working to train employees to be prepared for disasters

so they can address their own immediate needs before safely addressing the needs of the sector post-event.

- Some towers have fiber optic lines as a redundancy. However, these lines are vulnerable in a catastrophic earthquake, in particular where lines are connected to bridge spans.
- Water infrastructure systems rely on communication for operations and maintenance through a "Supervisory Control and Data Acquisition" (SCADA) system. The system provides remote monitoring and control of the water system components. Radio system capability is needed for these systems to operate effectively. Much of this infrastructure is isolated. For example, Salem's infrastructure is located on an island.
- Amateur Radio provides critical back up to public safety radio communications in a disaster, but does not provide the necessary capacity to meet emergency management needs. Jurisdictions should consider investing in satellite voice and data capabilities.
- Local servers may be damages in an earthquake. Jurisdictions should consider "cloud based" data storage solutions to backup vital records.

Transportation

Transportation is critical lifeline infrastructure. The transportation network facilitates the movement of people, goods, resources, and commerce throughout Marion County and beyond. The transportation system consists of local, state, and federal road and highway networks; passenger and freight rail; passenger and freight air service; pipelines; transit; dedicated bicycle and pedestrian systems; and limited water-based modes. All lifeline sectors depend on the transportation system.

Access to means of transportation is fundamental to human existence. Transportation infrastructure facilitates everything from a local trip to the park, drugstore, or place of employment to international trade and commerce. Furthermore, the ability to move people, goods and services is vital before, during and after emergency events. It is no accident that FEMA's number one Emergency Support Function is transportation. ESF #1 covers the following:

- Aviation/airspace management and control
- Transportation safety
- Restoration/recovery of transportation infrastructure
- Movement restrictions
- Damage and impact assessment

The scope of ESF #1 includes supporting, ". . . prevention, preparedness, response, recovery and ***mitigation*** activities among transportation stakeholders . . .[emphasis added]" and coordinating, "the restoration of the transportation systems and infrastructure."[55]

[55] FEMA, Emergency Support Function #1 – Transportation Annex. 2008. https://www.fema.gov/pdf/emergency/nrf/nrf-esf-01.pdf

Transportation lifeline sector participants identified a number of interconnected resources and elements of their operations. These include included roads, bridges, buses, and physical buildings. While this assessment focusses on infrastructure, participants noted that transportation staff and professionals are a critical resource as well.

Transportation Summary Table

<table>
<tr>
<td>Critical Interdependencies:
Systems of all types are dependent on other systems in order to function. In order to operate, the transportation sector is particularly <u>DEPENDENT ON</u>:
• Energy and Fuel
• Communication
• Business and Industry
• Public Works
Other critical lifeline sectors that <u>DEPEND ON</u> the transportation sector to operate include:
• Water
• Electricity
• Liquid fuel
• Public Safety and Emergency Management
• Public Works
• Economy</td>
<td>Crucial Vulnerabilities:
Each sector has a number of vulnerabilities. The transportation sector is particularly vulnerable to the following:
• Federal, state and local bridge infrastructure is particularly vulnerable to earthquake (especially ODOT facilities over the Willamette).
• System relies heavily on fossil fuels for construction, operation, and maintenance.
• Hwy 22 is the primary east-west connection; there are few redundant east-west routes.
• Significant backlog of deferred transportation maintenance projects.</td>
</tr>
<tr>
<td colspan="2">Major Findings:
• ODOT considers I-5 and Highway 22 to be critical routes. Other critical concerns include bridges, roads, communication, and energy including power and fuel.
• Much of the existing transportation infrastructure, including those of major roadways such as I-5, Highway 22, and Mission Road, are not seismically retrofitted and will likely experience structural failures during a Cascadia event.
• Following a Cascadia event, transportation will be limited for 6-12 months; aftershocks may extend that timeframe.
• Transportation is interdependent with communication, water, and energy systems and requires coordination and collaboration during the response and recovery process.
• Although winter storms continue to impact transportation systems, stakeholders respond to these events efficiently and continue to improve plans with every winter weather event. Downed trees, debris, and accumulated ice impact the response of this lifeline.
• Salem-Keizer Transit operates city and regional buses, dial-a-ride, CherryLift for people with disabilities, and coordinates non-emergent medical transportation</td>
</tr>
</table>

services. They provide about 4-million rides a year and are currently working to improve individual employee preparedness as well as existing emergency plans.

- Salem-Keizer Public Schools transports an estimated 22,000 students a day including about 2,000 medically fragile students. The top priority for this organization is student safety.
- The electricity grid in Oregon is not particularly dependent on the transportation sector to operate. However, the power generation and distribution network does rely on the transportation network for construction as well as ongoing maintenance and repairs.
- Conversely, all of the liquid fuel in the state is transported by one of three primary transportation modes: truck, rail, and pipeline. Therefore, the distribution fuel in the state is completely dependent on the transportation sector.
- Like the electric grid, the communications sector is not particularly dependent on the transportation sector to operate. However, the power generation and distribution network does rely on the transportation network for construction as well as ongoing maintenance and repairs.
- Business and industry is very dependent on the transportation sector. From the movement of raw material, to getting employees to and from work, to getting finished products to market, virtually all business and industry activity in the region is facilitated by transportation.
- Public works is dependent on transportation in two primary ways. First, the transportation sector facilitates the movement of equipment, materials, and workers. Second, significant portions or components of public works' infrastructure are collocated within transportation rights of way.

Water

For the purposes of this assessment, the water sector includes information pertaining to drinking water, stormwater, and wastewater. Stakeholder participants included a range of local and regional infrastructure and service providers. The information provided in this summary is based on research of the county's water resources and infrastructure.

Ready access to virtually unlimited amounts of clean drinking water is often taken for granted, particularly here in the Pacific Northwest. Water is vital for basic daily living, for business and industry especially including agriculture, for fire protection and medical service provision, and for wastewater management. In addition, stormwater facilities provide critical protection from a variety of localized flood risks. FEMA Emergency Support Function #3 covers public works, including water, wastewater and stormwater services. Ensuring that all water related public works infrastructure is operational is critical to the function of any community.

Water Summary Table

Critical Interdependencies: **Systems of all types are dependent on other systems to function. To operate, the water sector is particularly <u>DEPENDENT ON</u>:** • Electricity • Communication • Transportation • Liquid Fuel **Other critical lifeline sectors that <u>DEPEND ON</u> the water sector to operate include:** • Fire and EMS • Business and industry • Electricity	**Crucial Vulnerabilities:** **Each sector has many vulnerabilities. The transportation sector is particularly vulnerable to the following:** • The water sector in Marion County consists of numerous local and regional systems. • Several reservoirs, transmission lines and the Salem Treatment Facility are vulnerable to multiple hazards. • Aquifer storage capacity not sufficient to meet need as a backup source.
Major Findings: • People living in unincorporated areas of Marion County rely on wells and septic tanks. • Low water reserves and low river flow pose a serious threat to the water supply. • Some infrastructure pertaining to water systems are old which increases the risk vulnerability to withstand a Cascadia event. Impacted infrastructure located near rivers could cause service disruptions and flooding during an event or incident. Power is vital to the water facilities. • Generators are co-located at critical facilities and need to be maintained requiring various fuel types in order to support redundancy. • Road access is vital to conduct damage assessments and or repair impacted facilities.	

FEMA Risk MAP Middle Willamette Valley Discovery

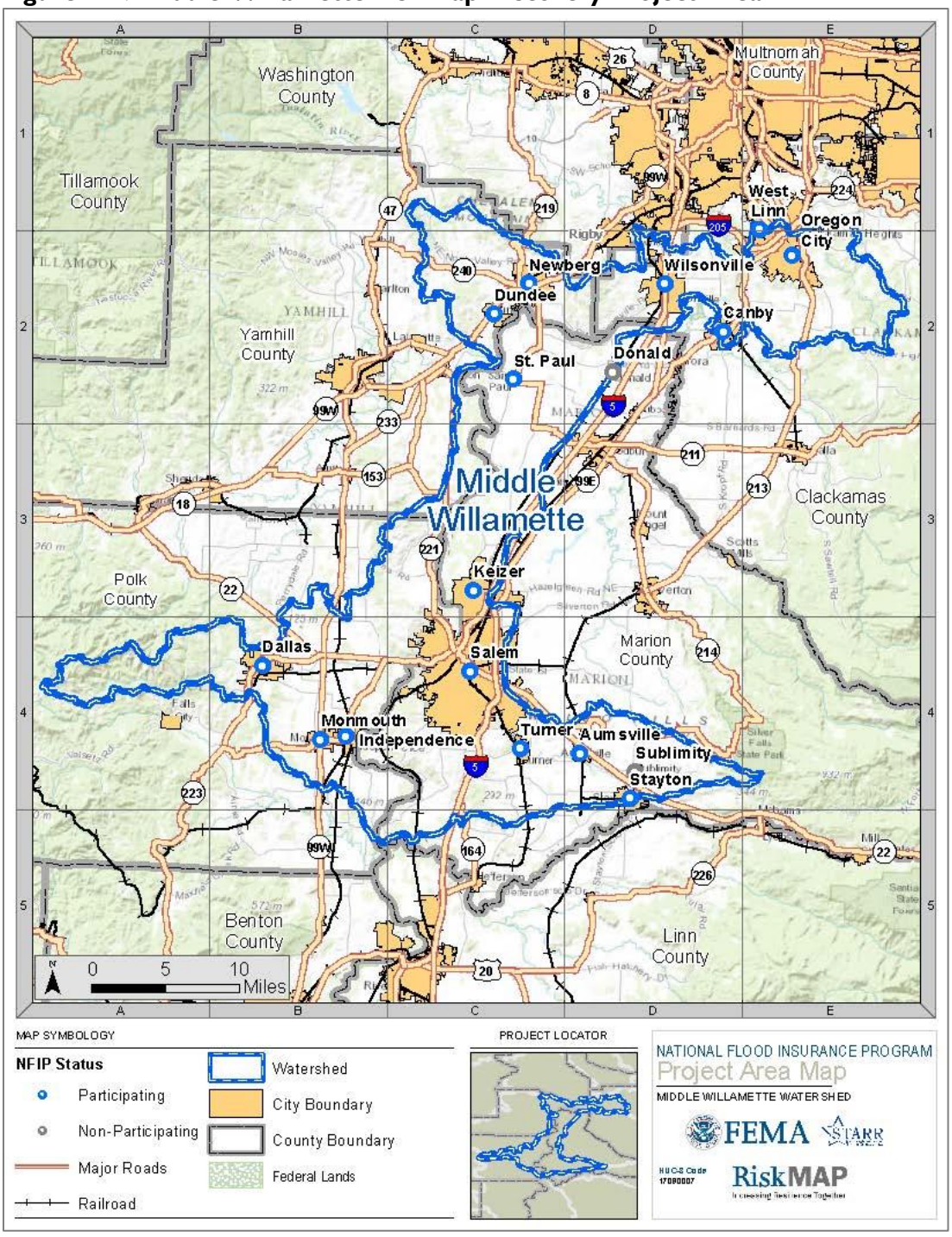
FEMA Region X initiated a Risk MAP[56] funded "Discovery" project for the Middle Willamette Watershed in December 2015. According to FEMA, Risk MAP Discovery is a process of, "data collection, hazard mapping, and cooperative information exchange with community stakeholders to understand a watershed area, decide if a flood risk project is appropriate, and if so, collaborate on project planning." In addition to the flood hazard, the Oregon Risk MAP program also includes the potential for assessment of other natural hazards. For this Discovery project, FEMA is including the following hazards: flood, wildfire, wind, earthquake, and landslide.

Marion County Emergency Management and the communities of Salem, Keizer, Turner, Aumsville, Stayton, Donald, St. Paul, and Sublimity are collaborating on the discovery process (Figure 2-17). The Discovery Process includes four phases:

- **Phase 1** involves is a comprehensive collection of tabular) and spatial data. This data is analyzed and developed into Community Fact Sheets and Discovery Maps.
- **Phase 2** utilizes the map products to identify specific areas of concern, locations where additional data and analysis is needed, and areas of vulnerability where mitigation projects are desired.
- **Phase 3** results in a set of "Discovery Meetings" with local representatives. The purpose of these meetings is to facilitate discussion and build consensus about study needs, mitigation project needs, desired compliance support, and local flood risk awareness efforts.
- **Phase 4** integrates the ideas gathered from community interviews and Discovery Meetings with GIS mapping and data analysis into a set of recommendations for further action. These recommendations often include specific risk-management projects, mitigation strategies for communities to consider, identification of funding sources, and suggested priorities.

[56] Risk MAP provides high quality flood maps and information, tools to better assess the risk from flooding and planning and outreach support to communities to help them take action to reduce (or mitigate) flood risk. Each Risk MAP flood risk project is tailored to the needs of each community and may involve different products and services. For more information visit: http://www.fema.gov/risk-mapping-assessment-and-planning-risk-map.

Figure 2-17 Middle-Willamette Risk Map Discovery Project Area



Source: DRAFT Discovery Report, June 2016

Marion County Community Wildfire Protection Plan

In August of 2017, Marion County adopted an updated Community Wildfire Protection Plan (CWPP). Developed in coordination with the Oregon Department of Forestry, the Marion County CWPP is the result of a countywide effort initiated to reduce wildland fire risk to

communities, citizens, and environmental resources in Marion County. The CWPP was developed in accordance with provisions of the Healthy Forest Restoration Act of 2003. The DRAFT CWPP identifies the following wildfire mitigation related objectives:

General

- Provide oversight to all activities related to the MCCWPP.
- Ensure representation and coordination between the sub-committees.
- Develop and refine goals for fire protection in Marion County/Salem.
- Develop a long-term structure for sustaining efforts of the MCCWPP.

Risk Assessment

- Identify and update as needed Communities-at-Risk and the Wildland-Urban Interface.
- Develop and conduct a wildland fire risk assessment.
- Identify and prioritize hazardous fuels treatment projects.

Fuels Reduction

- Identify strategies for coordinating fuels treatment projects at a landscape scale.
- Coordinate administration of fuels program so that it is equitable across fire districts.
- Provide low-income special need citizens with an opportunity to reduce their fuels and participate in local programs.
- Identify opportunities for marketing and utilization of smaller diameter wood products.

With respect to wildfire risk, the CWPP identifies specific Communities at Risk. In addition, the plan includes a set of maps and data that specifically identify the location, severity, extent and probability of wildfire in Marion County/Salem. The final CWPP risk assessment, when adopted, is incorporated herein by reference as a specific wildfire supplement to the all-hazard risk assessment.

North Santiam Drought Contingency Plan

Salem is a key partner in a multi-jurisdictional, multi-stakeholder process to develop a drought contingency plan for the North Santiam Watershed. The effort includes an overall assessment of drought risk, a process for ongoing monitoring of drought in the region, and a set of mitigation strategies and recommendations to ensure coordinated management of water resources. Identified vulnerabilities by sector or asset category include: agriculture, municipal water supplies (i.e. drinking water), energy, forestry, environmental (e.g. endangered species), recreation, and socio-economic (i.e. commercial, industrial and community uses).

Various portions of the plan are in draft form. However, full integration of the Drought Contingency Plan with the NHMP will need to take place during the post-adoption maintenance and implementation phase.

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 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

SECTION 3: MITIGATION STRATEGY

Section 3 outlines Salem'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 B.

Mitigation Plan Mission

The plan mission states the purpose and defines the primary functions of Salem'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 Salem NHMP is:

Reduce or eliminate long-term risk to people and their property from hazards and their effects.

The 2017 NHMP Steering Committee reviewed the previous plans mission statement and agreed to retain the mission as previously worded. The Steering Committee believes the concise nature of the mission statement allows for a comprehensive approach to mitigation planning.

Mitigation Plan Goals

Mitigation plan goals are more specific statements of direction that Salem citizens, and public and private partners can take while working to reduce the city'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 plan goals. Meetings with the project Steering Committee, stakeholder interviews and public workshops all served as methods to obtain input and priorities in developing goals for reducing risk and preventing loss for natural hazards in Salem.

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

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

Goal 1: Develop and implement mitigation activities to protect human life.

Goal 2: Protect existing buildings and infrastructure as well as future development from the impacts of natural hazards.

Goal 3: Strengthen communication and coordination of public and private partnerships and emergency services among local, county and regional governments and the private sector.

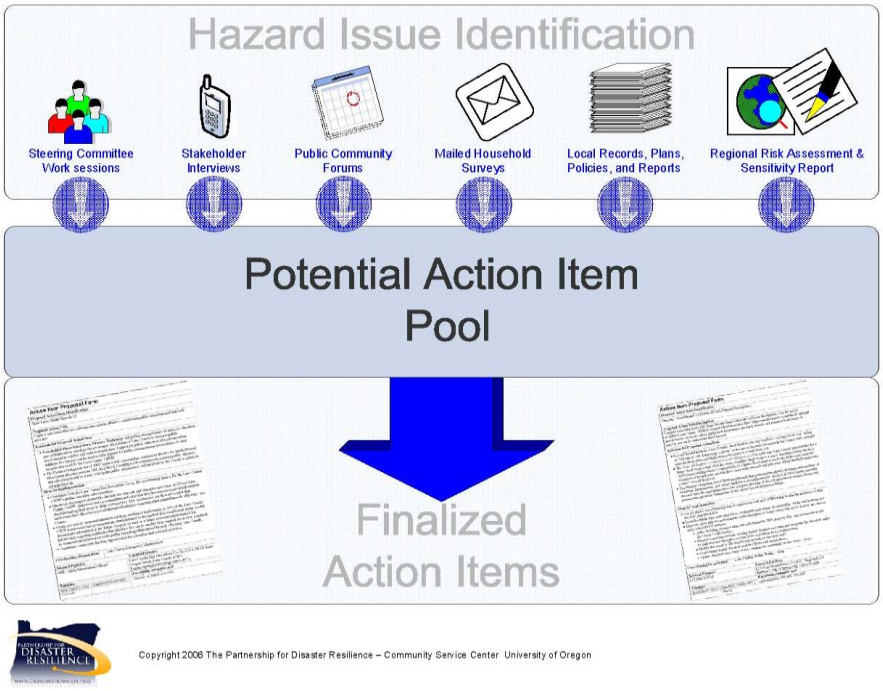
Goal 4: Enhance economic resilience to reduce the impact on the local economy.

Goal 5: Preserve and rehabilitate natural systems to serve natural hazard mitigation functions and protect natural resources.

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. Figure 3-1 illustrates some of these sources.

Figure 3-1 Development of Action Items



Most 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, Salem is listing a set of high priority actions (Table 3-1) to focus attention on an achievable set of high leverage activities over the next five-years. Detailed implementation information for each priority action is listed in Appendix A-1. This plan identifies priority actions based on an evaluation of high impact hazards, resource availability and FEMA identified best practices.

Action Item Pool

The action item pool (Table 3-2) presents a list of lower priority mitigation actions. Most 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. Appendix A-1, *Priority Action Items*, and Appendix A-2, *Action Item Pool*, provide detailed information about each of the priority action items (and some of the other actions). A blank action item form is included for use by the NHMP committee as additional action items are considered for implementation (Appendix A-3).

Table 3-1 Salem High Priority Action Items

Action Item ID	Mitigation Action Item	Coordinating Organization	Partner Organizations	Timeline
Priority Actions				
Multi-Hazard				
MH #1	Identify and Designate Priority Transportation Routes.	Public Works	Emergency Management, ODOT	Mid Term (3-5 Years)
Earthquake				
EQ #1	Develop an inventory of un-reinforced masonry structures and develop appropriate mitigation action items to reduce the impacts of seismic events.	Community Development Department	Urban Development, Public Works, Fire, FEMA, DOGAMI	Mid Term (3-5 Years)
EQ #2	Identify, inventory, and mitigate (as prioritization and resources allow) critical facilities and utilities that require seismic retrofit (consider structural and non-structural retrofit options).	Emergency Management	Natural Hazards Mitigation Committee, Community Development Department, Public Works, FEMA, OEM, DOGAMI, School Districts	Ongoing
EQ #3	Create a bridge prioritization inventory based on major lifeline routes including state highways, routes, and major road arteries.	Public Works/ GIS	Emergency Management, ODOT	Mid Term (3-5 Years)
EQ #4	Collaborate with SEDCOR to develop relevant public-private partnerships with businesses that can contribute to mitigation, response, and recovery.	Emergency Management	Urban Development; Marion County Emergency Management, SEDCOR, Regional Solutions, UO EDAUC	Mid Term (3-5 Years)

Source Salem NHMP Steering Committee, updated 2017
Action ID Key: MH = Multi-Hazard, EQ = Earthquake

Table 3-2 Salem Action Item Pool

Action Item ID	Mitigation Action Item	Coordinating Organization	Partner Organizations	Timeline
Action Item Pool				
Multi-Hazard				
MH #2	Coordinate with the Capitol Planning Commission to integrate natural hazard mitigation into State and City respective capital improvements.	Community Development Department	Natural Hazard Mitigation Committee, FEMA, OEM, Capital Projects Advisory Board	Ongoing
MH #3	Develop an inventory of the number and type of critical facilities within the community that are at reasonable risk for each hazard type.	Public Works	Natural Hazards Mitigation Committee, GIS, IT, FEMA	Short Term (0-2 Years)
MH #4	Develop public outreach materials for all natural hazard risks addressed in the Salem Natural Hazards Mitigation Plan. Materials should include mitigation actions residents and businesses can implement to reduce their risk to natural hazards, and where they can obtain more detailed natural hazard information.	Emergency Management	Community Development Department, Public Works, FEMA, Oregon State Police, Oregon Office of Emergency Management, DLCD, DOGAMI	Ongoing
MH #5	Include a post-disaster recovery and mitigation annex/appendix in the Salem Emergency Operations Plan that encourages property owners to incorporate retrofitting and mitigation measures in recovery efforts.	Emergency Management	Natural Hazards Mitigation Committee, FEMA, Oregon State Police, Oregon Office of Emergency Management	Short Term (0-2 Years)
MH #6	Ensure Unified Development Code (UDC) updates consider specific hazards when updating the Salem code for mitigating the location of future development in identified/mapped high hazard areas.	Community Development Department	Natural Hazards Mitigation Committee, DLCD, FEMA	Ongoing
MH #7	Strengthen or replace unsafe public structures (especially facilities critical to disaster and post-disaster planning/response).	Public Works	Fire Department, Police Department, Community Development, Urban Development, Administrative Services, FEMA, ODOT	Long Term (5+ Years)
MH #8	Continue developing alert and warning systems to notify residents of incidents involving natural hazards and hazardous materials.	Emergency Management	Public Works, Police Department, GIS and Mapping Departments, ODOT, FEMA, OSHA	Ongoing

Source Salem NHMP Steering Committee, updated 2017
Action ID Key: MH = Multi-Hazard

Table 3-2 Salem Action Item Pool (continued)

Action Item ID	Mitigation Action Item	Coordinating Organization	Partner Organizations	Timeline
Action Item Pool				
Multi-Hazard				
MH #9	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.	Public Works	Community Development, Emergency Management, GIS and Mapping; Public Utilities Commission, Pacific Power	Ongoing
MH #10	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including the Comprehensive Plan (particularly Goal 7).	Community Development Department	Emergency Management, Public Works, City Administration	Ongoing
MH #11	Participate in assessments of the short and long term needs for sheltering access and functional needs populations for all hazards.	Emergency Management	Marion County, Community Development, Oregon Department of Human Services	Short Term (0-2 Years)
Drought				
DR #1	Complete and implement the North Santiam Drought Contingency Plan.	Public Works	City Departments, Marion County (Emergency Management), Santiam Water Control District, City of Stayton, Linn Soil & Water Conservation District, Marion Soil & Water Conservation District, Norpac Foods, Inc., North Santiam Watershed Council, Oregon Department of Agriculture, Oregon Department of Environmental Quality, Oregon Department of Forestry	Short Term (0-2 Years)

Source Salem NHMP Steering Committee, updated 2017
Action ID Key: MH=Multi-Hazard; DR = Drought

Table 3-2 Salem Action Item Pool (continued)

Action Item ID	Mitigation Action Item	Coordinating Organization	Partner Organizations	Timeline
Action Item Pool				
Earthquake				
EQ #5	Partner with the school districts to help identify and prioritize seismic retrofits to school district facilities.	Emergency Management	Salem Natural Hazards Mitigation Committee, Salem Community Development Department, FEMA, OEM, DOGAMI, Salem-Keizer School District, private schools, Chemeketa C.C., Willamette University, Corban University	Short Term (0-2 Years)
Extreme Heat				
EH #1	No specific action item developed for this hazard. See multi-hazard actions for applicable mitigation strategies.			
Flood				
FL #1	Update, maintain, and implement flood actions via a floodplain management plan in accordance with FEMA's Community Rating System guidelines.	Public Works	Emergency Management, Fire, Operations and Engineering FEMA, DLCD, National Flood Insurance Program, Floodplain Management Committee	Ongoing
FL #2	Improve the City of Salem's National Flood Insurance Program (NFIP) Community Rating System (CRS) rating in order to reduce flood risk and NFIP premiums.	Public Works	Community Development DLCD, National Flood Insurance Program, FEMA, Marion and Polk Counties	Ongoing

Source Salem NHMP Steering Committee, updated 2017
Action ID Key: EQ = Earthquake, EH=Extreme Heat Event, FL = Flood, HM=Hazardous Materials Incident

Table 3-2 Salem Action Item Pool (continued)

Action Item ID	Mitigation Action Item	Coordinating Organization	Partner Organizations	Timeline
Action Item Pool				
Landslide				
LS #1	Map areas of landslide risk adjacent to the North Santiam River (upstream of the Geren Island water intake structures) and areas impacted by a catastrophic failure of the Detroit or Big Cliff Dams.	Public Works	Community Development, DOGAMI, US Army Corps, DLCD, FEMA, BLM, USFS	Long Term (5+ Years)
LS #2	Update landslide overlay maps using Light Detection and Ranging (LIDAR) data.	Public Works	Natural Hazards Mitigation Committee, City GIS technicians, FEMA, NOAA, DLCD, DOGAMI, Keizer, Turner, Marion County, Polk County	Long Term (5+ Years)
LS #3	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.	Community Development Department	GIS and Mapping, Emergency Management, DOGAMI, DLCD	Short Term (0-2 Years)
Volcano				
VE #1	No specific action item developed for this hazard. See multi-hazard actions for applicable mitigation strategies.			
Windstorm				
WD #1	Partner with public and private utilities to educate the public about hazardous trees and the damage they can cause in the event of a windstorm.	Public Works	Community Services Parks Operations , Fire Department, ODOT, Portland General Electric, Electric	Ongoing
Winter Storm				
WT #1	Partner with public and private utilities to educate the public about hazardous trees and the damage they can cause in the event of a winter storm.	Public Works	Community Services Parks Operations , Fire Department, ODOT, Portland General Electric, Electric	Ongoing

Source Salem NHMP Steering Committee, updated 2017
Action ID Key: LS=Landslide, VE=Volcano, WD=Windstorm, WT=Winter Storm

Table 3-2 Salem Action Item Pool (continued)

Action Item ID	Mitigation Action Item	Coordinating Organization	Partner Organizations	Timeline
Action Item Pool				
Wildfire				
WF #1	Conduct wildfire prevention outreach, as outlined in the Marion County and Polk County (West Salem) Community Wildfire Protection Plans (CWPPs), to residents near the wildland-urban interface.	Fire Department	Public Works, Community Development Departments, Police Department, Community Services, Oregon Department of Forestry, Marion County Fire District #1, Salem Suburban Fire District, Neighborhood Associations	Ongoing
Hazardous Materials Incident				
HM #1	Map facilities that handle or contain hazardous materials, rank them based on their level of risk, and refine response strategies for each situation in the event of an accident.	Fire Department	Emergency Management, Public Works OSHA, Chamber of Commerce, Neighborhood Associations, ODOT, OEM, State Police, State Fire Marshal	Short Term (0-2 Years)/ Ongoing

Source Salem NHMP Steering Committee, updated 2017
Action ID Key: WF=Wildfire

Action Item Forms

Each action item (Table 3-1 and Table 3-2) has a corresponding action item form describing the activity, identifying the rationale for the project, identifying potential ideas for implementation, and assigning coordinating and partner organizations. The action item forms can assist the community in pre-packaging potential projects for grant funding. The form components are described below and are located in Appendix A-1, *Priority Action Items* and Appendix A-2, *Action Item Pool*.

Action Item

Each action item includes a brief description of the proposed action.

Alignment with Plan Goals

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

Alignment with Existing Plans/Policies

This NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the city. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. Salem 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, the jurisdictions will work to incorporate the mitigation action items into existing programs and procedures.

Many of the recommendations contained in the Salem NHMP are consistent with the goals and objectives of the existing plans and policies. Where possible, Salem will implement the recommendations and actions contained in the NHMP through existing plans and policies. Plans and policies already in existence have support from local residents, businesses, and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can adapt easily to changing conditions and needs.[1] Implementing the action items contained in the NHMP through such plans and policies increases their likelihood of being supported and implemented.

Rationale for Proposed Action Item

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

[1] Ibid

Ideas for Implementation

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

Coordinating Organization

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

Partner Organizations

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

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

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

Potential Funding Sources

The steering committee has identified potential funding sources for each priority action item (listed on Action Item Form within Appendices A-1 and A-2). Example funding sources can include: the federal Pre-Disaster Mitigation and Flood Mitigation Assistance Programs; state funding sources such as the Oregon Seismic Rehabilitation Grant Program; or local funding sources such as capital improvement or general funds. An action item may also have multiple funding sources.

Estimated Cost

Where possible, an estimate of the cost for implementing the action item is included.

Timeline

Action items include short, mid-, and long-term activities. Each action item includes an estimate of the timeline for implementation. ***Short-term action items*** **(ST)** are activities that may be implemented with existing resources and authorities within two years. ***Mid-Term action items*** **(MT)** may require new or additional resources and/or authorities, and may take from three to five years to implement. ***Long-term action items*** **(LT)** will require new or additional resources and/ or authorities and likely will occur after the next update cycles (five or more years to implement). ***Ongoing*** action items signify that work has begun and will either exist over an indefinite timeline, or an extended timeline; where possible specific measurable objectives are included.

Action Item Status

As action items are implemented or new ones are created during the plan maintenance process, it is important to indicate the status of the action item—whether it is **new** (created during this plan update cycle), **ongoing** (created in a previous planning process with some work accomplished), **deferred** (these actions have yet to see any significant work begin), or **complete** (these actions are considered accomplished and are listed in Appendix B). Documenting the status of the action will make reviewing and updating the mitigation Plan easier during the plan's five-year update, and can be used as a benchmark for progress.

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 city will integrate public participation throughout the plan maintenance and implementation process.

Implementing the Plan

The success of the Salem 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 convener shall be designated, 3) a coordinating body will be assigned, 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 Salem NHMP was developed and will be implemented through a collaborative process. After the plan is locally reviewed and deemed complete, the Salem Emergency Manager (or their designee) submits it 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 city will adopt the plan via resolution. At that point, the city will gain eligibility for the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program funds, and Flood Mitigation Assistance program funds.

Convener

The Salem Emergency Manager 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. 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 Salem 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 Steering Committee during the development of the Salem NHMP (for a list of individuals see Appendix B - *Acknowledgements*):

- Emergency Management
- Community Development
- Public Works
- Urban Development
- Salem Electric
- Salem Health
- Salem Fire
- Salem Police
- Marion County Emergency Management

To make the coordination and review of the Salem 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. Specific organizations have been identified as either internal or external partners on the individual action item forms found in Appendix A.

Implementation through Existing Programs

The NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the city. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. Salem currently addresses statewide planning goals and legislative requirements through their comprehensive land use plan, capital improvement plans, mandated standards, and building codes. To the extent possible, Salem will work to incorporate the recommended 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 city's existing plans and policies. Where possible, Salem 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 Budget
- 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 C, *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 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** (twice per year) to complete the following tasks. During the first 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:

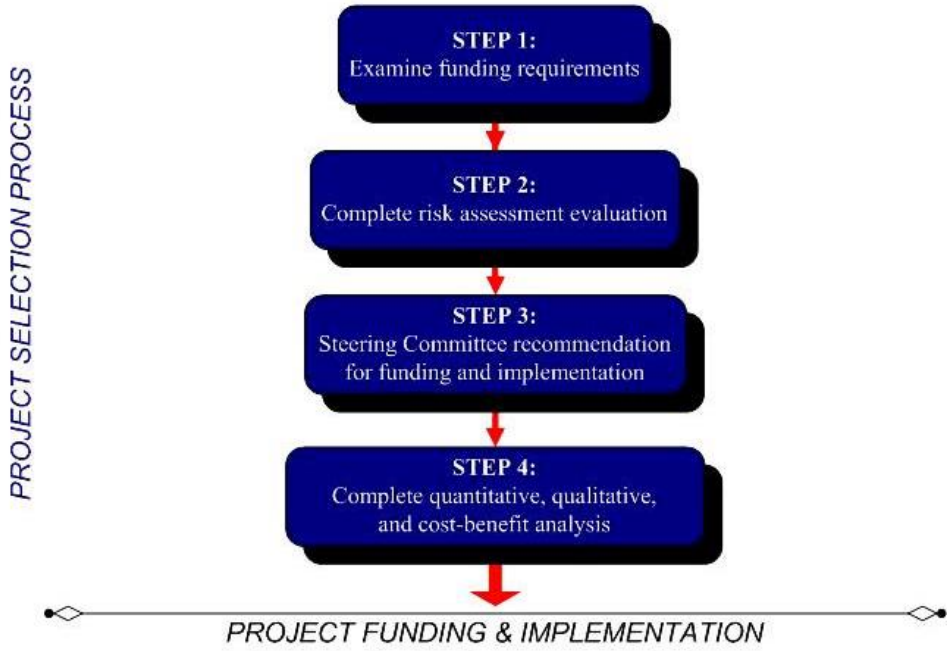
- Review existing and new risk assessment data;
- Discuss methods for continued public involvement; and
- Document successes and lessons learned during the year.

The convener will be responsible for documenting the outcome of the semi-annual meetings in Appendix B. The process the Coordinating Body will use to prioritize mitigation projects is detailed in the section below. The plan's format allows the city 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.

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 city'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 E, *Grant Programs* for a more comprehensive list of potential grant programs.

Because grant programs open and close on differing schedules, the Coordinating Body will examine upcoming funding streams' requirements to determine which mitigation activities would be eligible. The Coordinating Body may consult with the funding entity, Oregon 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 Plan maintenance meetings.

Step 2: Complete risk assessment evaluation

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

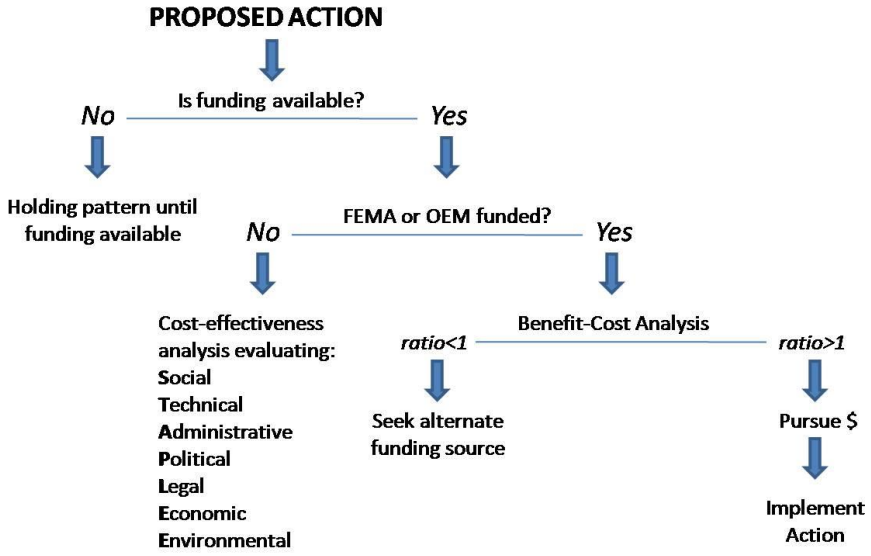
Step 3: Coordinating Body Recommendation

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 Salem 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 City will:

- Post copies of their plans on corresponding websites;
- Place articles in the local newspaper directing the public where to view and provide feedback; and
- Use existing newsletters such as schools and utility bills to inform the public where to view and provide feedback.

In addition to the involvement activities listed above, Salem will ensure continued public involvement by posting the Salem NHMP on the city's website

(http://www.cityofsalem.net/). 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 Salem NHMP is due to be updated by [MONTH] [DATE], 2022.** The Convener will be responsible for organizing the coordinating body to address plan update needs. The Coordinating Body will be responsible for updating any deficiencies found in the plan, and for ultimately meeting the Disaster Mitigation Act of 2000's plan update requirements.

The following 'toolkit' 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: Appendices

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Appendix A:
Action Items

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APPENDIX A-1: PRIORITY ACTION ITEMS

Table A-1 lists priority actions for the 2017 Salem Natural Hazard Mitigation Plan.

The action item forms that follow Table A-1 present specific information for each action item. Additional action items and forms are located within Appendix A-2: Action Item Pool.

Table A-1 High Priority NHMP Actions

Action Item ID	Mitigation Action Item
Priority Actions	
Multi-Hazard	
MH #1	Identify and Designate Priority Transportation Routes.
Earthquake	
EQ #1	Develop an inventory of un-reinforced masonry structures and develop appropriate mitigation action items to reduce the impacts of seismic events.
EQ #2	Identify, inventory, and mitigate (as prioritization and resources allow) critical facilities and utilities that require seismic retrofit (consider structural and non-structural retrofit options).
EQ #3	Create a bridge prioritization inventory based on major lifeline routes including state highways, routes, and major road arteries.
EQ #4	Collaborate with SEDCOR to develop relevant public-private partnerships with businesses that can contribute to mitigation, response, and recovery.

Source: Salem NHMP Steering Committee (2017)

Priority Action Item Forms

Action Item: Multi-Hazard #1	**Alignment with Plan Goals:**	
Identify and Designate Priority Transportation Routes	☒ Goal 1 ☒ Goal 2 ☒ Goal 3	☐ Goal 4 ☐ Goal 5
Alignment with Existing Plans/Policies:		
Transportation System Plan (2016)		
Rationale for Proposed Action Item:		
In order to focus limited analysis, assessment and mitigation project resources, the city can designate priority transportation routes. This will ensure that when investments are made, they are prioritized to those routes that will be most important to post event response and recovery efforts. The Salem TSP lists arterials as critical routes.		
Ideas for Implementation:		
Develop a "hub and spoke" approach to priority route planning focused on post-event resource collection and distribution.		

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**
Emergency Management	ODOT

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources	TBD	☐ Ongoing ☐ Short Term (0-2 years) ☒ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee (2017)
Action Item Status:	New

Action Item: Earthquake #1	**Alignment with Plan Goals:**	
Develop an inventory of un-reinforced masonry structures and develop appropriate mitigation action items to reduce the impacts of seismic events.	☒ Goal 1 ☒ Goal 2 ☐ Goal 3	☐ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

- Salem has numerous un-reinforced masonry structures in their downtown. Un-reinforced masonry structures are particularly susceptible to earthquakes, and if damaged, can disrupt businesses located in historic downtown buildings. Inventorying un-reinforced masonry structures and developing action items to address these buildings will help reduce the vulnerability to seismic events.
- The Salem Natural Hazards Mitigation Committee identified seismic events as having a high probability of recurrence and a high vulnerability in Salem. Addressing the most vulnerable buildings first, those made of un-reinforced masonry, will reduce the city's vulnerability to seismic events.
- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(ii)]. Inventorying un-reinforced masonry structures will identify the major issues surrounding these buildings and what appropriate mitigation measures should be used to address these issues. In addition, protecting existing buildings and infrastructure will help reduce the negative impact of a seismic event on the community.

Ideas for Implementation:

- Identify critical facilities constructed of un-reinforced masonry and develop appropriate mitigation action items or consider relocating the facility to a new building.
- Seek funding to develop programs to retrofit un-reinforced masonry buildings and provide outreach on seismic hazards.

Coordinating Organization:	Community Development Department	
Internal Partners:	**External Partners:**	
Urban Development, Public Works, Fire	FEMA, DOGAMI	
Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources	TBD	☐ Ongoing ☐ Short Term (0-2 years) ☒ Mid-Term (3-5 years) ☐ Long-Term (5+ years)
Form Submitted by:	Salem Natural Hazards Mitigation Committee	
Action Item Status:	Ongoing, revised from 2012 version of the NHMP	

Action Item: Earthquake #2	**Alignment with Plan Goals:**	
Identify, inventory, and mitigate (as prioritization and resources allow) critical facilities and utilities that require seismic retrofit (consider structural and non-structural retrofit options).	☐ Goal 1 ☒ Goal 2 ☒ Goal 3	☐ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

- The Salem Natural Hazards Mitigation Committee noted that certain critical facilities have a high vulnerability for seismic events. Seismically retrofitting these facilities will significantly reduce their vulnerability in the event of an earthquake.
- Oregon Senate Bill 3 (2005) enabled the state develop a grant program to seismically rehabilitate critical public facilities. Conducting an inventory of critical facilities early will assist communities in obtaining funding.
- The Disaster Mitigation Act of 2000 requires communities to identify comprehensive actions that protect new and existing buildings [201.6(c)(3)(ii)]. Seismically retrofitting existing critical facilities, including reservoirs and pump stations, will help Salem reduce their vulnerability to seismic events.
- The Department of Geology and Mineral Industries (DOGAMI) Statewide Seismic Needs Assessment completed in 2007 of educational and emergency service facilities in Salem identified 53 structures with a high or very high likelihood of collapse in the event of a major earthquake. facilities should be retrofitted accordingly to reduce the likelihood of collapse should an earthquake occur. (See Section 2 for a list of retrofitted facilities)

Ideas for Implementation:

- Use DOGAMI's Seismic Needs Assessment of buildings in Salem to identify and prioritize buildings vulnerable to seismic events. Seek additional information from DOGAMI, if vulnerable reservoirs and pump stations are not included in the Seismic Needs Assessment.
- Coordinate with OEM and FEMA to determine funding for conducting seismic retrofit of buildings.

Coordinating Organization:	Emergency Management

Internal Partners:	**External Partners:**
Natural Hazards Mitigation Committee, Community Development Department, Public Works	FEMA, OEM, DOGAMI, School Districts

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
HMGP, PDM, Local Funding Resources, SRGP	TBD	☒ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Ongoing, revised from 2012 version of the NHMP

Action Item: Earthquake #3	**Alignment with Plan Goals:**	
Create a bridge prioritization inventory based on major lifeline routes including state highways, routes, and major road arteries.	☐ Goal 1 ☒ Goal 2 ☐ Goal 3	☐ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:
Salem EOP, TSP; Marion County EOP, TSP
Rationale for Proposed Action Item:
Salem does not currently have a bridge prioritization list that is tied to major lifeline routes.
Ideas for Implementation:
Work with Transportation lifeline sector representatives to identify the lifeline routes. Establish bridge prioritization list based on those routes.

Coordinating Organization:	Public Works/ GIS

Internal Partners:	**External Partners:**
Emergency Management	ODOT

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources	Less than $10,000	☐ Ongoing ☐ Short Term (0-2 years) ☒ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee (2017)
Action Item Status:	New

Action Item: Earthquake #4	**Alignment with Plan Goals:**	
Collaborate with SEDCOR to develop relevant public-private partnerships with businesses that can contribute to mitigation, response, and recovery.	☐ Goal 1 ☐ Goal 2 ☒ Goal 3	☐ Goal 4 ☐ Goal 5
Alignment with Existing Plans/Policies:		
Community Economic Development Strategy		
Rationale for Proposed Action Item:		
Government cannot do everything. Engaging the private sector is critical to success.		
Ideas for Implementation:		
Continue the innovative and successful collaboration with SEDCOR to engage local business.		

Coordinating Organization:	Emergency Management

Internal Partners:	**External Partners:**
Urban Development	Marion County Emergency Management, SEDCOR, Regional Solutions, Mid-Willamette Valley Council of Governments, UO Economic Development Administration University Center

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Economic Development Administration, Hazard Mitigation Grant Program, General Fund, Business Oregon	TBD	☐ Ongoing ☐ Short Term (0-2 years) ☒ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee (2017)
Action Item Status:	New

APPENDIX A-2: ACTION ITEM POOL

Table A-2 and the subsequent action item forms, are the complete list of non-priority actions for the 2017 Salem NHMP.

Table A-2 Action Item Pool

Action Item ID	Mitigation Action Item
Action Item Pool	
Multi-Hazard	
MH #2	Coordinate with the Capitol Planning Commission to integrate natural hazard mitigation into State and City respective capital improvements.
MH #3	Develop an inventory of the number and type of critical facilities within the community that are at reasonable risk for each hazard type.
MH #4	Develop public outreach materials for all natural hazard risks addressed in the Salem Natural Hazards Mitigation Plan. Materials should include mitigation actions residents and businesses can implement to reduce their risk to natural hazards, and where they can obtain more detailed natural hazard information.
MH #5	Include a post-disaster recovery and mitigation annex/appendix in the Salem Emergency Operations Plan that encourages property owners to incorporate retrofitting and mitigation measures in recovery efforts.
MH #6	Ensure Unified Development Code (UDC) updates consider specific hazards when updating the Salem code for mitigating the location of future development in identified/mapped high hazard areas.
MH #7	Strengthen or replace unsafe public structures (especially facilities critical to disaster and post-disaster planning/response).
MH #8	Continue developing alert and warning systems to notify residents of incidents involving natural hazards and hazardous materials.
MH #9	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.
MH #10	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including the Comprehensive Plan (particularly Goal 7).
MH #11	Participate in assessments of the short and long term needs for sheltering access and functional needs populations for all hazards.
Drought	
DR #1	Complete and implement the North Santiam Drought Contingency Plan.
Earthquake	
EQ #5	Partner with the school districts to help identify and prioritize seismic retrofits to school district facilities.

Source: Salem NHMP Steering Committee (2017)

Table A-3 Action Item Pool (Continued)

Action Item ID	Mitigation Action Item
Action Item Pool	
Extreme Heat	
EH #1	No specific action item developed for this hazard. See multi-hazard actions for applicable mitigation strategies.
Flood	
FL #1	Update, maintain, and implement flood actions via a floodplain management plan in accordance with FEMA's Community Rating System guidelines.
FL #2	Improve the City of Salem's National Flood Insurance Program (NFIP) Community Rating System (CRS) rating in order to reduce flood risk and NFIP premiums.
Landslide	
LS #1	Map areas of landslide risk adjacent to the North Santiam River (upstream of the Geren Island water intake structures) and areas impacted by a catastrophic failure of the Detroit or Big Cliff Dams.
LS #2	Update landslide overlay maps using Light Detection and Ranging (LIDAR) data.
LS #3	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.
Volcano	
VE #1	No specific action item developed for this hazard. See multi-hazard actions for applicable mitigation strategies.
Windstorm	
WD #1	Partner with public and private utilities to educate the public about hazardous trees and the damage they can cause in the event of a windstorm.
Winter Storm	
WT #1	Partner with public and private utilities to educate the public about hazardous trees and the damage they can cause in the event of a winter storm.
Wildfire	
WF #1	Conduct wildfire prevention outreach, as outlined in the Marion County and Polk County (West Salem) Community Wildfire Protection Plans (CWPPs), to residents near the wildland-urban interface.
Hazardous Materials Incident	
HM #1	Map facilities that handle or contain hazardous materials, rank them based on their level of risk, and refine response strategies for each situation in the event of an accident.

Source: Salem NHMP Steering Committee (2017)

Action Item: Multi-Hazard #2	**Alignment with Plan Goals:**	
Coordinate with the Capitol Planning Commission to integrate natural hazard mitigation into State and City respective capital improvements.	☐ Goal 1 ☒ Goal 2 ☒ Goal 3	☐ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

- The Capitol Planning Commission (SB 671, 2009 Session) is identified as the main body to implement the State of Oregon capital improvement projects within the greater Salem area. A similar responsibility rests with the Salem Public Works Department in the development and implementation of the City's Capital Improvements Program (CIP).
- It is important that natural hazard mitigation be integrated into both the State's and Salem's Capital Improvement Program so that critical public facilities, including government buildings, are constructed to function during and after natural disasters. Local units of government want to ensure continuous service by strengthening essential facilities. Ensuring continuous service will assist residents in recovering from a natural disaster as well as make the process easier.
- The Disaster Mitigation Act of 2000 requires communities to maintain the Hazard Mitigation Plan by having local governments incorporate the requirements of the mitigation plan into other planning mechanisms [201.6(c)(4)(ii)]. Coordinating mitigation activities with other planning activities will help local governments incorporate mitigation into other plans and policies currently being developed. Coordination will also reduce duplication of planning efforts, strengthening the overall mitigation planning process.

Ideas for Implementation:

- Determine what roles the Capitol Planning Commission plays in mitigating natural hazards, especially for State of Oregon properties or others in Salem for which it has jurisdiction.
- Review action items and discuss which ones can be integrated into Capital Improvement Programs for Salem.
- Inventory critical facilities that may be potentially vulnerable to a natural disaster and present these to the Capitol Planning Commission for their review.
- Include members of the Capitol Planning Commission in the NHMP Committee meetings
- Realign or replace roads and utilities when feasible in the course of regularly scheduled replacement to reduce the impact of natural hazard events on new development.
- Explore the possibility of under grounding utilities that are vulnerable to severe weather.

Coordinating Organization:	Community Development Department

Internal Partners:	**External Partners:**
Natural Hazard Mitigation Committee	FEMA, OEM, Capitol Planning Commission

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources	TBD	☒ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Ongoing, revised from 2012 version of the NHMP

Action Item: Multi-Hazard #3	**Alignment with Plan Goals:**	
Develop an inventory of the number and type of critical facilities within the community that are at reasonable risk for each hazard type.	☐ Goal 1 ☒ Goal 2 ☐ Goal 3	☐ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Emergency Operations Plan, Comprehensive Plan

Rationale for Proposed Action Item:

- Many older commercial buildings in Salem are vulnerable to damage in the event of a natural disaster. This could have significant impacts on Salem's economy. Identifying and retrofitting buildings that are susceptible to a natural disaster will reduce the vulnerability of the buildings in the event of a natural disaster and improve the resiliency of Salem's local economy.
- OEM's checklist for local mitigation plans includes the need to estimate the type and number of structures within the community at risk for each hazard type, including residences, businesses, critical facilities (hospitals, fire stations, and storage sites for hazardous materials), and infrastructure (e.g., roads and utilities). There also needs to be a map of repetitive flood loss properties (extent of flooding, no evaluation of cost of property damage) and discussion of potential mitigation activities for these properties.
- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(ii)]. Inventorying important historic and cultural resources and identifying their vulnerability to natural hazards will help to develop mitigation actions that reduce Salem's overall vulnerability to natural hazards.

Ideas for Implementation:

- Determine vulnerabilities of community structures to natural hazards
- Identify appropriate mitigation measures to help preserve structures within the community that are at risk for each hazard type.
- Create an electronic data base which illustrates an inventory of the number and type of structures within the community that are at risk for each hazard type.
- Identify significant cultural and historic resources, whether on the national register or not, that are worthy of additional protection.

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**
Natural Hazards Mitigation Committee, GIS, IT	FEMA

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources	TBD	☐ Ongoing ☒ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Retained, from 2012 version of the NHMP

Action Item: Multi-Hazard #4	**Alignment with Plan Goals:**	
Develop public outreach materials for all natural hazard risks addressed in the Salem Natural Hazards Mitigation Plan. Materials should include mitigation actions residents and businesses can implement to reduce their risk to natural hazards, and where they can obtain more detailed natural hazard information.	☐ Goal 1 ☒ Goal 2 ☒ Goal 3	☒ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

- Conducting public outreach campaigns raises awareness about natural hazards and helps illustrate what residents and businesses can do to reduce the impact of a natural disaster on their properties, thereby significantly reducing the impact of a natural disaster on Salem.
- Several natural hazards, such as severe weather, earthquakes, and floods, have the potential for disrupting transportation services and isolating rural residents from basic services and needs. Salem residents need to be educated about the dangers that natural hazards pose and what actions they can take to mitigate the impact hazards on the community.
- The Disaster Mitigation Act of 2000 requires communities to identify comprehensive actions and projects that reduce the effects of a hazard on the community [201.6(c)(3)(ii)].

Ideas for Implementation:

- Conduct public outreach campaigns, such as articles in the newspaper or through brochures instructing residents and businesses about the risks natural hazards pose and mitigation actions they can implement.
- Coordinate with other groups conducting other emergency management activities to assist in conducting public outreach campaigns, developing emergency kits, and educating residents and businesses about other mitigation activities
- Develop handouts that inform residents and businesses about natural hazard risk, appropriate mitigation actions that can be implemented, and where citizens can obtain further information.
- Create an online informational website where residents and businesses can be educated about appropriate mitigation actions residents and businesses can implement to reduce the impact of natural hazards
- Work with local real estate trade associations to prepare informational handouts advising property owners of natural hazard risks in their area and measures they can implement to reduce their risk of exposure.

Coordinating Organization:	Emergency Management

Internal Partners:	**External Partners:**
Community Development Department, Public Works	FEMA, Oregon State Police, OMD-Office of Emergency Management, DOGAMI, DLCD

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources, FEMA, DLCD, DOGAMI	TBD	☒ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Ongoing, from 2012 version of the NHMP

Action Item: Multi-Hazard #5	**Alignment with Plan Goals:**	
Include a post-disaster recovery and mitigation annex/appendix in the Salem Emergency Operations Plan that encourages property owners to incorporate retrofitting and mitigation measures in recovery efforts.	☐ Goal 1 ☒ Goal 2 ☒ Goal 3	☐ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Emergency Operations Plan

Rationale for Proposed Action Item:

- Disaster response is an important component to natural hazards planning that can save lives and property during a natural disaster. Coordinating disaster response efforts with the mitigation plan will ensure that the plan remains relevant to the larger community.
- Resources that may not be available on a routine basis for certain improvements may become available through various disaster relief sources, particularly where careful planning has allowed the community to identify certain needs in advance, saving critical time in the aftermath of a disaster.
- The Disaster Mitigation Act of 2000 requires communities to develop actions that reduce the impact of a natural hazard [201.6(c)(3)(ii)]. Incorporating information about mitigation and retrofitting will increase Salem's ability to recover from a natural disaster.

Ideas for Implementation:

- Seek guidance from FEMA and the Oregon Office of Emergency Management on how to incorporate recovery and mitigation measures into the Salem Emergency Operations Plan.
- Periodically update the recovery and mitigation measures that have been incorporated into the Salem Emergency Operations Plan

Coordinating Organization:	Emergency Management

Internal Partners:	**External Partners:**
Natural Hazards Mitigation Committee	FEMA, Oregon State Police, OMD-Office of Emergency Management

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources	TBD	☐ Ongoing ☒ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Deferred, from 2012 version of the NHMP

Action Item: Multi-Hazard #6	**Alignment with Plan Goals:**	
Ensure Unified Development Code (UDC) updates consider specific hazards when updating the Salem code for mitigating the location of future development in identified/mapped high hazard areas.	☐ Goal 1 ☒ Goal 2 ☐ Goal 3	☐ Goal 4 ☒ Goal 5
Alignment with Existing Plans/Policies:		
Rationale for Proposed Action Item:		
• Goal 7 of Oregon's Land Use Planning Goals requires that local governments "adopt or amend, as necessary, based on the evaluation of risk, plan policies and implementing measures...[that prohibit] the siting of essential facilities, major structures, hazardous facilities and special occupancy structures, as defined in the state building code (ORS 455.447(1) (a)(b)(c) and (e)), in identified hazard areas..." • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Adjusting the Salem code to move future development from identified/mapped hazards areas will reduce the vulnerability of new development to natural hazards.		
Ideas for Implementation:		
• Consider transferring development rights from high hazard areas to safer areas, especially in those areas where the risk to people and property cannot be mitigated. • Address high hazard areas and consider measures for mitigating the location of future development in these areas during the update of the Salem code.		

Coordinating Organization:	Community Development

Internal Partners:	**External Partners:**
Natural Hazards Mitigation Committee	DLCD, FEMA

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources, DLCD Technical Assistance Grant	TBD	☒ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Ongoing, revised from 2012 version of the NHMP

Action Item: Multi-Hazard #7	**Alignment with Plan Goals:**	
Strengthen or replace unsafe public structures (especially facilities critical to disaster and post-disaster planning/ response).	☒ Goal 1 ☒ Goal 2 ☐ Goal 3	☐ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

- The Disaster Mitigation Act of 2000 requires communities to assess their vulnerability to natural hazards, particularly by identifying the types and number of buildings, infrastructure, and critical facilities that could be affected.
- It is important that critical facilities function during and after disasters. Strengthening all essential facilities will improve recovery capacity and reduce risk and loss of life.
- Retrofitting of vital infrastructure, such as schools and community buildings, provides important improvements that reduce hazard exposure and the cost and time associated with recovery.

Ideas for Implementation:

- Develop formal agreements with internal and external partners who could assist the partners in collaborating and sharing the responsibility of natural hazard mitigation. Such actions to form collaborative partnerships and commitments to mitigation can assist the City in reducing its risk to the natural hazards addressed by the Natural Hazards Mitigation Plan.
- Conduct structural and non-structural retrofits of critical facilities to reduce the impacts of a natural hazard.
- Conduct a cost-benefit analysis to assess whether the cost of mitigation improvements to critical facilities balance with the benefits to be gained.
- Create proposals to reinforce buildings so they can withstand an earthquake and thereby reduce vulnerability risks; ORS 455.447 regulates vulnerable building retrofits.

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**
Fire Department, Police Department, Community Development, Urban Development, Administrative Services	FEMA, ODOT

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
FMA, HMGP, PDM, SRGP, Local Funding Resources,	TBD	☐ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☒ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Retain, revised from 2012 version of the NHMP

Action Item: Multi-Hazard #8	**Alignment with Plan Goals:**	
Continue developing alert and warning systems to notify residents of incidents involving natural hazards and hazardous materials.	☒ Goal 1 ☐ Goal 2 ☒ Goal 3	☐ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

- Alert and warning systems can provide a life-saving service to residents in the event of a natural or manmade disaster. Natural and manmade disasters can occur at any time, often unannounced, putting people at risk. Developing alert and warning systems can reduce the risk of exposure to natural hazard incidents and hazardous materials spills and help to save lives and property.
- Alert and warning system have significant relevance to hazardous materials accidents. Hazardous materials are located near businesses and residences in Salem as well as along major transportation routes. Trucking routes along the I-5 corridor and Highway 22 may also contain hazardous materials because there are no restrictions on the type of cargo that travels over these routes which run through residential and commercial areas in the city. In addition, the heavily-traveled railroad line near the Capital area has approximately 12,000 cars of hazardous materials running through the area each year. Accidents in businesses or on any of the above routes can have an adverse impact on the quality of life and economy of the city and the state; significant events have already occurred in Salem in 1976 and along the I-5 corridor. Alert and warning systems can help to prevent larger accidents from occurring and help to save lives and property.

Ideas for Implementation:

- Continue to enforce the Salem Fire Prevention Code to regulate hazardous materials.
- Develop strategies in local building codes and zoning ordinances to reduce the impact of natural hazard and manmade hazard events on buildings and infrastructure.
- Continue to develop a reverse 9-11 system to alert nearby residents and businesses of natural hazard events or hazardous materials accident.
- Develop improved maps to locate areas vulnerable to natural hazard events and hazardous materials.

Coordinating Organization:	Emergency Management

Internal Partners:	**External Partners:**
Public Works, Police Department, GIS and Mapping Departments	ODOT, FEMA, OSHA

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
FEMA, Local Funding Resources	TBD	☒ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Ongoing, from 2012 version of the NHMP

Action Item: Multi-Hazard #9	**Alignment with Plan Goals:**	
Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.	☐ Goal 1 ☒ Goal 2 ☒ Goal 3	☒ Goal 4 ☐ Goal 5
Alignment with Existing Plans/Policies:		
Transportation Plan, Community Wildfire Protection Plans (Marion and Polk)		
Rationale for Proposed Action Item:		
Downed power lines result in power failures and block critical transportation routes. The loss of electric power for a long period of time (more than 72 hours) can lead to failures of multiple critical systems including health care, water filtration, wastewater treatment, communications, transportation, and others. Impassable roadways from downed lines also inhibit emergency response and restoration of critical services, such as drinking water and health care, and is particularly problematic if fuel for backup generators cannot be delivered. The hazards most likely to impair surface transportation and disrupt electric service are severe winter storm (snow, ice, downed trees, utility pole, and wire failures) and earthquake (downed trees, utility pole and wire failures).		
Ideas for Implementation:		
Over the next five years: a) Develop a list of key backbone transmission and distribution routes that serve critical customers and enable efficient restoration to the broader distribution system; b) Develop a long-term plan to underground, relocate, or "harden" key electric distribution lines along critical corridors (including feasibility assessment and prioritization); c) Seek funds and opportunities to relocate power poles and power lines, or harden existing facilities, where feasible and appropriate, to reduce blockage of roadways and to reduce risk of outages from natural disasters; and d) Continue to enhance wind and winter storm resistant construction methods where possible to reduce damage to utilities and critical facilities.		
Coordinating Organization:	Public Works	
Internal Partners:	**External Partners:**	
Community Development, Emergency Management, GIS	Public Utility Commission, Pacific Power	
Potential Funding Sources:	**Estimated cost:**	**Timeline:**
HMGP, PDM, Electric Utilities, Local Funding Resources	TBD	☒ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)
Form Submitted by:	Salem Natural Hazards Mitigation Committee (2017)	
Action Item Status:	New	

Action Item: Multi-Hazard #10	Alignment with Plan Goals:	
Integrate the Mitigation Plan findings into planning and regulatory documents and programs including Comprehensive Plans.	☒ Goal 1 ☒ Goal 2 ☐ Goal 3	☒ Goal 4 ☒ Goal 5

Alignment with Existing Plans/Policies:

Action proposes integration with relevant existing plans and policies.

Rationale for Proposed Action Item:

The federal Disaster Mitigation Act of 2000 requires communities to describe a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms, when appropriate.

Every five years, natural hazard mitigation plans must be updated and resubmitted for approval in order to continue to be eligible for mitigation project grant funding. The updated plan must explain how the local government incorporated the mitigation plan into other planning mechanisms, when appropriate, as a demonstration of progress in local mitigation efforts. This action item serves as a reminder to the Natural Hazards Mitigation Plan committee that efforts must be made to integrate the requirements of the mitigation plan into other planning mechanisms.

Ideas for Implementation:

Local government functions provide a myriad of methods in which to implement actions identified in the mitigation strategy. Among them is the comprehensive plan. Others include, but are not limited to, the following: sustainability plans, capital improvement plans, redevelopment plans, post-disaster redevelopment or recovery plans, regional development plans, flood mitigation plans, college campus plans, etc. (see Federal Emergency Management Agency Local Mitigation Planning Guidance, July 2008).

Conduct an 'audit' of the Salem Comprehensive Plan (specifically, Goal 7). Determine whether information needs to be (or can be) updated by content within the natural hazards mitigation plan or otherwise. Develop a strategy and timeline for updating Goal 7 content. Ideally, integration should happen as a dedicated component of future comprehensive plan or natural hazards mitigation plan updates.

Inventory and review other local plans to identify gaps, weaknesses, or opportunities for enhancing plan integration.

The American Planning Association (APA) developed a report entitled *Hazard Mitigation: Integrating Best Practices into Planning*. The report identifies where local planning activities could benefit from better integration of hazard mitigation concerns.

The Federal Emergency Management Agency (FEMA) developed a guidebook entitled *Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan*. The guidebook includes case studies of Benton County and Corvallis NHMP integration efforts.

Coordinating Organization:	Community Development

Internal Partners:	**External Partners:**
Emergency Management, Public Works, City Administration	FEMA, American Planning Association, DLCD, OEM

Potential Funding Sources:		Estimated cost:	Timeline:
Local Funding Resources, DLCD Technical Assistance Grants		TBD	☒ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)
Form Submitted by:	Salem Natural Hazards Mitigation Committee (2017)		
Action Item Status:	New		

Action Item: Multi-Hazard #11	**Alignment with Plan Goals:**	
Participate in assessments of the short and long term needs for sheltering access and functional needs populations for all hazards.	☒ Goal 1 ☐ Goal 2 ☐ Goal 3	☐ Goal 4 ☐ Goal 5
Alignment with Existing Plans/Policies:		
Salem EOP, Marion County EOP, Marion County NHMP		
Rationale for Proposed Action Item:		
Marion County has been conducting an ongoing effort to address functional needs populations. This action acknowledges the success of that work and acknowledges that additional effort is needed. Functional needs populations are an identified priority for the city and county. Salem will participate with the county's corresponding NHMP action (Marion County NHMP Priority Action #3, 2017).		
Ideas for Implementation:		
Interviews, focus groups and data analysis.		

Coordinating Organization:	Emergency Management

Internal Partners:	**External Partners:**
Community Development	Marion County Emergency Management, Oregon DHS

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources, Americorps/ Resource Assistance for Rural Environments	TBD	☐ Ongoing ☒ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee (2017)
Action Item Status:	New

Action Item: Drought #1	**Alignment with Plan Goals:**	
Complete and Implement the North Santiam Drought Contingency Plan	☐ Goal 1 ☐ Goal 2 ☒ Goal 3	☒ Goal 4 ☒ Goal 5
Alignment with Existing Plans/Policies:		
Water Master Plan, Comprehensive Plan		
Rationale for Proposed Action Item:		
Water availability is an increasing concern in Salem and Marion County. The ongoing water contingency planning effort is an innovative and successful collaboration between numerous local and regional partners. The effort is already resulting in significant mitigation benefits across Marion County.		
Ideas for Implementation:		
Complete, adopt and begin to implement the plan.		

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**	
City Departments	Marion County (Emergency Management), Santiam Water Control District, City of Stayton, Linn Soil & Water Conservation District, Marion Soil & Water Conservation District, Norpac Foods, Inc., North Santiam Watershed Council, Oregon Department of Agriculture, Oregon Department of Environmental Quality, Oregon Department of Forestry	
Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Bureau of Reclamation, Local Funding Resources	TBD	☐ Ongoing ☒ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee (2017)
Action Item Status:	New

Action Item: Earthquake #5	**Alignment with Plan Goals:**	
Partner with the school districts to help identify and prioritize seismic retrofits to school district facilities.	☒ Goal 1 ☒ Goal 2 ☐ Goal 3	☐ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

- Due to the high concentration of students and the relative vulnerability of that population, schools have large negative impacts from seismic events. Seismically retrofitting these facilities will significantly reduce their vulnerability in the event of an earthquake.
- Oregon Senate Bill 3 (2005) enables the Oregon Office of Emergency Management to develop a grant program to seismically rehabilitate critical public facilities. While the grant program is still being developed, conducting an inventory of critical facilities early will assist communities in obtaining funding once the grant program is in place.
- The Department of Geology and Mineral Industries (DOGAMI) Statewide Seismic Needs Assessment completed in 2007 of educational facilities in the state of Oregon identified 48 school structures with a high or very high likelihood of collapse in the event of a major earthquake. These facilities should be retrofitted accordingly to reduce the likelihood of collapse in the event of an earthquake.
- The Disaster Mitigation Act of 2000 requires communities to identify comprehensive actions that protect new and existing buildings [201.6(c)(3)(ii)]. Seismically retrofitting existing critical facilities, including reservoirs and pump stations and especially schools, will help Salem reduce their vulnerability to seismic events.

Ideas for Implementation:

- Use DOGAMI's Seismic Needs Assessment of Salem school facilities to identify and prioritize school district facilities that are vulnerable to seismic events.
- Educate school district officials about the effectiveness of natural hazard mitigation actions.
- Coordinate with OEM and FEMA to seek funding for conducting seismic retrofit of buildings.
- Engage the members of the school district with the Salem Natural Hazards Mitigation Committee.

Coordinating Organization:	Emergency Management

Internal Partners:	**External Partners:**
Natural Hazards Mitigation Committee, Community Development Department,	FEMA, OEM, DOGAMI, Salem-Keizer School District, private schools, Chemeketa C.C., Willamette University, Corban University

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
HMGP, PDM, Local Funding Resources, SRGP	TBD	☐ Ongoing ☒ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Ongoing, revised from 2012 version of the NHMP

Action Item: Flood #1	**Alignment with Plan Goals:**	
Update, maintain, and implement flood actions via a floodplain management plan in accordance with FEMA's Community Rating System guidelines.	☐ Goal 1 ☒ Goal 2 ☒ Goal 3	☐ Goal 4 ☒ Goal 5
Alignment with Existing Plans/Policies:		
Rationale for Proposed Action Item:		
Floodplain management for Salem is unique and warrants a separate public process to identify specific action items. Factors include involvement in the Community Rating System, Endangered Species Act and compliance with existing adopted plans.		
Ideas for Implementation:		
Continue 10-step process identified by FEMA. The City's Public Works department has started the process and anticipates a final Floodplain Management Plan to be presented to City Council by the end of 2012.		

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**	
Emergency Management, Fire, Operations and Engineering	FEMA, DLCD, National Flood Insurance Program, Floodplain Management Committee	
Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources, DLCD Technical Assistance Grant	TBD	☒ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Ongoing, revised from 2012 version of the NHMP

Action Item: Flood #2	**Alignment with Plan Goals:**	
Improve the City of Salem's National Flood Insurance Program (NFIP) Community Rating System (CRS) rating in order to reduce flood risk and NFIP premiums.	☐ Goal 1 ☒ Goal 2 ☒ Goal 3	☒ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

- The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, insurance premiums under the NFIP are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance.
- Salem has a CRS program rating of **five**. Implementing action items to improve the CRS rating will significantly reduce NFIP premiums on structures located within the floodplain.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address existing buildings and infrastructure [201.6(c)(3)(ii)]. Maintaining the status of the Community Rating System program can help the community to enhance mitigation efforts and decrease the vulnerability to floods. In addition, the Flood Mitigation Assistance Program requires that communities maintain their compliance with the NFIP.

Ideas for Implementation:

- Coordinate with the Department of Land Conservation and Development (DLCD) and FEMA to maintain the Community Rating System.
- Educate businesses and homeowners currently under the NFIP program about the CRS program and any mitigation actions they can implement to reduce their insurance premiums.
- Identify homes not in the NFIP that should have flood insurance.
- Develop mitigation activities to address repetitive and single loss flood properties in Salem, particularly in the area of McGilchrist Avenue and Pringle Road SE, adjacent to West Pringle Creek.

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**
Community Development	DLCD, National Flood Insurance Program, FEMA, Marion and Polk Counties

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources	TBD	☒ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Ongoing, from 2012 version of the NHMP

Action Item: Landslide #1	**Alignment with Plan Goals:**	
Map areas of landslide risk adjacent to the North Santiam River (upstream of the Geren Island water intake structures) and areas impacted by a catastrophic failure of the Detroit or Big Cliff Dams.	☒ Goal 1 ☒ Goal 2 ☐ Goal 3	☐ Goal 4 ☒ Goal 5

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

- The current landslide hazard maps are a compilation of existing maps. These maps are a "work in progress" and have been compiled at widely varying scales and sometimes only depict risk for certain types of landslides. These various scales and levels of detail may lead to people to believe that some areas have no slope hazard, when the case is that those areas just have not yet been evaluated. Systematic upgrading of these maps will lead to greater understanding of hazard locales. Focusing on areas that will be developed and will affect people and critical infrastructure will improve land use planning and provide for more efficient and cost effective development.
- Better data provides for better decisions to minimize loss. Incorporating indirect economic loss better depicts the cost from natural hazard events.

Ideas for Implementation:

- Improve knowledge of debris flow (rapid moving) landslide hazard areas.
- Improve landslide hazard area maps for a variety of types of landslides that focus on areas that will affect people and critical infrastructure and facilities.
- Educate identified vulnerable residential and commercial building owners, occupants, and developers of their vulnerability to risk.

Coordinating Organization:	Public Works Department

Internal Partners:	**External Partners:**
Community Development	USACE, DOGAMI, DLCD, FEMA, BLM, USFS

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
HMGP, PDM, Risk MAP, Local Funding Resources	TBD	☐ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☒ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Deferred, revised from 2012 version of the NHMP

Action Item: Landslide #2	**Alignment with Plan Goals:**	
Update landslide overlay maps using Light Detection and Ranging (LIDAR) data.	☐ Goal 1 ☒ Goal 2 ☒ Goal 3	☐ Goal 4 ☐ Goal 5
Alignment with Existing Plans/Policies:		
Rationale for Proposed Action Item:		
• LIDAR (Light Detection and Ranging) is a new tool that can provide very precise, accurate, and high-resolution images of the surface of the earth, vegetation, and the built environment. The data are collected with aircraft-mounted lasers capable of recording elevation measurements at a rate of 2,000 to 5,000 pulses per second and have a vertical precision of 15 centimeters (6 inches). LIDAR mapping increases the ability to identify areas that are prone to landslides. • In 2007, the Oregon Legislature Assembly directed DOGAMI to extend LIDAR collection efforts throughout the state. The ultimate goal is to provide high-quality LIDAR coverage for the entire state.		
Ideas for Implementation:		
• Contact DOGAMI and provide a map of Salem along with an estimate of available funding. • Seek funding opportunities with DOGAMI to conduct LIDAR mapping for Salem. • Once mapping is complete assess the need to update landslide ordinances. • Explore potential cost-sharing agreements with Keizer, Turner, Marion and Polk Counties for LIDAR mapping of the entire Salem-Keizer urbanized area.		

Coordinating Organization:	Public Works Department
Internal Partners:	**External Partners:**
Natural Hazards Mitigation Committee, City GIS technicians	FEMA, NOAA, DLCD, DOGAMI, Keizer, Turner, Marion County, Polk County

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
HMGP, PDM, Risk MAP, Local Funding Resources	TBD/ Potentially very expensive	☐ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☒ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Deferred, from 2012 version of the NHMP

Action Item: Landslide #3	**Alignment with Plan Goals:**	
Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.	☐ Goal 1 ☒ Goal 2 ☒ Goal 3	☐ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Comprehensive plans, Lidar data available from DOGAMI

Rationale for Proposed Action Item:

The risk assessment identified the potential for landslides to cause damage to buildings and infrastructure within the city; landslides may cause road closures and interruptions to utility services. The risk assessment also identified previous incidents of landslides that affected the city. Road closures sometimes force residents to find alternate transportation routes. Review and monitor existing public infrastructure to identify specific exposure to landslide risk.

The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Identifying existing public infrastructure with exposure to landslide risk will allow the implementation of mitigation measures to reduce this risk.

Ideas for Implementation:

Utilize the Landslide Susceptibility Map and Data (DOGAMI O-16-02) to perform landslide risk analysis. Use the new information to prioritize risk reduction actions. Perform risk reduction. Update/ develop Landslide Ordinances as applicable

Coordinating Organization:	Community Development

Internal Partners:	**External Partners:**
GIS and Mapping, Emergency Management	DOGAMI, DLCD

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Risk MAP, PDM, HMGP, Local Funding Resources	TBD	☐ Ongoing ☒ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	New

Action Item: Windstorm #1	**Alignment with Plan Goals:**	
Partner with public and private utilities to educate the public about hazardous trees and the damage they can cause in the event of a wind or winter storm.	☐ Goal 1 ☒ Goal 2 ☐ Goal 3	☒ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

- Overhead electrical lines and other above ground utilities are subject to damage from nearby trees in high winds and winter storm damage. Post-disaster, it is difficult to remove debris from the downed utility lines and this difficulty delays the time for restoration of power to the community. Partnering with utility companies to maintain and remove hazardous trees, in addition to educating the public about the damage hazardous trees can cause, will help reduce risk of damage from severe wind and winter storms.
- The Disaster Mitigation Act of 2000 requires communities to develop comprehensive actions to reduce the impacts of natural hazards, with an emphasis on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Maintenance and removal of hazardous trees will reduce the impact of severe weather, and will continue power service to rural customers as well as ODOT, State Police, county sheriff, emergency services, telephone utilities, and cell phone companies.

Ideas for Implementation:

- Coordinate with the Salem Public Works Department to gather information about the maintenance and removal of hazardous trees.
- Work with the community and Salem Public Works Department to identify areas that are prone to damage from nearby trees and perform the necessary maintenance or removal of those trees.
- Create a hazardous tree inventory.

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**	
Community Services Parks Operations, Fire Department	ODOT, Portland General Electric, Salem Electric	
Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources, Utilities	TBD	☒ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Ongoing, from 2012 version of the NHMP

Action Item: Winter Storm #1	**Alignment with Plan Goals:**	
Partner with public and private utilities to educate the public about hazardous trees and the damage they can cause in the event of a wind or winter storm.	☐ Goal 1 ☒ Goal 2 ☐ Goal 3	☒ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

- Overhead electrical lines and other above ground utilities are subject to damage from nearby trees in high winds and winter storm damage. Post-disaster, it is difficult to remove debris from the downed utility lines and this difficulty delays the time for restoration of power to the community. Partnering with utility companies to maintain and remove hazardous trees, in addition to educating the public about the damage hazardous trees can cause, will help reduce risk of damage from severe wind and winter storms.
- The Disaster Mitigation Act of 2000 requires communities to develop comprehensive actions to reduce the impacts of natural hazards, with an emphasis on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Maintenance and removal of hazardous trees will reduce the impact of severe weather, and will continue power service to rural customers as well as ODOT, State Police, county sheriff, emergency services, telephone utilities, and cell phone companies.

Ideas for Implementation:

- Coordinate with the Salem Public Works Department to gather information about the maintenance and removal of hazardous trees.
- Work with the community and Salem Public Works Department to identify areas that are prone to damage from nearby trees and perform the necessary maintenance or removal of those trees.
- Create a hazardous tree inventory.

Coordinating Organization:	Public Works Department	
Internal Partners:	**External Partners:**	
Community Services Parks Operations, Fire Department	ODOT, Portland General Electric, Salem Electric	
Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources, Utilities	TBD	☒ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)
Form Submitted by:	Salem Natural Hazards Mitigation Committee	
Action Item Status:	Ongoing, from 2012 version of the NHMP	

Action Item: Wildfire #1	**Alignment with Plan Goals:**	
Conduct wildfire prevention outreach, as outlined in the Marion County and Polk County (West Salem) Community Wildfire Protection Plans (CWPPs), to residents near the wildland-urban interface.	☒ Goal 1 ☐ Goal 2 ☒ Goal 3	☐ Goal 4 ☐ Goal 5

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

- The Oregon Department of Forestry (ODF) completed a Communities at Risk Assessment for Salem that shows areas in northwest and south Salem that are at high risk to wildfire events. These areas are just outside of Salem but are vulnerable to wildfire events that could impact residents within the city. Conducting wildfire prevention outreach to residents near these areas can significantly reduce the vulnerability of the neighborhoods to wildfire events.
- Interviews with Salem Fire Department staff indicate that the areas with the highest risk have the steepest slopes, the right fuels, and high valued property. The areas outlined by the ODF Communities at Risk Assessment show that many of the areas at risk are near steep slopes and have combustible fuels. Conducting wildfire prevention outreach can help to reduce vulnerability of residents to wildfire events.
- The Marion County and Polk County CWPPs outline strategies for conducting wildfire prevention outreach to residents living in the wildland-urban interface. Conducting wildfire prevention outreach using the CWPP will help to integrate mitigation into existing plans and policies as required by the Disaster Mitigation Act of 2000 [201.6(c)(4)(ii)].
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Conducting wildfire prevention outreach measures will help to protect new and existing buildings from wildfire.

Ideas for Implementation:

- The Marion and Polk County CWPPs contain several action items for reducing the impacts of wildfire on communities throughout the city, including actions to conduct public outreach about fuels reduction and defensible space. Using these action items can assist in reducing the impact of wildfire on Salem.
- Coordinate with responsible agencies listed in the CWPPs to implement action items.

Coordinating Organization:	Fire Department

Internal Partners:	**External Partners:**
Public Works and Community Development Departments, Police Department, Community Services	Oregon Department of Forestry, Marion County Fire District #1, Salem Suburban Fire District, Neighborhood Associations

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources, ODF	TBD	☒ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Ongoing, revised from 2012 version of the NHMP

Action Item: Hazardous Materials Incident #1	**Alignment with Plan Goals:**	
Map facilities that handle or contain hazardous materials, rank them based on their level of risk, and refine response strategies for each situation in the event of an accident.	☒ Goal 1 ☐ Goal 2 ☒ Goal 3	☐ Goal 4 ☒ Goal 5

Alignment with Existing Plans/Policies:

Rationale for Proposed Action Item:

- Salem has identified and mapped hazardous materials located in the city. These maps need to be updated to determine the number and types of natural hazards present, and their level of risk.
- The Salem Natural Hazards Mitigation Committee indicated how the railroad running near the Capital Mall area in Salem is an area for potential concern because of the significant amount of hazardous materials that run through the area each year. Accidents with people and automobiles could derail cars and have the potential to spill hazardous materials in the Capital Mall area, affecting City and State operations. Refining response strategies for accidents on the railroad line would reduce the vulnerability of Salem to hazardous materials incidents.
- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(ii)]. Identifying facilities that handle or contain hazardous materials, ranking them based on their level of risk, and developing appropriate response strategies will help reduce the negative impact of hazardous materials on the population in Salem and improve disaster response efforts.

Ideas for Implementation:

- Contact businesses and property owners with hazardous materials about strategies they can implement to reduce the impacts of hazardous materials in their immediate area.
- Coordinate response strategies with alert warning systems to minimize potential exposure to hazardous materials.
- Provide information on shelter-in-place strategies to property owners and neighbors to reduce exposure to hazardous materials and simplify response efforts.
- Identify vulnerable areas along the Union Pacific and Burlington Northern Santa Fe railroad lines and coordinate with railroad companies to develop strategies for reducing accidents along the railroad lines.

Coordinating Organization:	Fire Department

Internal Partners:	**External Partners:**
Emergency Management, Public Works	OSHA, Salem Chamber of Commerce, Neighborhood Associations, ODOT, OEM, State Police, State Fire Marshal

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
Local Funding Resources	TBD	☒ Ongoing ☒ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)

Form Submitted by:	Salem Natural Hazards Mitigation Committee
Action Item Status:	Retain, from 2012 version of the NHMP

APPENDIX A-3:
ACTION ITEM FORM

Action Item:	**Alignment with Plan Goals:**	
	☐ Goal 1 ☐ Goal 2 ☐ Goal 3	☐ Goal 4 ☐ Goal 5
Alignment with Existing Plans/Policies:		
Rationale for Proposed Action Item:		
Ideas for Implementation:		
Coordinating Organization:		
Internal Partners:	**External Partners:**	
Potential Funding Sources:	**Estimated cost:**	**Timeline:**
		☐ Ongoing ☐ Short Term (0-2 years) ☐ Mid-Term (3-5 years) ☐ Long-Term (5+ years)
Form Submitted by:		
Action Item Status:		

APPENDIX B:
PLANNING AND PUBLIC PROCESS

Plan Update Changes

This memo describes the changes made to the 2012 Salem NHMP Natural Hazards Mitigation Plan (NHMP) during the 2016-2017 plan update process. Major changes are documented by plan section.

Project Background

Salem partnered with the Oregon Partnership for Disaster Resilience (OPDR) to update the stand alone 2012 Salem 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 Salem steering committee to update their NHMP. OPDR and the committee 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 B-1 lists the 2012 Salem 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 B-1 Changes to Plan Organization

2012 Salem NHMP	2017 Salem NHMP
Acknowledgements	Acknowledgements
Table of Contents	Table of Contents
-	Approval Letters and Resolutions
-	FEMA Review Tool
Volume I: Natural Hazard Mitigation Plan	Volume I: Basic Plan
Executive Summary	Plan Summary
Section 1: Introduction	Section 1: Introduction
Section 2: Risk Assessment	Section 2: Risk Assessment
Section 3: Mission, Goals, and Action Items	Section 3: Mitigation Strategy
Section 4: Plan Implementation and Maintenance	Section 4: Implementation and Maintenance
Volume II: Hazard Chapters	Volume I: Basic Plan
Drought	Section 2: Risk Assessment
Earthquake	
Extreme Heat	
Flood	
Hazardous Materials	
Landslide	
Volcanic Eruption	
Wildfire	
Windstorm	
Winter Storm	
Volume III: Resource Appendices	Volume II: Appendices
Appendix A: Action Item Forms	Appendix A: Action Items
Appendix B: Planning and Public Process	Appendix B: Planning and Public Process
Appendix C: Economic Analysis of Natural Hazard Mitigation Projects	Appendix D: Economic Analysis of Natural Hazard Mitigation Projects
Appendix D: Community Profile	Appendix C: Community Profile
Appendix E: Grant Programs	Appendix E: Grant Programs
-	Appendix F: Lifeline Sector Analysis
-	Appendix G: Survey

Front Pages

1. The plan's cover has been updated.
2. Acknowledgements have been updated to include the 2017 project partners and planning participants.
3. The FEMA approval letter, review tool, and city resolution of adoption are included. *(will be included with the final version of the NHMP)*

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 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 2012 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.

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 Salem NHMP (2012 NHMP, Volume II) 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:

- The section name changed from "Mission, Goals, Actions" to "Mitigation Strategy"
- Mission and Goals were reviewed and compared with the State NHMP Mission and Goals, no changes were made.

- The revision of existing actions, and coordinating and partner organization designations were revised as applicable (as shown in Tables 3-1 and 3-2 and Appendix A).
- A list of prioritized actions for each jurisdiction, Table 3-1 (including new action item forms in Appendix A-1).
- The Salem steering committee met to review the previous NHMP action items. Steering Committee members and stakeholders provided updates and edits to the actions where applicable.
- 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 Appendix A.

Section 4: Plan Implementation and Maintenance

The steering committee did not formally meet since the previous version of this NHMP. Progress towards action items is documented in the action item section below (Appendix A). The steering committee agreed to meet semi-annually and the Salem Emergency Manager 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: Appendices

Below is a summary of the appendices included in the 2017 NHMP:

Appendix A: Action Items

Action item forms were created for new actions, others have been updated to account for new information. The action item forms reference the status of the action item, timeline, rationale, implementation measures, coordinating and partner organizations, and potential funding sources. The list below tracks progress made towards previous plans' actions (*in the list below the previous action item number is listed first, followed by the 2017 action item number as applicable*).

Table B-2 Action Item Status and Changes

2012 Action	2017 Action	Mitigation Action Item	Status	NOTES
PI #1	-	Request FEMA approval of the Natural Hazards Mitigation Plan Update.	Delete	Part of normal NHMP approval process.
PI #2	-	Salem Emergency Management will take on the role of convener to coordinate hazard mitigation meetings and implementation of mitigation action items.	Delete	Part of normal NHMP implementation and maintenance process.
PI #3	-	The Salem Natural Hazard Mitigation Committee will be the coordinating body responsible for implementing the Salem Natural Hazards Mitigation Plan.	Delete	Part of normal NHMP implementation and maintenance process.
PI #4	-	The Salem Natural Hazard Steering Committee will review the Hazard Mitigation Crosswalk to identify hazard mitigation policy changes for the City of Salem throughout existing plans. (Action Item under development)	Delete	Replaced with MH #10
-	MH #1	Identify and Designate Priority Transportation Routes.	New	Designating priority transportation routes will ensure that when investments are made, they are prioritized to those routes that will be most important to post event response and recovery efforts.
MH #1	MH #2	Coordinate with the ~~Capital Projects Advisory Board~~ Capitol Planning Commission to integrate natural hazard mitigation into State and City respective capital improvements.	Ongoing	Salem coordinates with the Capitol Planning Commission.
MH #2	MH #3	Develop an inventory of the number and type of critical facilities within the community that are at reasonable risk for each hazard type.	Retain	Some buildings are mapped.
MH #3	MH #4	Develop public outreach materials for all natural hazard risks addressed in the Salem Natural Hazards Mitigation Plan. Materials should include mitigation actions residents and businesses can implement to reduce their risk to natural hazards, and where they can obtain more detailed natural hazard information.	Ongoing	Outreach materials are currently provided on the Salem website.
MH #4	MH #5	Include a post-disaster recovery and mitigation annex/appendix in the Salem Emergency Operations Plan that encourages property owners to incorporate retrofitting and mitigation measures in recovery efforts.	Deferred	EOP was last updated in 2014.
MH #5	MH #6	Ensure Unified Development Code (UDC) updates consider specific hazards when updating the Salem code for mitigating the location of future development in identified/mapped high hazard areas.	Ongoing	Development code was last updated in 2014; including sections dealing with natural hazards.

Table B-2 Action Item Status and Changes (continued)

2012 Action	2017 Action	Mitigation Action Item	Status	NOTES
MH #6	MH #7	Strengthen or replace unsafe public structures (especially facilities critical to disaster and post-disaster planning/response).	Retain	5 bridges rebuilt; Winter St, Commercial St, Fairway Dr., Capitol St, and Center St Ongoing - installation of seismic valves at reservoirs
MH #7	MH #8	Continue developing alert and warning systems to notify residents of incidents involving natural hazards and hazardous materials.	Ongoing	City currently uses: OneRain System: https://hww.onerain.com/home.php, High water warning, Everbridge Mass Communication, 311, Developing a "Flood Responses and Warning Plan".
-	MH #9	Enhance hazard resistant construction methods (wind, winter storm, landslide, etc.) where possible to reduce damage to utilities and critical facilities. In part, this may be accomplished by encouraging electric utility providers to convert existing overhead lines to underground lines.	New	Electric utilities are at risk from several hazards (wind, winter storm, etc.). Protecting these systems is vital to continued operations.
-	MH #10	Integrate the Mitigation Plan findings into planning and regulatory documents and programs including the Comprehensive Plan (particularly Goal 7).	New	Incorporating the non-regulatory NHMP into regulatory city plans and codes will provide greater opportunities to reduce risk.
-	MH #11	Participate in assessments of the short and long term needs for sheltering access and functional needs populations for all hazards.	New	Per Marion Co. NHMP. Increasing sheltering to vulnerable populations is a vital community need.
-	DR #1	Complete and implement the North Santiam Drought Contingency Plan.	New	This plan is underway and is vital to reduce the risk from drought. http://northsantiam.org/projects/north-santiam-drought-contingency-planning-2016-2017/
EQ #1	EQ #1	Develop an inventory of un-reinforced masonry structures and develop appropriate mitigation action items to reduce the impacts of seismic events.	Retain	Fire Station 1, 2, 4, and 6 are seismically retrofitted. Stations 5, 7, 10, and 11 are built under new seismic regulations. Stations 3, 8, and 9 are modernized but have not been seismically retrofitted.
EQ #2	EQ #2	Identify, inventory, and mitigate (as prioritization and resources allow) critical facilities and utilities that require seismic retrofit (consider structural and non-structural retrofit options).	Ongoing	Some facilities have been mitigated. See EQ #1.
-	EQ #3	Create a bridge prioritization inventory based on major lifeline routes including state highways, routes, and major road arteries.	New	Per Marion Co. NHMP. Do not currently have a bridge prioritization list.

Table B-2 Action Item Status and Changes (continued)

2012 Action	2017 Action	Mitigation Action Item	Status	NOTES
-	EQ #4	Collaborate with SEDCOR to develop relevant public-private partnerships with businesses that can contribute to mitigation, response, and recovery.	New	Per Marion Co. NHMP. Engaging private sector is critical to mitigation success.
EQ #3	EQ #5	Partner with the school districts to help identify and prioritize seismic retrofits to school district facilities.	Ongoing	Richmond Elementary (SRGP, 2013-14, $1.5 million) Salem-Keizer School District - Four Corners Elementary (2015-17, Phase Two, $1,492,268)
EH #1	EH #1	Action Item in Development	Delete	No action previously identified or considered necessary at this time.
FL #1	FL #1	Update, maintain, and implement flood actions via, ~~Adopt~~ a floodplain management plan in accordance with FEMA's Community Rating System guidelines.	Ongoing	Most recent Floodplain Management Plan is 2014 (5-year update cycle, annual reports): http://www.cityofsalem.net/Departments/PublicWorks/Administration/DevelopmentServices/Documents/floodplain_management_plan.pdf Table 14B includes plan actions.
FL #2	FL #2	Improve the City of Salem's National Flood Insurance Program (NFIP) Community Rating System (CRS) rating in order to reduce flood risk and NFIP premiums.	Ongoing	Salem currently has a **Class 5** rating.
HM #1	HM #1	Map facilities that handle or contain hazardous materials, rank them based on their level of risk, and refine response strategies for each situation in the event of an accident.	Retain	Facilities have been mapped and a commodity flow study performed, but have not been ranked based on their level of risk. The Local Emergency Planning Committee (LEPC) is pursuing.
LS #1	LS #1	Map areas of landslide risk adjacent to the North Santiam River (upstream of the Geren Island water intake structures) and areas impacted by a catastrophic failure of the Detroit or Big Cliff Dams.	Deferred	DOGAMI has Lidar for Salem.
LS #2	-	Improve the existing Erosion Prevention and Sediment Control (EPSC) program and regulations established in SRC 65 and 69 to help control erosion.	Complete	Ordinance 9 updated chapter 810/ MS4 Permit

Table B-2 Action Item Status and Changes (continued)

2012 Action	2017 Action	Mitigation Action Item	Status	NOTES
LS #3	LS #2	Update landslide overlay maps using Light Detection and Ranging (LIDAR) data.	Retain	DOGAMI has Lidar for Salem.
-	LS #3	Utilize the updated regional landslide risk maps (DOGAMI O-16-02) to identify hazard areas and collaborate with the Oregon Department of Geology and Mineral Industries to work on landslide risk reduction efforts; determine areas and buildings at risk to landslides and propose Comprehensive Plan and land use policies accordingly.	New	Recommended by DOGAMI in order to map high hazard areas identified via LiDAR and DOGAMI report O-06-12.
VE #1	VE #1	No specific action item developed.	Delete	No action previously identified or considered necessary at this time.
WD #1	WD #1	Partner with public and private utilities to educate the public about hazardous trees and the damage they can cause in the event of a windstorm.	Ongoing	Education and outreach is continuous. Maintenance occurs before and after storm events.
WT #1	WT #1	Partner with public and private utilities to educate the public about hazardous trees and the damage they can cause in the event of a winter storm.	Ongoing	Education and outreach is continuous. Maintenance occurs before and after storm events.
WF #1	WF #1	Conduct wildfire prevention outreach, as outlined in the Marion County and Polk County (West Salem) Community Wildfire Protection Plans (CWPPs), to residents near the wildland-urban interface.	Ongoing	Wildfire actions are conducted via the county CWPPs.

Appendix B: Planning and Public Process

This planning and public process appendix reflects changes made to the Salem NHMP and documents the 2017 planning and public process.

Appendix C: Community Profile

The community profile has been updated to conform with the OPDR template and includes information for Salem.

Appendix D: Economic Analysis of Natural Hazard Mitigation Projects

Updates are provided for the economic analysis of natural hazard mitigation projects.

Appendix E: 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.

Appendix F: Lifeline Sector Assessment

This new section from the Marion County NHMP provides in-depth risk and vulnerability information for the four critical lifeline sectors identified by Marion County (as applicable to Salem): Transportation, Water, Energy, and Communication.

Appendix G: Community Survey

This community survey was conducted with the 2017 update of the NHMP and was utilized to inform the development of mitigation strategies and identification of community vulnerabilities. It is provided herein as documentation and to serve as a resource for future planning efforts.

PUBLIC PARTICIPATION PROCESS

2016-2017 NHMP Update

Salem 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 Salem were also given the opportunity to provide feedback about the Plan. In addition, the public will be involved during the semi-annual implementation and maintenance.

Salem made the draft NHMP available via the Oregon Partnership for Disaster Resilience's website for public comment from June 20, 2017 through the FEMA review period.

Public Involvement Summary

Salem provided a press release on June 20, and placed an article in the city newsletter and announced the plan on its social media (Facebook, June 21 and earlier) to inform the public that an update to the NHMP was occurring and to take a survey and provide an opportunity for the public to learn more about the update and comment.

There were no comments received during the public review period via the OPDR project page for the Salem NHMP update. Members of the steering committee provided edits and updates to the NHMP during this period as reflected in the final document.

Press Release

CITY OF Salem
AT YOUR SERVICE
PUBLIC WORKS DEPARTMENT
555 Liberty Street SE / Room 325 • Salem OR 97301-3513 • Phone 503-588-6211 • Fax 503-588-6025

FOR IMMEDIATE RELEASE
DATE: Tuesday, June 20, 2017

CONTACT PERSONS: Mike Gotterba, Emergency Preparedness/Communication Manager
City of Salem, Public Works Department
503-588-6347 | mgotterba@cityofsalem.net

Roger Stevenson, Salem Emergency Manager
City of Salem, Fire Department
503-763-3331, rstevenson@cityofsalem.net

Salem Seeks Additional Public Input on Update to Natural Hazards Mitigation Plan

(Salem, OR) – Salem is currently in the process of updating their existing Natural Hazards Mitigation Plan (NHMP). This work is being performed in cooperation with the University of Oregon Community Service Center-Oregon Partnership for Disaster Resilience and the Oregon Military Department's Office of Emergency Management utilizing funds obtained from the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation Grant Program. With re-adoption of the plan, Salem will maintain its eligibility to apply for federal funding toward natural hazard mitigation projects. This local planning process includes a wide range of representatives from the city and emergency management personnel, and outreach to members of the public in the form of an electronic survey.

A natural hazards mitigation plan gives communities goals, action items, and resources designed to reduce risk from future natural disaster events. Jurisdictions that engage in mitigation activities see 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.

An electronic version of the updated draft Salem NHMP Is available at http://opdr.uoregon.edu/salem_nhmp

In addition, Salem asks residents to complete a brief survey regarding their preparedness for natural hazards at http://bit.ly/2rAdh9d.

If you have any questions regarding the Salem NHMP or the update process in general, please contact: Roger Stevenson Salem Emergency Manager at 503-763-3331 or rstevenson@cityofsalem.net; or Michael Howard, Assistant Program Director for the Oregon Partnership for Disaster Resilience at (541) 346-8413 or mrhoward@uoregon.edu.

###

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Parks Operations
1460 20th Street SE / Building 14
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Phone 503-588-6336
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Willow Lake Water Pollution Control Facility
5915 Windsor Island Road N
Keizer OR 97303-6179
Phone 503-588-6380
Fax 503-588-6387

❖ Reasonable accommodation and accessibility services will be provided upon request ❖
Servicios razonables de alojamiento y accesibilidad se facilitáran por petición

Salem Steering Committee

Steering committee members possessed familiarity with the Salem 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. The steering committee met on the following dates:

- **Meeting #1:** Kickoff, October 20, 2016
- **Meeting #2:** Hazard Vulnerability Assessment, March 6, 2017
- **Meeting #3:** Mitigation Strategies, Implementation and Maintenance, May 12, 2017

The following pages provide copies of meeting agendas and sign-in sheets from city steering committee meetings.

Meeting #1

UNIVERSITY OF OREGON

OREGON PARTNERSHIP FOR DISASTER RESILIENCE

Agenda

Meeting: **City of Salem NHMP**
Date: October 20, 2016
Time: 1:00 – 3:30 PM (2.5 hours)
Location: City of Salem Emergency Operations Center, 595 Cottage St NE, Salem 97301

[NOTE: Parking is limited to pay options only. Please plan to carpool or consider alternative transportation modes.]

I.	**Welcome and Background** a. Introductions b. Project context	**10 minutes**
II.	**Natural Hazard Mitigation Planning** a. Emergency Management Overview b. Natural Hazard Mitigation Plans (NHMP) Overview c. Project Timeline	**15 minutes**
III.	**Community Profile Review and Update** a. Community Profile b. Critical facilities	**15 minutes**
IV.	**Hazard History** a. Review and revise hazard history b. What are the critical hazard concerns for your community?	**15 minutes**
V.	**State, County and City Goals review** a. Discussion of identified hazard events b. Other hazard events to be added?	**15 minutes**
VI.	**Salem Mitigation Actions Review** a. Review previous actions and update status b. Review and discuss new/proposed actions c. Feedback, revisions, and new actions	**60 minutes**
VII.	**Public Outreach Strategy** a. Examples of outreach b. Document your outreach!	**15 minutes**
VIII.	**Wrap Up and Next Steps** a. Next Steps/Questions?	**5 minutes**

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**

PARTNERSHIP FOR DISASTER RESILIENCE | OSU/OREGON EDUCATION

Meeting Sign-In

Salem NHMP Update: Meeting #1: Kickoff October 20, 2016

Name	Email	Representing
MIKE GOTTERBA	mgotterba@cityofsalem.net	Public Works
Mark Becktel	mbecktel@cityofsalem.net	Public Works
Wayne McFarlin	wayne.mcfarlin@salemhealth.org	Salem Health Hospitals & Clinics
GLENN DAVIS	gdavis@cityofsalem.net	City of Salem Public Works
Pamela Cole for Aaron Parko	pcole@cityofsalem.net aparko@cityofsalem.net	City of Salem CD/ Planning
NITIN JOSHI	njoshi@city of salem.net	City of Salem Public Works
EFlick	eflick@co.marion.or.us	marion county EM.

PARTNERSHIP FOR DISASTER RESILIENCE | OSU/OREGON EDUCATION

Meeting Sign-In

Salem NHMP Update: Meeting #1: Kickoff October 20, 2016

Name	Email	Representing
ANTHONY GAMALLO	AGAMALLO@CITY OF SALEM.NET	SALEM PW
JASON VANMETER	JVANMETER@CITYOFSALEM.NET	SALEM P.O.
ROGER STEVENSON	RSTEVENSON@CITYOFSALEM.NET	EMGMT

Meeting #2

UNIVERSITY OF OREGON

OREGON PARTNERSHIP FOR DISASTER RESILIENCE

Agenda

Meeting: **City of Salem NHMP**
Date: March 6, 2017
Time: 1:30 – 3:30 PM (2.0 hours)
Location: City of Salem Emergency Operations Center, 595 Cottage St NE, Salem 97301

[NOTE: Parking is limited to pay options only. Please plan to carpool or consider alternative transportation modes.]

I. Welcome and Review — **15 minutes**
   a. Review 10/20/16 meeting

II. Risk Assessment (Hazard Vulnerability Assessment) Update — **30 minutes**
   a. Lifeline Sector Assessment (Marion Co./ Salem Updates)
   b. Update 2012 NHMP HVA

III. Action Item Update/ Review/ Prioritization — **45 minutes**
   a. Review changes made at 10/20/16 meeting
   b. Review and discuss new/proposed actions
   c. Prioritize actions

IV. Plan Implementation and Maintenance — **25 minutes**
   a. Review and revise implementation and maintenance schedule

V. Wrap Up and Next Steps — **5 minutes**
   a. Next Steps/Questions? Next meeting **May 12, 2:00**
   b. Public Outreach

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

City of Salem NHMP Update: Meeting #2: March 6, 2017

Name	Email	Representing
AARON PANKO	apanko@cityofsalem.net	COMMUNITY DEVELOPMENT
NITIN JOSHI	njoshi@cityofsalem.net	PUBLIC WORKS.
Clint Dameron	cdameron@cityofsalem.net	U.D.
GLENN DAVIS	gdavis@cityofsalem.net	CITY OF SALEM PW
Tony Schacher	schacher@salemelectric.com	Salem Electric
Wayne McFarlin	wayne.mcfarlin@salemhealth.com	Salem Health
CARL M. DECARLO	cdecarlo@cityofsalem.net	SALEM FIRE

Meeting Sign-In

City of Salem NHMP Update: Meeting #2: March 6, 2017

Name	Email	Representing
MIKE GOTTERBA	mgotterba@CITYOFSALEM.NET	PW

Meeting #3

UNIVERSITY OF OREGON

OREGON PARTNERSHIP FOR DISASTER RESILIENCE

Agenda

Meeting: **City of Salem NHMP**
Date: May 12, 2017
Time: 1:30 – 3:30 PM (2.0 hours)
Location: City of Salem Emergency Operations Center, 595 Cottage St NE, Salem 97301

[NOTE: Parking is limited to pay options only. Please plan to carpool or consider alternative transportation modes.]

I. **Welcome and Review**
   a. Review 03/06/17 meeting

II. **Review of NHMP Updates**

III. **Complete Action Item Update/ Review/ Prioritization**
   a. Review changes made at 10/20/16 and 03/06/17 meetings
   b. Review and discuss new/proposed actions
   c. Prioritize actions

IV. **Public Outreach**
   a. Survey
   b. Draft Plan

V. **Wrap Up and Next Steps**
   a. Next Steps/Questions?
   b. Public Outreach – Survey Implementation

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NATURAL HAZARDS MITIGATION REVIEW MEETING		5/12/2017	
Name	Present	Attendance	Response
Roger Stevenson	RS	Meeting Organizer	Accepted
Aaron Panko	AP	Required Attendee	None
Anthony Gamallo		Required Attendee	Declined
Bender, Dean		Required Attendee	None
Bob Maca		Required Attendee	None
Carl DeCarlo		Required Attendee	Accepted
Clinton Dameron	EMAILED CONFLICTED	Required Attendee	Declined
Ed Flick	ODT	Required Attendee	None
Glenn Davis		Required Attendee	Declined
Greg EK~Collins (john.g.ek-collins@odot.state.or.us)		Required Attendee	None
Jason VanMeter (JVanMeter@cityofsalem.net)		Required Attendee	None
Jay Jewess (Jay.Jewess@pgn.com) JOHN PLEUSBLNGGR	CALLED	Required Attendee	Tentative
Josh Bruce		Required Attendee	None
Julie Warncke		Required Attendee	None
Justin Boyington		Required Attendee	None
Karen Garcia		Required Attendee	None
Mark Becktel		Required Attendee	Accepted
Michael Bennett		Required Attendee	Declined
Michael Howard		Required Attendee	Accepted
Mike Gotterba	MG	Required Attendee	None
Nitin Joshi (NJoshi@cityofsalem.net)	NJ	Required Attendee	Accepted
Pamela Cole		Required Attendee	Declined
Patricia Farrell		Required Attendee	Declined
Robert Demchak (rdemchak@marionpolkfoodshare.org)		Required Attendee	Declined
Robin Dalke		Required Attendee	None
Todd Felix (Todd.Felix@nwnatural.com)		Required Attendee	None
Tony Schacher (schacher@salemelectric.com)	ACS	Required Attendee	Tentative
Wayne McFarlin*	WMcF	Required Attendee	None
zach swick (zach.swick@mil.state.or.us)		Required Attendee	None
Dan Brown	ODT	Required Attendee	None
Greg Hadley		Optional Attendee	None
Kristin Retherford		Optional Attendee	Declined
Wayne McFarlin		Optional Attendee	Accepted
Susan Blohm	CALLED	Optional Attendee	Accepted

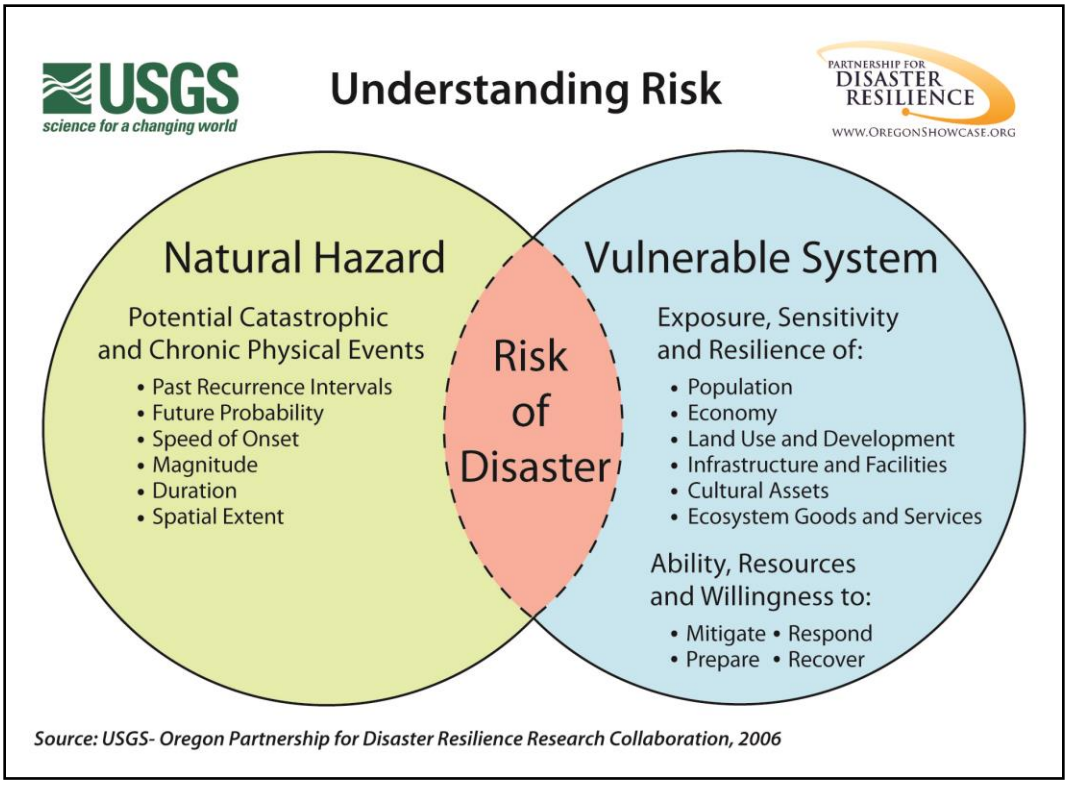
APPENDIX C: COMMUNITY PROFILE

Community resilience can be defined as the community's ability to manage risk and adapt to natural hazard impacts. To help define and understand the city's sensitivity and resilience to natural hazards, the following capacities must be examined:

- **Natural Environment**
- **Social/Demographic**
- **Economic**
- **Built Environment**
- **Community Connectivity**
- **Political**

The Community Profile describes the sensitivity and resilience to natural hazards of Salem 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 city. 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 city's sensitivity and increase its resiliency assist in reducing overall risk of disaster, the area of overlap in the figure below.

Figure C-1 Understanding Risk



Source: Oregon Partnership for Disaster Resilience

Natural Environment Capacity

The capacity of the natural environment is composed of elements known as natural capital. Natural capital is essential in sustaining all forms of life including human life, yet it often plays an underrepresented role in community resiliency to natural hazards. Natural capital includes land, air, water, and other natural resources that support and provide space to live, work and recreate.[1] 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.

Geography and Climate

The City of Salem is in the Willamette Valley, between the Coast and the Cascade Mountain Ranges and encompasses 47.9 square miles[2]. The average elevation within the city limits is 154 ft. above sea level, ranging from 120 ft. around the Willamette River to 800 ft in the surrounding hills.[3] Salem contains the volcanic Salem Hills in the south and is positioned between the 1,000 ft. Eola Hills directly to the west and the 600 ft. Waldo Hills to the east.

Like most of the Willamette Valley, Salem experiences a modified marine climate where winters are cool and wet, while summers are moderately warm and dry.[4] The average annual precipitation is approximately 39.28 inches with the heaviest rainfall in late fall and winter. While major snow falls are rare, Salem does report an average annual snowfall of 7.1 inches.[5]

The primary river that flows through Salem is the Willamette River; other important streams that pass through are Mill Creek, the Mill Race, Pringle Creek, and the Shelton Ditch. Smaller streams in the eastern part of the city include Clark Creek, Jory Creek, Battle Creek, Croisan Creek and Clagget Creek, while glen Creek and Brush Creek flow through West Salem.[6]

Salem obtains its drinking water from the North Santiam River watershed, located in the Cascade Foothills. Salem's average summer water use is over 35 million gallons with an average winter use of roughly 23 million gallons[7].

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[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.

[2] U.S. Census Bureau. State and County Quick Facts. http://quickfacts.census.gov/qfd/states/41/4164900.html. Accessed January 30, 2011

[3] Oregon Blue Book. http://bluebook.state.or.us/local/cities/sy/salem.htm. Accessed January 30, 2011

[4] Northwest River Forecast Center. http://www.nwrfc.noaa.gov/river/river.cgi

[5] Oregon Climate Service. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?or7500. Accessed January 30, 2011

[6] Salem Online History. The Creeks of Salem. http://www.salemhistory.net/natural_history/salems_creeks.htm. Accessed January 30, 2011

[7]City of Salem. Department of Public Works. http://www.cityofsalem.net/Departments/PublicWorks/Operations/Water%20Services/Documents/ccr.pdf

Land Cover

Salem has a mix of residential, commercial, and industrial land uses. The central business district is in the core of downtown Salem, to the east of the Willamette River. Residential zoned lands emanate in all directions from the downtown. In many areas, including West Salem, agricultural use lands buffer in between the urban growth boundary and residential zoned areas. Due to the expansive network of rivers and streams throughout Salem, many residential, commercial and industrial zoned lands can be impacted by potential flooding, in the event the Willamette River and other local creeks and streams overflow their banks.

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. Climate change variability also has the potential to increase the effects of hazards in the area. These factors combined with a growing population 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

Table C-1 shows that between 2010 and 2015, Salem experienced a population percent change of approximately 4%, with an average annual growth rate of 0.7%. These figures are slightly below statewide growth over the same period. Salem is located within Marion and Polk Counties; 84% of its population is within Marion County. The Portland State University Population Research Center forecasts Salem/Keizer's population to increase by 23% from 2017 - 2035, an increase of approximately 57,000 additional persons in the combined UGB.[8]

C-1 Population Estimate for State, County, and Salem

	2010		2015		Change		
Jurisdiction	Number	Percent*	Number	Percent*	Number	Percent	AAGR
Oregon	3,837,300	100%	4,013,845	100%	176,545	4.6%	0.9%
Marion County	315,900	8.2%	329,770	8.2%	13,870	4.4%	0.9%
Salem (Part)	130,788	3.4%	135,148	3.4%	4,359	3.3%	0.7%
Polk County	75,495	2.0%	78,570	2.0%	3,075	4.1%	0.8%
Salem (Part)	24,312	0.6%	25,542	0.6%	1,231	5.1%	1.0%
Total Salem	**155,100**	**4.0%**	**160,690**	**4.0%**	**5,590**	**3.6%**	**0.7%**

Source: Portland State University, Population Research Center, "Annual Population Estimates", 2015.
*Percent calculated as percent of state population.

Vulnerable Populations

Vulnerable populations, including seniors, disabled citizens, women, and children, as well 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

[8] Population Research Center College of Urban and Public Affairs Portland State University. Oregon Population Forecast Program. Region 3 Documents. 2017. https://www.pdx.edu/prc/region-3-documents

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.

While English is the dominant language spoken in Salem, 8% of the total population is not proficient in English and speaks another primary language. 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 C-2 Salem Language Barriers

	Population 5 years and over	English Only		Multiple Languages		Limited or No English	
		Number	Percent	Number	Percent	Number	Percent
Oregon	3,707,831	3,148,786	85%	559,045	15%	225,797	6%
Marion County	300,667	224,986	75%	75,681	25%	31,827	11%
Polk County	72,709	63,018	87%	9,691	13%	3,196	4%
Salem	**148,446**	**116,523**	**78%**	**31,923**	**22%**	**12,552**	**8%**

Source: U.S. Census Bureau, 2011-2015 American Community Survey, 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 Salem's population by race and ethnicity.

Table C-3 describes Salem's population by race and ethnicity. While nearly 80% of people in Salem identify themselves as white, 20% percent identify with a race other than white. Similarly, individuals with Hispanic or Latino origins comprise approximately 22% of the total Salem population.

Table C-3 Salem Race and Hispanic or Latino Origin

Race	Oregon	Marion	Polk	Salem
Total Population	3,939,233	323,259	77,264	160,008
White	85%	82%	80%	80%
Black	2%	1%	1%	1%
AIAN	1%	1%	1%	1%
Asian	4%	2%	2%	3%
NHPI	<1%	1%	<1%	1%
Some Other Race	3%	8%	0%	7%
Two or More Races	4%	5%	3%	6%
Hispanic or Latino	485,646	81,907	9,910	34,786
Percent	12%	25%	13%	22%

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

Salem has slightly more females than males (Female 50.3%, Male: 49.7%).[9] 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.

Age

Of the factors influencing socio demographic capacity, the most significant indicator in Salem may be age of the population. As depicted in the table below, as of 2015, 13% of the city population is over the age of 64 and 21% of the population is 15 or younger. The Salem age dependency ratio[10] is 50.2. 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 overall population over the age of 64. As the population ages, the city may need to consider different mitigation and preparedness actions to address the specific needs of a dependent population.

[9]Social Explorer, Table 4, U.S. Census Bureau, 2011-2015 American Community Survey Estimates

[10] 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.

Table C-4 Population by Vulnerable Age Groups

Jurisdiction	Total	< 15 Years		> 64 Years		15 to 64	Age Dependency Ratio
		Number	Percent	Number	Percent		
Oregon	3,939,233	712,967	18%	606,877	15%	2,619,389	50.4
Marion County	323,259	69,048	21%	45,211	14%	209,000	54.7
Polk County	77,264	14,887	19%	12,648	16%	49,729	55.4
Salem	**160,008**	**33,350**	**21%**	**20,146**	**13%**	**106,512**	**50.2**
2035							
Oregon	4,995,200	865,889	17%	1,082,781	22%	3,046,530	64.0
Marion County	430,652	90,132	21%	80,796	19%	259,723	65.8
Polk County	113,348	20,994	19%	21,798	19%	70,556	60.6

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).

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.[11]

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. Salem is predominately comprised of family households (64%). Of all households, 29% are one-person non-family households (householder living alone). About 10% of householders live alone and are over the age of 65.

[11] Wood, Nathan. Variations in City Exposure and Sensitivity to Tsunami Hazards in Oregon. U.S. Geological Survey, Reston, VA, 2007.

Table C-5 Selected Households and Families

Jurisdiction	Total Households Estimate	Family Households Estimate	Family Households Percent	Household Living Alone Estimate	Household Living Alone Percent	Householder Living Alone (age 65+) Estimate	Householder Living Alone (age 65+) Percent
Oregon	1,533,430	971,791	63%	427,884	28%	164,312	11%
Marion County	113,996	78,914	69%	28,746	25%	12,217	11%
Polk County	28,458	19,363	68%	6,672	23%	3,165	11%
Salem	**57,729**	**37,054**	**64%**	**16,783**	**29%**	**5,959**	**10%**

Source: U.S. Census Bureau, 2011-2015 American Community Survey Estimates, Table DP02

Table C-6 shows household structures for families with children. About 21% of all households within the city are married family households that have children. Another 11% of households are single parent households. These populations will likely require additional support during a disaster and may inflict strain on the system if improperly managed.

Table C-6 Households with Children

Jurisdiction	Total Households Estimate	Married-Couple with Children Estimate	Married-Couple with Children Percent	Single Parent with Children Estimate	Single Parent with Children Percent
Oregon	1,533,430	277,856	18%	130,209	8%
Marion County	113,996	23,273	20%	13,294	12%
Polk County	28,458	5,677	20%	2,129	7%
Salem	**57,729**	**11,863**	**21%**	**6,627**	**11%**

Source: U.S. Census Bureau, 2011-2015 American Community Survey Estimates, Table DP02Income

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. Table C-7 lists the distribution of household income and the median income in Salem in 2010 and 2015. Between 2010 and 2015 the share of households making less than $15,000 increased by 2% (1,158 households). Median household Income decreased across Salem by 1%, from $47,597 (2015 inflation adjusted) to $47,191.

Table C-7 Household and Median Income

Household Income	2010^		2015		Change in Share	
	Households	Percent	Households	Percent	Households	Percent
Less than $15,000	6,807	12%	7,965	14%	1,158	2%
$15,000-$29,999	9,982	18%	9,575	17%	-407	-1%
$30,000-$44,999	9,882	17%	9,861	17%	-21	<-1%
$45,000-$59,999	7,329	13%	7,800	14%	471	1%
$60,000-$74,999	5,879	10%	5,903	10%	24	<1%
$75,000-$99,999	6,498	11%	7,118	12%	620	1%
$100,000-$199,999	8,783	16%	8,139	14%	-644	-1%
$200,000 or more	1,419	3%	1,368	2%	-51	<-1%
Median Household Income	$47,597		$47,191		-406	-1%

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 table below identifies the percentage of individuals and cohort groups that are below the poverty level in 2015. It is estimated that 18% of individuals, 25% of children under 18, and 9% of people 65 and older live below the poverty level in Salem.

Table C-8 Poverty Rates

Jurisdiction	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
Oregon	636,947	16%	182,938	22%	405,616	17%	48,393	8%
Marion County	57,846	18%	22,323	28%	32,238	17%	3,285	8%
Polk County	12,270	16%	3,378	19%	7,988	18%	904	7%
Salem	27,744	18%	9,813	25%	16,290	17%	1,641	9%

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.[12]

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 Salem, TANF reaches approximately 1,740 families

[12] Cutter, S. L. (2003). Social Vulnerability to Environmental Hazards. *Social Science Quarterly*.

per month and SNAP helps to feed about 47,000 people per month.[13] 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.

According to the U.S. Census, 87% of the Salem population over 25 years of age has graduated from high school or received a high school equivalency, with 27% going on to earn a Bachelor's Degree or higher.

Table C-9 Educational Attainment

	Oregon	Marion County	Polk County	Salem
Population 25 years and over	2,714,972	209,106	49,104	102,941
Less than High School	10%	16%	9%	13%
High School Graduate or GED	24%	27%	27%	26%
Some College	35%	35%	35%	34%
Bachelor's Degree	19%	15%	18%	17%
Master's Degree	8%	5%	9%	7%
Professional School Degree	2%	1%	1%	2%
Doctorate Degree	1%	1%	1%	1%
Percent without Highschool Degree	*10%*	*16%*	*9%*	*13%*
Percent High School Graduate or Higher	*90%*	*84%*	*91%*	*87%*
Percent Bachelor's Degree or Higher	*31%*	*22%*	*30%*	*27%*

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

[13] Sabatino, J. (2017). Oregon TANF Caseload FLASH, "One and Two Parent Families Combined", District 3 (North and South Salem); May 2017 data, and Sabatino, J. (2017). Oregon SNAP Program Activity, "SSP, APD and AAA Combined", District 3 (North and South Salem); May 2017 data. Retrieved from State of Oregon Office of Business Intelligence website: http://www.oregon.gov/DHS/ASSISTANCE/Pages/Data.aspx, September 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. Thirteen-percent (13%) of the population in Salem is without health insurance. The percentage of uninsured changes with age, the highest rates of uninsured are within the 18 to 34-year cohorts. The ability to provide services to the uninsured populations may burden local providers following a natural disaster.

Table C-10 Health Insurance Coverage

Population Without Health Insurance	Salem	
	Number	Percent
Total Civilian Noninstitutionalized Population	20,705	13%
Population Under 18:	2,236	6%
Population 18 to 24:	3,488	21%
Population 25 to 34:	5,673	26%
Population 35 to 64:	9,193	16%
Population 65 or Older:	115	1%

Source: Social Explorer, Table 146, U.S. Census Bureau, 2011-2015 American Community Survey Estimates.

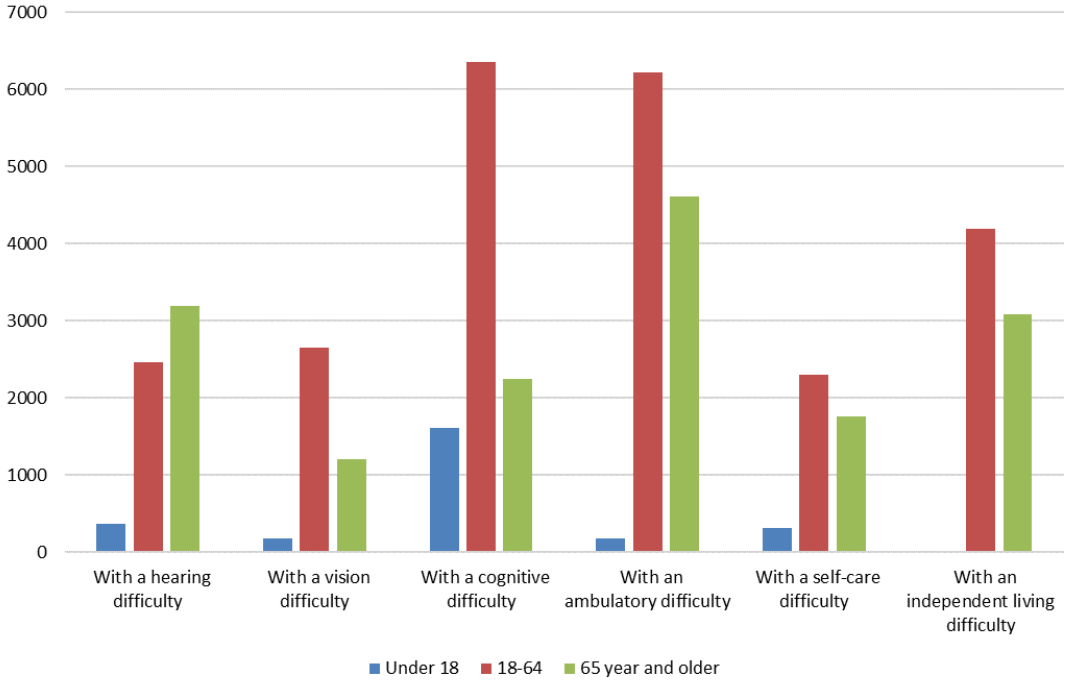
Table C-11 and Figure C-4 describe the percent and characteristics of the Salem disabled population. As of 2015, 14% of the Salem population has a disability; 5% of the population under 18, 14% of the population 18 to 64, and 37% of the population 65 and older. In addition, the most prevalent disabilities are cognitive and ambulatory. Overall, 7% of the population has a cognitive disability (about 10,200 people) and another 7% have an ambulatory disability (about 11,000 people). These populations may have unique challenges and needs in the event of an emergency situation.

Table C-11 Disability Status

Jurisdiction	Total Population Estimate	With a disability		Under 18 years with a disability		18 to 65 years with a disability		65 years and over with a disability	
		Estimate	Percent	Estimate	Percent^	Estimate	Percent^	Estimate	Percent^
Oregon	3,900,771	562,324	14%	39,690	5%	297,936	19%	224,698	26%
Marion County	317,324	46,774	15%	4,573	6%	25,806	14%	16,395	37%
Polk County	76,884	11,292	15%	846	5%	5,799	13%	4,647	37%
Salem	**154,822**	**22,412**	**14%**	**2,014**	**5%**	**13,217**	**14%**	**7,181**	**37%**

Source: U.S. Census Bureau, 2011-2015 American Community Survey, Table S1810.

Figure C-2 Characteristics of the Disabled Population by Age Cohort

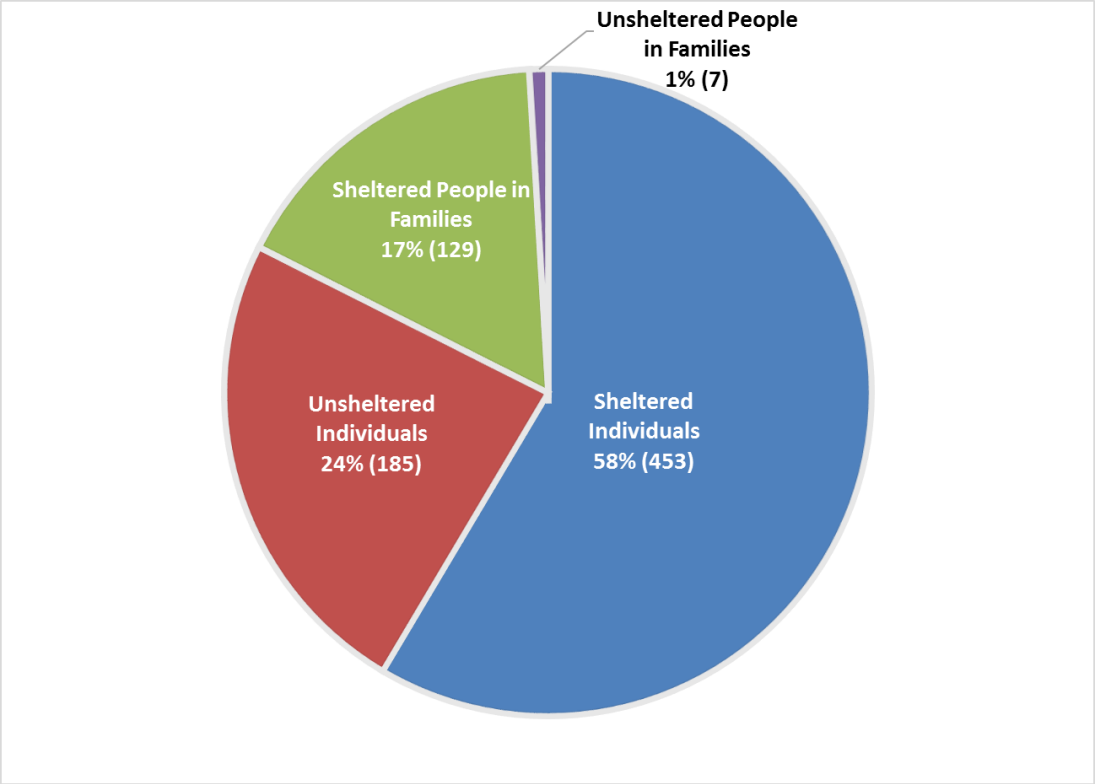


Source: U.S. Census Bureau, 2011-2015 American Community Survey, Table S1810.

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 638 individuals and persons in families in Marion and Polk Counties (including Salem) identify as homeless; 582 (75%) were sheltered (453 individuals and 129 persons in families), 192 (25%) were unsheltered (185 individuals and 7 persons in families).

The homeless have little resources to rely on, especially during an emergency. It will likely be the responsibility of the city 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 C-3 Marion and Polk Counties PIT Homeless Count (2015)



Source: Oregon Housing and Community Services, 2015 Point-in-Time Homeless Count

Synthesis

For planning purposes, it is essential Salem 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 socio-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 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).

Salem has a Gini coefficient of 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 equality.[14]

[14] Susan 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 C-12 Regional Income Equality

Jurisdiction	Income Inequality Coefficient
Oregon	0.46
Marion County	0.43
Polk County	0.42
Salem	0.44

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.

In Salem, 44% of all households spend more than 30% of their income on housing.[16] Renters were the group most likely to fall in this category (50%), while homeowners without a mortgage were the least likely (23%). 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.[17] This disparity imposes challenges for a community recovering from a disaster as housing costs may exceed the ability of 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 C-13 Households Spending as Percent of Income

Jurisdiction	Owners				Renters	
	With Mortgage		Without Mortgage			
	Number	Percent	Number	Percent	Number	Percent
Oregon	314,873	50%	65,875	22%	299,549	50%
Marion County	22,764	49%	4,613	21%	22,953	50%
Polk County	5,754	46%	982	17%	5,389	53%
Salem	**9,744**	**45%**	**2,090**	**23%**	**13,505**	**50%**

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] Social Explorer, Tables 103 and 109, U.S. Census Bureau, 2011-2015 American Community Survey Estimates

[17] University of California Berkeley. Building Resilient Regions, Resilience Capacity Index. http://brr.berkeley.edu/rci/.

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 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 city and regional economies with those of states or the nation. Using the Herfindahl Index, a diversity ranking of 1 indicates the city with the most diverse economic activity compared to the state, while a ranking of 36 corresponds with the least diverse city economy. The table below describes the Herfindahl Index Scores for counties in the region.

Table C-14 shows that Marion and Polk Counties have economic diversity rankings of 3 and 9 respectively 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.

Table C-14 Regional Herfindahl Index Scores

	2008			2013		
County	Employment	Number of Industries	State Rank	Employment	Number of Industries	State Rank
Benton	26,433	199	23	25,247	201	21
Lane	123,008	260	4	114,670	260	5
Linn	36,360	225	5	33,934	222	4
Marion	**105,758**	**252**	**3**	**101,571**	**245**	**3**
Polk	**12,837**	**178**	**18**	**12,179**	**167**	**9**
Yamhill	27,797	209	9	27,860	209	6

Source: Oregon Employment Department

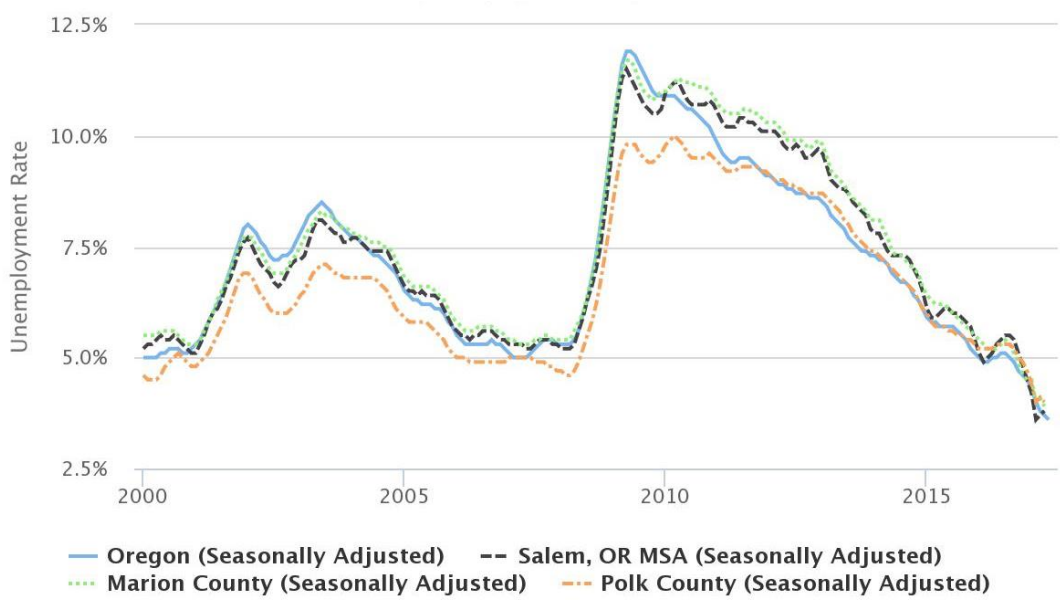
While illustrative, economic diversity is not a guarantor of economic vitality or resilience. Salem, as of 2015, is listed as an economically distressed community as prescribed by Oregon Law. The economic distress measure is based on indicators of decreasing new jobs, average wages, and income, and is associated with an increase of unemployment.[18]

[18] 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 a high of 11.5% in April 2009. As of April 2017, the unemployment rate for Salem (3.8%) is about the same as the rate for Oregon (3.7%).

Figure C-4 Unemployment Rate



Source: Oregon Employment Department (Qualityinfo.org), "Local Area Unemployment Statistics".

Salem employers draw in about two-thirds (65%) of their workers from outside the city. The Salem economy is a cornerstone of regional economic vitality. Figure C-5 shows the city's laborshed; the map shows that about 35% of workers live and work in the city (32,000), 65% of workers come from outside the city (58,271), and about 48% of residents work outside of the city (29,760).

Figure C-5 Salem 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 Salem residents and businesses.

Approximately 87% of commuters travel by car; 74% of these individuals commute alone while 13% carpool.[19] Increased commuting creates a greater dependency on roads, communications, accessibility, and, in the event of a hazard incident, emergency evacuation routes to reunite people with their families. Before a natural hazard event, large or small businesses can develop strategies to prepare for natural hazards, respond efficiently, and prevent loss of life and property.

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

[19] Social Explorer, U.S. Census Bureau, 2011-2015 American Community Survey. Table T128

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 a natural hazard negatively impacts these industries, 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 in Salem. The top six industry sectors in Salem comprising the highest percent of total payroll employment, as of 2016, are Government (24%), Trade, Transportation, and Utilities (16%), Education and Health Services (15%), Leisure and Hospitality (9%) and Professional and Business Services and Manufacturing (both 8%). While Salem has some basic industries, such as Manufacturing; four out of their 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 C-15 Total Employment by Industry 2016, Expected Growth 2024

	2016				Percent Change in Employment (2010-2016)	Employment Forecast (2014-2024)
Industry	Firms	Employment	Percent Employment	Average Wage		
Total Payroll Employment	12,224	168,942	100%	$42,033	13%	10%
Total Private	11,556	127,499	75%	$38,177	18%	11%
Natural Resources and Mining	625	11,648	7%	$32,779	9%	**11%**
Construction	1,266	9,205	5%	$51,658	**46%**	**19%**
Manufacturing	477	13,170	**8%**	$41,499	13%	9%
Trade, Transportation & Utilities	1,905	26,293	**16%**	$34,465	14%	8%
Wholesale Trade	478	3,919	2%	$55,217	12%	7%
Retail Trade	1,176	18,378	11%	$27,493	14%	8%
Information	137	1,122	1%	$52,377	-9%	0%
Financial Activities	1,038	5,969	4%	$48,947	3%	5%
Professional and Business Services	1,634	13,564	**8%**	$42,851	**19%**	**17%**
Education and Health Services	1,311	24,900	**15%**	$48,134	**22%**	**15%**
Leisure and Hospitality	962	14,640	**9%**	$16,975	**24%**	9%
Other Services	2,165	6,968	4%	$25,458	**19%**	**15%**
Private Non-Classified	35	18	-	$46,538	-	-
Government						
Federal	68	1,377	1%	$64,752	-24%	-5%
State	210	21,386	**13%**	$58,583	3%	4%
Local	386	17,107	**10%**	$48,159	-9%	2%

Source: Oregon Employment Department, "2010 and 2016 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

As of 2012, within Marion County the three sectors with the highest revenue were Retail Trade ($3.9 billion), Wholesale Trade (3.2 billion), and Manufacturing (2.5 billion). In Polk County, the three highest revenue sectors were Manufacturing ($424 million), Retail Trade ($361 million), and Health care and social assistance ($169 million). The table below shows the revenue generated by each economic sector (Note: not all sectors are reported). *Information specific to Salem is not available*.

Salem 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 C-16 Revenue of Top Sectors in Salem (Employer)

Sector Meaning (NAICS code)	Marion	Polk
	Sector Revenue ($1,000)	Sector Revenue ($1,000)
Retail trade	**$ 3,862,230**	**$ 360,670**
Wholesale trade	**$ 3,190,000**	$ 100,909
Manufacturing	**$ 2,540,329**	**$ 424,650**
Transportation and warehousing (104)	$ 537,598	$ 46,192
Professional, scientific, and technical services	$ 448,352	$ 36,222
Administrative and support and waste management and remediation services	$ 318,626	$ 26,321
Real estate and rental and leasing	$ 269,711	$ 19,399
Other services (81)	$ 76,117	$ 25,738
Arts, entertainment, and recreation (71)	$ 215,700	$ 4,599
Educational services	$ 55,575	$ 1,701
Health care and social assistance (62)	D	**$ 168,554**
Accommodation and food services	D	D
Finance and Insurance	N	N
Information	N	N
Utilities	Q	Q

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 *Retail Trade* sector generated a combined $4.2 billion, making it the largest earning sector in the Salem region. The *Retail Trade* sector typically relies on 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.

Wholesale Trade generated nearly about $3.3 billion in the region. Wholesale Trade is closely linked with retail trade but it has a broader client base, with local and non-local businesses as the typical clientele. Local business spending will be likely to diminish after a natural disaster, as businesses repair their properties and wait for their own retail trades to increase. Distanced clients may have difficulty reaching the local wholesalers due to transportation disruptions from a natural disaster.

The *Manufacturing* sector was the third largest revenue generator, generating $3.0 billion in the region. It is highly dependent upon the transportation network 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.

If any of these primary sectors are impacted by a disaster, Salem may experience a significant disruption of economic productivity.

Future Employment in Industry

Between 2010 and 2016 the sectors that experienced the largest percent growth were construction (46%), leisure and hospitality (24%), education and health services (22%), professional and business services (19%), and other services (19%). Some of these sectors often require more training and education, while others require less education and have lower 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 C-16, between 2014 and 2024, the largest employment growth is anticipated within construction (19%), professional and business services (17%), health care and social assistance (20%), education and health services (15%), and other services (15%).[20]

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 Professional and Business Services, Construction, Health Care and Social Assistance, Education and Health Services, and Manufacturing are key to post-disaster recovery efforts, the region is bolstered by its major employment sectors. The city's economy is expected to grow by 2024, with much of the growth within the industries of construction, professional and business services, and education and health services industries. 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.

[20] Oregon Employment Department,"Mid-Valley Industry Employment Projections 2014-2024", http://qualityinfo.org/pubs/projections/projections.pdf, accessed September 2016.

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

One significant way in which Salem 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. Buildable lands within the Urban Growth Boundary (UGB) were intended to satisfy the demands of population and employment growth for a 20-year period. Follow this link for a map of Salem's current UGB: http://www.cityofsalem.net/CityDocuments/salem-urban-growth-boundary-map.pdf.

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 to Corvallis 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 and forested lands throughout Corvallis, 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 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 city. Of interest are mobile homes, which account for 5% of the housing in Salem). 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 C-17 Housing Profile

Jurisdiction	Total Housing Units	Single Family		Multi-Family		Mobile Homes*	
		Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Oregon	1,695,183	1,154,878	68%	396,724	23%	143,581	8%
Marion County	122,315	82,672	68%	28,722	23%	10,921	9%
Polk County	30,651	21,971	72%	6,425	21%	2,255	7%
Salem	**61,417**	**39,801**	**65%**	**18,277**	**30%**	**3,339**	**5%**

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.
Note: the percentages listed in the table above do not reflect the number of structures that are built within special flood hazard areas, or that are at risk of seismic damage.

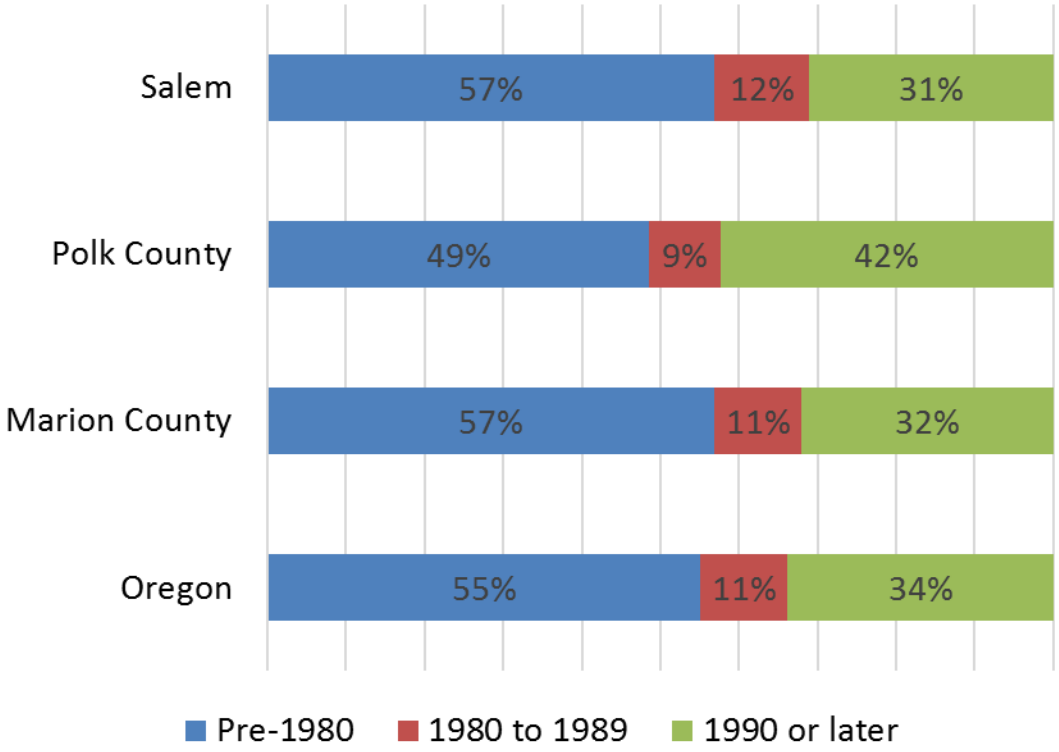
Aside from location and type of housing, the year structures were built has implications. Seismic building standards were codified in Oregon building code starting in 1974 more rigorous building code standards were passed in 1993 that accounted for the Cascadia earthquake fault.[21] Therefore, homes built before 1993 are more vulnerable to seismic

[21] 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/osspac/docs/history_seismic_codes_or.pdf

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 (locally 1979), communities started to develop floodplain management ordinances to protect people and property from flood loss and damage.

Within Salem, 57% of the housing stock was built prior to 1980, before the local implementation of floodplain management ordinances, while 12% of the housing stock was built before 1990 and the codification of seismic building standards. About 31% of the city's housing stock was built after 1990.

Figure C-6 Year Structure Built



Source: U.S. Census Bureau, 2011-2015 American Community Survey, "Selected Housing Characteristics".

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 table below shows the initial and current FIRM effective dates for Salem communities. For more information about the flood hazard, NFIP, and FIRMs, please refer to Flood Hazard section of the Risk Assessment.

Critical Facilities

Critical Facilities include buildings, their internal components and trained personnel, and may also include certain mobile units, such as those of first responders. For example, many vehicles of the police department, fire department (including ambulances), and public works

department are key and essential components of the functions provided by these critical facilities. The interruption or destruction of any of these facilities would have a debilitating effect on incident management and long-term recovery. Not all Critical Facilities are of equal importance, and are therefore subject to prioritization of criticality.

While lifelines and other physical infrastructure, such as, dams, power generation facilities and transmission lines, are also critical, they have been documented under physical infrastructure and utility lifelines for the purposes of this profile. This information provides the basis for informed decisions about the infrastructure and facilities already in place that can be used to reduce the vulnerability of Salem to natural hazards.

The critical facilities listed in this NHMP (Table C-18) utilize the same priority ranking scheme as the Salem LEAP (2012); it is based in part on the system used by Horry County, South Carolina, and makes use of the concept of Maximum Allowable Down Time ("MAD Time"). The top three lists of priorities appear below in order of descending importance.

- Priority One - Critical Facilities and Critical Infrastructure: The loss of energy supply to these facilities and assets, even for a few hours, could cause severe negative impacts on human life, health and safety, and the built environment, especially critical community assets. They are vital to the emergency response and recovery efforts, and require a constant energy supply to maintain functions. Emergency response plans shall include actions to assure that these Priority One Facilities and Infrastructure regain an adequate and stable source of energy as soon as possible after a disruption of energy flow.
- Priority Two - Critical Facilities and Critical Infrastructure: The loss of energy supply to these facilities and assets for more than 24 hours could cause severe negative impacts on human life, health and safety, and the built environment, especially critical community assets. Emergency response plans shall include actions to assure an adequate and stable energy source for these Priority Two Facilities and Infrastructure as soon as all (or as many as possible given the nature of the emergency event) of the Priority One Facilities and Infrastructure have been secured.
- Priority Three - Critical Facilities and Critical Infrastructure: The loss of energy supply to these facilities and assets for more than 72 hours could cause significant negative impacts on human life, health and safety, and the built environment, especially critical community assets. They are important to the disaster recovery effort and require an energy supply to maintain functions (although this supply may not need to be at normal levels nor uninterrupted). Emergency response plans shall include actions to secure appropriate energy for these facilities and infrastructure as soon as possible given the nature of the emergency event, and the ability of response and recovery teams to meet the energy needs of as many of the higher priority Critical Facilities and Infrastructure as possible.
- Priority 4 - Other Priority Critical Facilities and Infrastructure: As designated in coordination with the City and the emergency operation centers, this list should include the category of Nursing Homes, Critical Care Facilities, Special Needs Services, and Senior Centers. Schools in session should also be included here. Additional designated City of Salem Public Works Facilities and Infrastructure (e.g., water and sewage) should be included.

Table C-18 Critical Facilities

Facility Name	Owner	Type
Priority 1		
Anderson Readiness Center (Oregon National Guard)	Federal	Emergency Coordination/Communication
City Hall	Salem	Governance
Salem Fire Department	Salem	Emergency Response
Fire Station 1/ Fire Dept DOC	Salem	Emergency Response
Fire Station 2	Salem	Emergency Response
Fire Station 3	Salem	Emergency Response
Fire Station 4	Salem	Emergency Response
Fire Station 5	Salem	Emergency Response
Fire Station 6	Salem	Emergency Response
Fire Station 7	Salem	Emergency Response
Fire Station 8	Salem	Emergency Response
Fire Station 9	Salem	Emergency Response
Fire Station 10	Salem	Emergency Response
Fire Station 11	Salem	Emergency Response
Marion County Fire District 1	Special District	Emergency Response
Marion County Fire District 1	Special District	Emergency Response
Marion County Fire District 1	Special District	Emergency Response
Marion County Fire District 1 - Garage Bldg 2	Special District	Emergency Response
Marion County Fire District 1	Special District	Emergency Response
Marion County Fire District 1	Special District	Emergency Response
Marion County Sheriff's Office - Central District	Marion County	Emergency Response
Marion County Sheriff's Office	Marion County	Emergency Response
Oregon State Police	State	Emergency Response
Oregon State Police	State	Emergency Response
Fire Training/ Secondary EOC	Salem	Emergency Response
IT Department	Salem	Governance
Marion County Public Works	Marion County	Emergency Response
Oregon State Hospital Breitenbush Hall (Bldg 35)	Oregon	Medical
Oregon State Hospital Building 48	Oregon	Medical
Oregon State Hospital Eola Building (Bldgs 55/77)	Oregon	Medical
Oregon State Hospital McKenzie Hall (Bldg 40)	Oregon	Medical
Oregon State Hospital Santiam Hall (Bldg 34)	Oregon	Medical
Salem Health Laboratories	Private	Medical

Facility Name	Owner	Type
Salem Hospital Center for Outpatient Medicine	OHSU	Medical
Salem Hospital Critical Care Tower	OHSU	Medical
Salem Hospital Family Birth Center	OHSU	Medical
Salem Hospital Regional Rehabilitation Center	OHSU	Medical
Salem Hospital Winter Street Building	OHSU	Medical
Salem Police Department/ Police Department DOC	Salem	Emergency Response
Shop #19 Fleet Services Fuel Island	Salem	Transportation
Shop #2 Public Works Field Office/ DOC	Salem	Emergency Response
Shop #24 Radio Communication	Salem	Emergency Coordination/Communication
Shop #3 Fleet Services Office	Salem	Emergency Coordination/Communication
Willamette Valley Communication Center/ EOC	Salem	Emergency Coordination/Communication
Priority 2		
Cherriots (Salem-Keizer Transit)	Special District	Transportation
Comcast - Electrical	Private	Energy
GTE	Private	Energy
Info Tech Computer Support For Salem IT	Private	Emergency Response
Portland General Electric Company	Private	Energy
Qwest	Private	Energy
Salem Area Transit Dispatch (Cherriots)	Special District	Transportation
Salem Area Transit Fuel Station	Special District	Transportation
Salem Area Transit Maintenance Shop	Special District	Transportation
Salem Area Transit Wash Rack	Special District	Transportation
Salem Electric	Special District/ Cooperative	Energy
Salem Keizer School District Central Services, 24J	Special District	Mass Care and Shelter
Salem/Keizer School District Admin Office	Special District	Mass Care and Shelter
Center 50+	Non-Profit	Mass Care and Shelter
Priority 3		
Airport	Salem	Transportation
Airport Tower	Salem	Transportation
Amtrak	Federal	Transportation

Facility Name	Owner	Type
Army Aviation Support Facility	Federal	Emergency Response
Main Library	Salem	Miscellaneous
Salem Housing Authority	Salem	Miscellaneous
School District 24J Reprographics	Special District	Miscellaneous
Salem-Keizer Recycling and Transfer Station	Marion County	Miscellaneous
Weather Service		Governance
Priority 4		
Adult Mental Health	Marion County	Special Needs
Harmony House	Private	Special Needs
Mid-Willamette Valley Senior Center	Private	Mass Care and Shelter
Northwest Senior and Disability Services	Intergovernmental	Mass Care and Shelter
Northwest Senior and Disability Services	Intergovernmental	Mass Care and Shelter
Salem Senior Center	Private	Mass Care and Shelter
Seniors and Disabled Services		Special Needs
South Salem Sr. Center	Non-Profit	Mass Care and Shelter

Source: Salem Local Energy Assurance Plan. 2011. Updated by 2017 Salem NHMP Steering Committee

Salem is also unique in that there are a number of state owned government buildings throughout the city. These buildings are essential to government continuity throughout the entire state and should be included as critical infrastructure. It is essential that Salem recognize their importance; however, the city does not necessarily have control over them.

Physical Infrastructure

Physical infrastructure includes transportation networks, dams and utilities. These infrastructures support the Salem community and economic activity. 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.[22]

Transportation

Roads & Bridges

Roads and bridges in the City of Salem are highly vulnerable to hazards specifically earthquakes. Because bridges vary in size, materials, siting, and design, any given hazard will affect them differently. When considering the expanse and integrity of transportation infrastructure within Salem and how it will impact the resilience of the City, it is imperative that infrastructure across Marion County is also considered. If a principal arterial is

[22] State of Oregon Natural Hazards Mitigation Plan, Region 4 Southwest Oregon Regional Profile.

obstructed beyond the City limits it will likely have significant impacts on access in and out of Salem.

Interstate-5 (I-5) is the principle arterial that connects Salem to northern and southern Oregon, and traverses through the interior of the City. There are also two non-interstate principal arterials: Highway 22 and 99E. Highway 22 runs east and west, connecting the Oregon Coast to Central Oregon through Salem. Highway 99E runs north and south, and provides connections to Interstate-205 (I-205) at Oregon City, as well as, Corvallis and Eugene to the South. Both non-interstate principle arterials serve as the main access for rural areas outside of Salem, including, Dallas, Independence, and Monmouth. See Figure C-7 for more information on Salem streets.

Bridge condition surrounding the City is also a factor that affects risk from natural hazards. Bridges damaged by hazards such as earthquakes can disrupt traffic and exacerbate economic losses because of the inability of industries to transport services and products to clients. The Marion County Public Works Department has assigned bridges with an operating rate, which determines whether overweight trucks can receive a permit to cross the bridge and if any requirements will be placed on their usage of the bridge. Six bridges just beyond the Salem City limits are presently restricted to certain maximum vehicle weights or dimensions. Table C-19 lists the weight and height restrictions of these bridges and shows the functional class of the roadway crossing that bridge.

Table C-19 Marion County Bridges: Height and Weight Restrictions

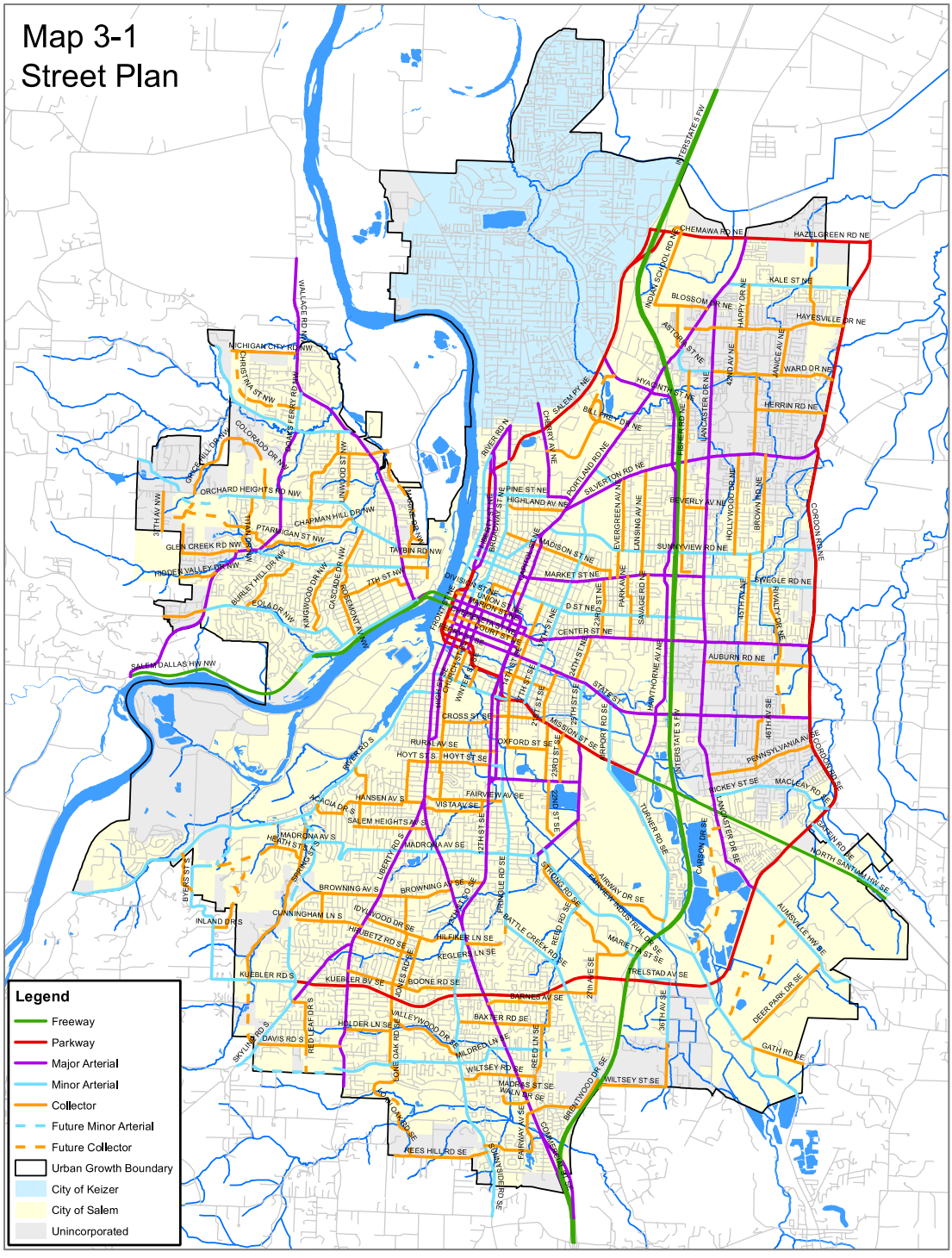
Bridge	Over	Restrictions	Functional Class
Gallon House Rd.	Abiqua Creek	20 Tons height: 14'2"	Local
Mt. Angel-Gervais Rd.	Pudding River	20-39 Tons*	Minor Collector
Jefferson-Marion Rd.	SP Railroad	40 Tons	Arterial
Labish Center Rd.	Little Pudding River	40 Tons	Minor Collector
Rambler Dr.	Little Pudding River	40 Tons	Local
River Rd. South	Willamette River	40 Tons	Arterial

Source: Marion County Rural Transportation Plan

* - Weight dependent on configuration.

Limiting maximum vehicular weight on bridges can reduce bridge maintenance, extend bridge lifespan, and preserve transportation system continuity. Bridges provide functional links for Salem transportation corridors, and if they are not maintained the bridge may become unusable in the event of a natural disaster, effectively isolating the City if no other alternative transportation network exists.

Figure C-7 Street Plan (Map 3-1 of Salem TSP)



Source: Salem Transportation System Plan (2016)

Alternate Modes of Transport

Other important modes of transportation include railway, airports and public transportation. Union Pacific and Oregon Short Lines operate freight lines that traverse

through Salem, connecting the transport of products to Washington and California.[23] The Oregon Department of Transportation also identifies four Amtrak passenger routes through the City: Routes 14, 9, 8 and 7. These routes transport people within the State and also Washington and California.[24] Facilities that support air travel include McNary Field, the only commercial service public use airport, three private use airports, and one heliport at the Salem Hospital.[25] Salem's mass transit services include Salem-Keizer Transit (Cherriots), serving the Salem-Keizer urban area, and the Chemeketa Area Regional Transportation System (CARTS). CARTS is a partnership between Marion, Polk and Yamhill Counties that provides weekday public transit for elderly and disabled persons as well as the general public.[26]

Dams

Dams play a crucial role in power generation and water control mechanisms for the region. Dam failures can occur rapidly and with little warning.[27] Fortunately most failures result in minor damage and pose little or no risk to life safety.[28] However, the potential for severe damage still exists. The Oregon Water and Resources Department has inventoried all dams located across Marion County and Salem. The "hazard level" estimates the amount of damage that could occur in the event of dam failure.

Marion County has over 56 dams, and two are ranked at a high hazard level: Detroit Dam and Big Cliff Dam. Detroit and Big Cliff are hydroelectric dams that control the flow of water on the Santiam River, providing a major boating and recreational area. However, both dams are considered a major hazard for the large population downstream that would be at risk in the event of a dam failure, including populations in Salem. Besides the Detroit and Big Cliff dams, other major dams surrounding the Salem area include Waconda and Silverton.[29]

Utility Lifelines

Utility lifelines are the resources that the public relies on daily, (i.e., electricity and fuel). 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.

More than half of Oregon's electricity comes from hydropower, and about one percent comes from renewable sources, primarily biomass and wind.[30] The network of electricity

[23] Oregon Department of Transportation. Oregon.gov. http://www.oregon.gov/ODOT/RAIL/docs/Maps_Drawings/OR_Railroad.pdf

[24] Oregon Department of Transportation. Oregon.gov. http://www.oregon.gov/ODOT/RAIL/docs/Maps_Drawings/Passrailmap.pdf

[25] Oregon Department of Transportation. Department of Aviation. http://www.oregon.gov/Aviation/municipal_airports.shtml

[26] Ibid.

[27] Federal Emergency Management Agency. Dam Failure. www.fema.gov/hazard/damfailure/index.shtm. Accessed November 18, 2011.

[28] Ibid.

[29] Marion County. Oregon Emergency Operations: Basic Plan. 2005.

[30] Loy, W. G., ed. 2001. Atlas of Oregon, 2nd Edition. Eugene, OR: University of Oregon Press

transmission through Salem and the greater Marion County area is operated and distributed by the Bonneville Power Administration and Pacific Power.[31]

Oregon does not have any crude oil resources or refineries, and so must import all of its petroleum products. Most is extracted and refined regionally – 90% of Oregon's petroleum products are refined in the Puget Sound area of Washington and 80% of the crude oil used to make these products comes from Alaska's North Slope oil fields.[32] The remainder of Oregon's petroleum comes primarily from refineries in Utah and British Columbia. Most of Oregon's oil enters on tanker ships at the Port of Portland, and is then distributed via tanker truck or via the Kinder-Morgan pipeline, which runs from Portland south to Eugene.[33] Although the Kinder-Morgan pipeline passes through Salem, it does not have an outlet there; Salem receives its petroleum via tanker truck. Oregon's petroleum supply system has many vulnerabilities that pose a risk to Salem. First, there is the possibility for disruption of the transmission system: the pipelines are 30 years old, and tanker trucks rely on the road network.[34]

Synthesis

Given that Salem is the State Capital and the second largest city in the state, it is that much more critical to maintain the quality of built capacity throughout the area, as it is likely that surrounding jurisdictions will seek assistance from Salem. The planning considerations seemingly most significant for the city are contingency planning for emergency services, medical resources, and lifeline systems. As mentioned above, functionality of the critical facilities should be a significant priority in providing for Salem residents. To maintain functionality, memorandums of understanding can be established with surrounding cities and counties for medical transport, treatment, utility and transportation lifeline 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.

[31] Ibid.

32Oregon Department of Energy, "Nuclear and Energy-Related Emergency Preparedness" www.oregon.gov/ENERGY/.../emergency_preparedness_fact_sheet.p.

33 City of Salem. Salem Local Energy Assurance Plan. 2011

34 Ibid.

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 capital is present in all communities; however, it may be dramatically different from one town to the next as these capitals reflect the specific needs and composition of the community residents.

Social Systems and Service Providers

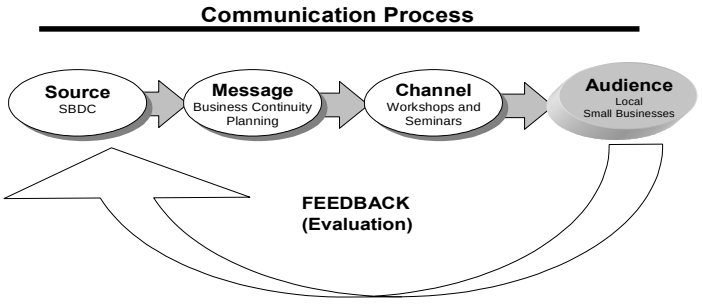
Social and cultural capital include community organizations and programs that provide community-based services, such as employment, health, senior and disabled services, professional associations, and veterans' affairs for the public. In planning for natural hazard mitigation, it is important to know 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 city can use existing social systems as resources for implementing such communication-related activities because these service providers already work directly with the public on many issues, one of which could be natural hazard preparedness and mitigation.

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 C-8 Communication Process



Source: Adapted from the U.S. Environmental Protection Agency Radon Division's outreach program

The social organizations identified in Salem can be involved in hazard mitigation; a few methods are defined below.

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

Cultural Resources

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

The National Register of Historic Places reports 62 historically significant structures in Salem; this is 58% of the historic structures across Marion City.[35] A complete list of these structures can be found on the Oregon State Historic Preservation Office website: http://www.oregon.gov/oprd/HCD/SHPO/Pages/index.aspx

The Marion Cultural Development Corporation maintains the historic and cultural resources across Salem. The non-profit preserves, enhances and supports the arts, history, architecture, libraries, museums, festivals, and other cultural assets for the public.

Community Stability

Residential Geographic 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.[36] Table C-20 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 city a year ago, compared to the percentage of people who have migrated into the region. Salem overall has geographic stability rating of about 92% (i.e., 92% of the population lived in the same house or moved within the county in the last year). For those that moved into the city, 5% of residents lived in a different Oregon city one year before, 32% lived in a different state and <1% lived in a different country.[37]

[35] National Register of Historic Places, "2006 State Listings: Oregon-Marion County". http://www.nationalregisterofhistoricplaces.com/or/Marion/state2.html. Accessed January 19, 2010.

[36] Cutter, Susan, Christopher Burton, Christopher Emrich. "Disaster Resilience Indicators for Benchmarking Baseline Conditions". Journal of Homeland Security and Emergency Management.

[37] Source: Social Explorer, Table 130, U.S. Census Bureau, 2011-2015 American Community Survey Estimates

Table C-20 Regional Residential Stability

Jurisdiction	Population	Geographic Stability	Same House	Moved Within Same County
Oregon	3,896,912	93%	82%	11%
Marion County	319,238	94%	83%	11%
Polk County	76,484	89%	81%	8%
Salem	**157,744**	**92%**	**79%**	**13%**

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. Collectively, about 53% of the occupied housing units in Salem are owner-occupied; about 47% are renter occupied. Salem's vacancy rate is 6%. In addition, seasonal or recreational housing accounts for approximately 6% of the city's vacant housing stock.[38]

Table C-21 Housing Tenure and Vacancy

	Housing Units	Owner-occupied		Renter-occupied		Vacant^	
		Estimate	Percent	Estimate	Percent	Estimate	Percent
Oregon	1,695,183	939,637	61%	593,793	39%	102,108	6%
Marion County	122,315	68,134	60%	45,862	40%	7,250	6%
Polk County	30,651	18,292	64%	10,166	36%	1,944	6%
Salem	**61,417**	**30,589**	**53%**	**27,140**	**47%**	**3,440**	**6%**

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 hazards.[39] In the most extreme cases, renters lack sufficient shelter options when lodging becomes uninhabitable or unaffordable post-disaster.

Synthesis

Salem comprises various social and cultural resources that work in favor to increase community connectivity and resilience. Sustaining and preserving social and cultural resources such as, social services and historic places may be essential to preserving community cohesion and a sense of place. It is important to consider that these social services may not be equally accessible to residents of rural areas beyond Salem jurisdictional boundaries, and Salem may need to expand these provisions beyond traditional service areas.

[38] U.S. Census Bureau, 2011-2015 American Community Survey Estimates, Table B25004.

[39] Cutter,S.L. (2003). Social Vulnerability to Environmental Hazards. *Social Science Quarterly*.

Political Capacity

Political capacity includes the government and planning structures established within the community. Public access to the political process is also an important element of Political Capital. 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.[40] 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.

Government Structure

Salem operates under the council-manager form of city government. The Mayor and the eight City Councilors are elected by the citizens and they develop the policies that direct city operation. The Mayor and Council hire the City Manager to implement policy direction and actually manage city operations. The City Charter provides the authority under which the city operates and outlines roles of the Mayor, Council, and City Manager.[41]

Beyond Emergency Management, most departments within the city governance structure have some degree of responsibility in building overall community resilience. Each plays a role in ensuring that city functions and normal operations resume after an incident, and the needs of the population are met.

Some divisions and departments of Salem government that have a role in hazard mitigation are:[42]

- **Community Development Department:** assists citizens in developing a dynamic and livable city through responsible land use planning and zoning, consistent application of building codes, solid support for compliance with all city codes, neighborhood association issues, and youth development.
    - **Planning Division:** is composed of two separate but intertwined programs. The Current Planning Program provides efficient, timely and fair development review, ensures compliance with land use riles, and protects and preserves historic heritage. The Long Range Planning Program ensures compliance with state land use planning goals, policies, and rules to maintain quality of living opportunities and to ensure well planned community growth.

[40] Mileti, D. 1999. Disaster by Design: a Reassessment of Natural Hazards in the United States. Washington D.C.: Joseph Henry Press.

[41] City of Salem, City Government. http://www.cityofsalem.net/CITYCOUNCIL/Pages/default.aspx. Accessed February 21, 2012.

[42] City of Salem, Departments. http://www.cityofsalem.net/DEPARTMENTS/Pages/default.aspx. Accessed February 12, 2012.

    - **Building and Safety Division:** encompasses construction plans review, inspection services, and permitting; professional and police protective licensing; maintenance of multifamily-housing licensing; and other development information.

- **Public Works:** constructs and maintains the infrastructure necessary for the basic urban needs of the Salem metropolitan area. This includes a safe and reliable road system, healthy and plentiful water supply, a well-functioning storm drainage system, and proper treatment of wastewater.

    - **Parks & Transportation Services Division:** is responsible for parks maintenance, recreation, planning, traffic engineering, and maintenance of the City's transportation systems.

- **Information Technology & Facilities:** is responsible for the City of Salem's technical environment, building maintenance, operations, and support. Working together with other City Departments, IT and Facilities provides solutions and support for building assets, computer networks, copy services, and telecommunication.

    - **Building Operations:** maintains the City's building operating systems through preventive and corrective maintenance at more than 90 city-owned structures, including the daily upkeep of the downtown parking structures and cemented areas.

    - **Network & Technical Services:** cooperatively works with the City of Salem Departments and regional entities to maintain; personal computers, network servers, network connectivity, data security, and telephone services.

    - **Geographic Information Systems (GIS):** is used by the City in many ways serving City staff, local and global businesses, and our citizens through mapping and spatial data.

- **Police:** The Salem Police Department brings police and citizens together to better fight crime in the community. Their mission is to reduce the fear of crime, protect individual rights, and enhance the quality of life.

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 residents, businesses, and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can adapt easily to changing conditions and needs.[43]

[43] Burby, Raymond J., ed. 1998. Cooperating with Nature: Confronting Natural Hazards with Land-Use Planning for Sustainable Communities.

The City of Salem Natural Hazard Mitigation Plan includes a range of recommended action items that, when implemented, will reduce the city's vulnerability to natural hazards. Many of these recommendations are consistent with the goals and objectives of the city's existing plans and policies. Linking existing plans and policies to the Natural Hazards Mitigation Plan helps identify what resources already exist that can be used to implement the action items identified in the Plan. Implementing the natural hazards mitigation plan's action items through existing plans and policies increases their likelihood of being supported and getting updated, and maximizes the city's resources. The following are a list of plans and policies already in place in Salem and Marion City.

- Salem Emergency Management Plan, 2014
- Salem Area Comprehensive Plan, 2015
- Salem Transportation Plan, 2012
- City of Salem Capital Improvement Plan, 2016
- City of Salem Comprehensive Park and Recreation System Master Plan, 2013
- City of Salem Stormwater Master Plan, 2000
- Salem Local Energy Assurance Plan, 2011

Synthesis

As addressed above, many governmental entities are responsible for work relevant to hazards planning; however, from this perspective it is challenging to decipher whether these structures work collaboratively in practice towards improving hazard mitigation. On a similar note, in short of reviewing each of the relevant policy documents it is questionable whether the documents effectively integrate hazard initiatives into implementation policy. Further analysis is needed to evaluate the effectiveness of political capital in terms of community resilience.

Appendix D: Economic Analysis of Natural Hazard Mitigation Projects

The Oregon Partnership for Disaster Resilience at the University of Oregon's Community Service Center developed this appendix. 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.

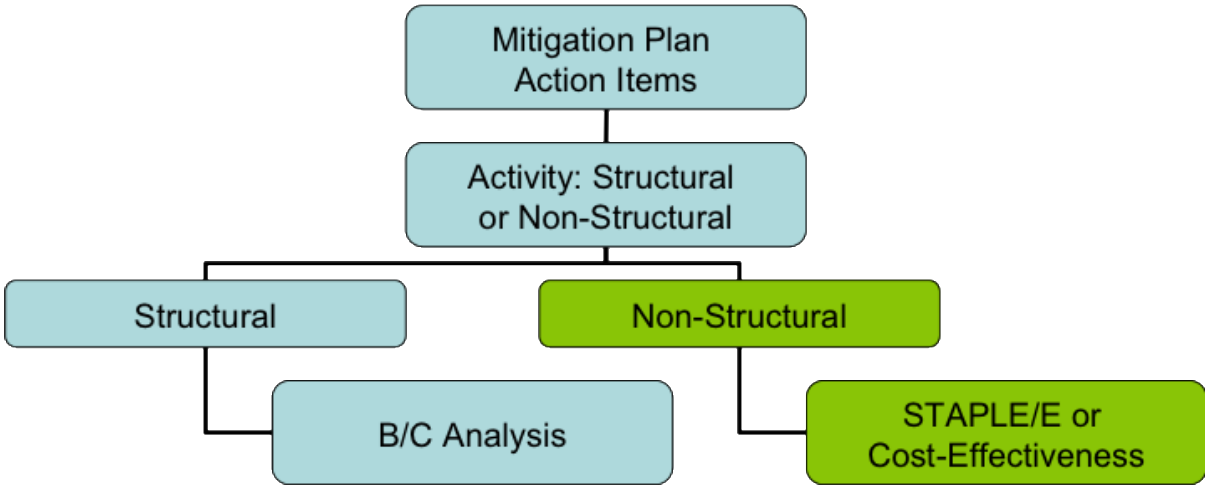
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

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 D-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.

1. Identify the Activities

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

2. Calculate the Costs and Benefits

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

- ***Determine the project cost***. This may include initial project development costs, and repair and operating costs of maintaining projects over time.
- ***Estimate the benefits***. Projecting the benefits, or cash flow resulting from a project can be difficult. Expected future returns from the mitigation effort depend on the correct specification of the risk and the effectiveness of the project, which may not be well known. Expected future costs depend on the physical durability and potential economic obsolescence of the investment. This is difficult to project. These considerations will also provide guidance in selecting an appropriate salvage value. Future tax structures and rates must be projected. Financing alternatives must be researched, and they may include retained earnings, bond and stock issues, and commercial loans.
- ***Consider costs and benefits to society and the environment***. These are not easily measured, but can be assessed through a variety of economic tools including existence value or contingent value theories. These theories provide quantitative data on the value people attribute to physical or social environments. Even without hard data, however, impacts of structural projects to the physical environment or to society should be considered when implementing mitigation projects.
- ***Determine the correct discount rate***. Determination of the discount rate can just be the risk-free cost of capital, but it may include the decision maker's time preference and also a risk premium. Including inflation should also be considered.

3. Analyze and Rank the Activities

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

- ***Net present value***. Net present value is the value of the expected future returns of an investment minus the value of the expected future cost expressed in today's dollars. If the net present value is greater than the projected costs, the project may be determined feasible for implementation. Selecting the discount rate, and identifying the present and future costs and benefits of the project calculates the net present value of projects.
- ***Internal rate of return***. Using the internal rate of return method to evaluate mitigation projects provides the interest rate equivalent to the dollar returns expected from the project. Once the rate has been calculated, it can be compared to rates earned by investing in alternative projects. Projects may be feasible to implement when the internal rate of return is greater than the total costs of the project. Once the mitigation projects are ranked on the basis of economic criteria, decision-makers can consider other factors, such as risk, project effectiveness, and economic, environmental, and social returns in choosing the appropriate project for implementation.

Economic Returns of Natural Hazard Mitigation

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

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

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

Additional Costs from Natural Hazards

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

- Commodity and resource prices
- Availability of resource supplies
- Commodity and resource demand changes

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

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

Additional Considerations

Conducting an economic analysis for potential mitigation activities can assist decision-makers in choosing the most appropriate strategy for their community to reduce risk and prevent loss from natural hazards. Economic analysis can also save time and resources from being spent on inappropriate or unfeasible projects. Several resources and models are listed on the following page that can assist in conducting an economic analysis for natural hazard mitigation activities.

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

Resources

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APPENDIX E:
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. https://www.fema.gov/fiscal-year-2017-emergency-management-performance-grant-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/ncrc/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 FY2015, 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/

APPENDIX F:
LIFELINE SECTOR ASSESSMENT

Note: This chapter originally appeared in the Marion County NHMP (2017) and is included herein in its entirety.

This section describes the findings from the 2016 Marion County Lifeline Sector Assessment. In 2015, a University of Oregon Community Planning Workshop student team conducted an assessment of lifeline sectors identified by Marion County – transportation, energy, communication, and water. The assessment focused on review of each sector's adaptive capacity and vulnerabilities, as well as critical interdependencies. The team adapted OPDR's Hazard and Climate Vulnerability Assessment Tool, which was created through public and private partnerships, to complete the assessment. The assessment consisted of the following general steps:

- Sector Assessment Part 1: The first step was to assess each sector's adaptive capacity. The team conducted this assessment independent of any particular hazard scenario. To complete the task the team adapted and administered Part 1 of the Vulnerability Assessment Tool to representatives from each sector. The team conducted this phase as part of facilitated meetings with lifeline sector stakeholders, system managers and experts. The team then summarized the information received in the sector report.
- Sector Assessment Part 2: The second step was to assess each sector's hazard sensitivity and potential impacts. The team utilized specific chronic and catastrophic hazard scenarios to inform and direct the discussion. The team worked with the local project lead to select one chronic hazard – flood, and one catastrophic hazard – Cascadia earthquake. To complete this task, the team adapted and administered Part 2 of the Vulnerability Assessment Tool to representatives from each sector. The team conducted this phase as part of facilitated meetings with lifeline sector stakeholders, system managers and experts. The team then summarized the information received in the sector report.
- Sector Assessment Part 3: The team compiled the results and information into a set of sector summaries.

The following subsections are organized as follows: Transportation, water, energy, and communications.

LIFELINE SECTOR: TRANSPORTATION

Transportation is critical lifeline infrastructure. The transportation network facilitates the movement of people, goods, resources and commerce throughout Marion County and beyond. The transportation system consists of local, state, and federal road and highway networks; passenger and freight rail; passenger and freight air service; pipelines; transit; dedicated bicycle and pedestrian systems; and limited water-based modes. All lifeline sectors depend on the transportation system.

Assessment Snapshot

Transportation Sector Summary

Critical Interdependencies:

Systems of all types are dependent on other systems in order to function. In order to operate, the transportation sector is particularly DEPENDENT ON:

- Energy and Fuel
- Communication
- Business and Industry
- Public Works

Other critical lifeline sectors that DEPEND ON the transportation sector to operate include:

- Water
- Electricity
- Liquid fuel
- Public Safety and Emergency Management
- Public Works
- Economy

Crucial Vulnerabilities:

Each sector has a number of vulnerabilities. The transportation sector is particularly vulnerable to the following:

- Federal, state and local bridge infrastructure is particularly vulnerable to earthquake (especially ODOT facilities over the Willamette).
- System relies heavily on fossil fuels for construction, operation, and maintenance.
- Hwy 22 is the primary east-west connection; there are few redundant east-west routes.
- Significant backlog of deferred transportation maintenance projects.

Major Findings:

- ODOT considers I-5 and Highway 22 to be critical routes. Other critical concerns include bridges, roads, communication, and energy including power and fuel.
- Much of the existing transportation infrastructure, including those of major roadways such as I-5, Highway 22, and Mission Road, are not seismically retrofitted and will likely experience structural failures during a Cascadia event.
- Following a Cascadia event, transportation will be limited for 6-12 months; aftershocks may extend that timeframe.

- Transportation is interdependent with communication, water, and energy systems and requires coordination and collaboration during the response and recovery process.
- Although winter storms continue to impact transportation systems, stakeholders respond to these events efficiently and continue to improve plans with every winter weather event. Downed trees, debris, and accumulated ice impact the response of this lifeline.
- Salem-Keizer Transit operates city and regional buses, dial-a-ride, CherryLift for people with disabilities, and coordinates non-emergent medical transportation services. They provide about 4-million rides a year and are currently working to improve individual employee preparedness as well as existing emergency plans.
- Salem-Keizer Public Schools transports an estimated 22,000 students a day including about 2,000 medically fragile students. The top priority for this organization is student safety.
- The electricity grid in Oregon is not particularly dependent on the transportation sector to operate. However, the power generation and distribution network does rely on the transportation network for construction as well as ongoing maintenance and repairs.
- Conversely, all of the liquid fuel in the state is transported by one of three primary transportation modes: truck, rail, and pipeline. Therefore, the distribution fuel in the state is completely dependent on the transportation sector.
- Like the electric grid, the communications sector is not particularly dependent on the transportation sector to operate. However, the power generation and distribution network does rely on the transportation network for construction as well as ongoing maintenance and repairs.
- Business and industry is very dependent on the transportation sector. From the movement of raw material, to getting employees to and from work, to getting finished products to market, virtually all business and industry activity in the region is facilitated by transportation.
- Public works is dependent on transportation in two primary ways. First, the transportation sector facilitates the movement of equipment, materials, and workers. Second, significant portions or components of public works' infrastructure are collocated within transportation rights of way.

Introduction

Access to means of transportation is fundamental to human existence. Transportation infrastructure facilitates everything from a local trip to the park, drugstore or place of employment to international trade and commerce. Furthermore, the ability to move people, goods and services is vital before, during and after emergency events. It is no accident that FEMA's number one Emergency Support Function is transportation. ESF #1 covers the following:

- Aviation/airspace management and control
- Transportation safety
- Restoration/recovery of transportation infrastructure
- Movement restrictions
- Damage and impact assessment

The scope of ESF #1 includes supporting, ". . . prevention, preparedness, response, recovery and ***mitigation*** activities among transportation stakeholders . . .[emphasis added]" and coordinating, "the restoration of the transportation systems and infrastructure."[1]

Transportation lifeline sector participants identified a number of interconnected resources and elements of their operations. These include included roads, bridges, buses, and physical buildings. While this assessment focusses on infrastructure, participants noted that transportation staff and professionals are a critical resource as well.

Primary Agencies and Organizations

The following organizations and agencies participated in this assessment:

- City of Salem
- City of Woodburn
- Marion County Public Works
- Marion County Sherriff's Office
- ODOT
- Salem Public Works
- Salem-Keizer School District
- Salem-Keizer Transit
- Woodburn Transit Service

Sector Description

The transportation sector consists of a vast, multimodal network of fixed and mobile public and private assets. This diversity is part of what makes the transportation sector so vital to so many users. However, it is also what makes assessment of the sector challenging.

The primary transportation infrastructure components in Marion County are summarized below followed by more detailed descriptions as provided by the sector participants:

- State and interstate highways: I-5, Hwy 22, Hwy 99, Hwy 214
- County and city road collection and distribution networks. Participants identified eight roads as making up the county's primary collector network: Cordon Road in Salem,

[1] FEMA, Emergency Support Function #1 – Transportation Annex. 2008. https://www.fema.gov/pdf/emergency/nrf/nrf-esf-01.pdf

Cascade Highway(213), Hillsboro-Silverton Highway (214), Lancaster Drive, Butteville Road, Jefferson/Marion Road, River Road, Aumsville Highway (connects to prison).
- Bridges, as a critical subset of the city, county, state and interstate road network.
- Public and semi-public transit providers (e.g. Salem Keizer Schools has over 250 school busses, a yard and 56 school drop sites with transit responsibility for roughly 22,000 schoolchildren daily; Salem transit district maintains 56 full size busses and multiple regional busses).
- Passenger and freight rail system: Amtrak operates on the UP line and offers daily passenger rail service through Marion County; Union Pacific, which runs roughly 24 freight trains a day on its line, including hazardous materials; and Portland and Western.
- Fuel and natural gas pipelines
- Two regional airports: Salem municipal airport (includes Oregon Army National Guard – Army Aviation Support Facility) and Albany Municipal Airport and numerous local airports and heliports.
- Two limited capacity ferries: Buena Vista Ferry and Wheatland Ferry

Marion County Public Works

Marion County Public Works identified critical roads for their operation including:

- Corden Road
- Cascade Highway
- Silverton Road
- Hail Prairie
- Butteville Road
- Jefferson Marion Road
- River Road N/S
- Aumsville Highway
- Highway 22
- Highway 99E
- Interstate 5

The City of Salem is the seat of Marion County. Accordingly, it is the main base of operations for Marion County Public Works and has access to backup power. There are three other district buildings, as well as underground fuel storage tanks. The only site that has its own generation capacity to pump fuel is at the North Marion location.

Marion County Sherriff's Office

The Marion County Jail is located on Aumsville Highway. It has backup generation for 36-hours. The Sherriff's Office is also responsible for the continued operation of the Marion County Courthouse. The jail is only served by Aumsville Highway without any redundancy in access.

City of Salem

Arterial streets and bridges are the most critical infrastructure in the City of Salem. The City has jurisdiction over several bridges and there are ODOT bridges that cross the Willamette River. The City identified these bridges as important to accessing West Salem. In the case of an emergency or natural hazard event, the Salem Public Works operations facility has heavy equipment that includes snowplows and dump trucks.

City of Woodburn

Woodburn identified the major roadways Oregon Routes 213, 214, 99E, and U.S. Interstate 5 as key transportation infrastructure. During a hazard event, the City's priority is keeping critical arterials roads open, as well as service collectors to help mitigate traffic flow.

Keizer School District

Keizer School District has a fleet of buses that transports over 20,000 students every day, of which 10 percent have special needs. The school district has 66 traditional school sites and 15 nontraditional school sites and their vulnerable populations are concentrated at their preschool, teen parent site, and alternative school site.

There are 12 support sites and school buses are stored at three facilities located on River Road, Gaffin Road, and Hawthorne Avenue respectively. Each facility has over 200 buses and 10,000 gallons of diesel fuel storage. But, their Hawthorne facility is constructed of poor quality concrete and is not ready for an earthquake. The facilities building has trucks and vans, in addition to refrigerator trucks located at the food service site. Keizer School District relies on a radio dispatch network to communicate with buses out on their routes. It is supported by repeaters and has backup generation capacity, with the intent to switch to a digital cable system.

Lastly, Risk Management staff are continuing to plan for scenarios with the Sheriff's Office and Salem by developing responses for man-made and natural hazard events.

Salem-Keizer Transit

Salem-Keizer Transit has 64 large buses and also operates regional and paratransit buses. The agency is taking steps to have employees prepare at home so that employees can get to work.

The buses run on either diesel or compressed natural gas (CNG). There is a direct connection to the natural gas line, but there is not backup power for pumping natural gas.

ODOT

ODOT considers all state and federal highways as priority roads and in Marion County. However, Highway 22 was identified as being particularly critical as it is the primary east-west connection through the county. ODOT also manages a railroad overpass that has been converted to a non-motorized alternative modes bridge. The bridge is open to runners, cyclists, and pedestrians. Notably, the project provides a critical half-mile link in the bicycle and pedestrian circulation systems for the community, the region, and the state. Moreover, ODOT also maintains a motor pool in Salem and operates its own inter-city transit services and vanpools. It also works with rail, airports, and public transit providers, including Amtrak, which maintains a hub in Salem. Amtrak shares rail lines with freight and while ODOT does not own any stations or lines, it is an important partner in operation for both services.

Highway 22 and Mission Road have structures that are not seismically retrofitted. However, the walking bridge would likely remain a viable alternative for pedestrian and bicycle access across the river after an earthquake. Some ODOT facilities are seismically retrofitted, including ODOT headquarters. ODOT is currently considering an option for a ferry to cross the Willamette River.

ODOT relies heavily on the communications sector and would have difficulty functioning without communications. They do have radio backup capabilities. ODOT identified rerouting must consider overpass availability and has established rerouting of traffic around Interstate 5 using side and city roads. Some facilities, like the Salem Operation Center, may not withstand a Cascadia event. ODOT identified Highway 22 as a critical road as it may be one of the only east-west connections through the cascades.

Adaptive Capacity

Adaptive Capacity refers to a system's ability to accommodate a new or changing environment, exploit beneficial opportunities, or moderate negative effects.

In general terms, the transportation sector has a low level of adaptive capacity. This is primarily due to the large scale and fixed nature of the infrastructure itself. Highways, roads, bridges, airports, and railroads are expensive to construct and not easy to relocate. The political, financial and policy issues related to transportation work as further limits to adaptation. Furthermore, when transportation infrastructure is damaged or otherwise impacted, it takes significant time and investment to fix. Similarly, a huge portion of the sector is completely reliant on fossil fuels to operate. In a state with significant fuel vulnerability, fuel availability becomes a single point of failure for much of the sector even if the physical infrastructure is not impacted. Finally, the entrenched set of sub-sector or mode-specific subsidies, incentives or disincentives pose significant challenges to sector diversification, particularly at the local level.

Interdependencies

Systems of all types are dependent on other systems in order to function. In order to operate, the transportation sector is particularly ***dependent on***:

Energy: Electricity and Fuel

The transportation sector is not particularly dependent on electricity. Electricity is needed for traffic signaling and network lighting needs. Further, a small but growing portion of passenger vehicles and some transit modes use electricity. However, these represent a very small percentage of the entire transportation fleet across all modes. The sector is, however, critically dependent on liquid fuel. The vast majority of passenger and freight vehicles, emergency vehicles, aircraft, equipment, and rail all run on fossil fuel. In addition, significant portions of the infrastructure itself consists of fossil fuel derivatives, asphalt being the most notable.

Communication

Transportation is dependent on communication in some modes more than others. Air traffic control, for example, depends on multiple modes of communication to ensure safe air travel. Similarly, passenger and freight rail rely on communications for switching and scheduling. Increasingly, communication systems are used for real-time transportation demand management, traffic control, emergency routing information and trip planning purposes. Finally, communication systems are used to dispatch maintenance crews and to communicate with transportation-related public-safety and law enforcement units.

Business and Industry

The transportation system is heavily reliant on private engineering, design, construction, manufacturing and raw material businesses and industry. Further, most of the vehicles used in transportation are manufactured by private business and industry. Freight rail, commercial air, and pipeline infrastructure is largely owned and operated by private businesses. In short, the transportation sector is critically dependent on private business and industry to operate.

Public Works

Similarly, significant portions of the physical transportation infrastructure are financed, constructed and maintained by the public sector. State and local public works departments are responsible for much of the surface transportation infrastructure in Marion County.

Vulnerabilities

The assessment team evaluated the transportation sector's vulnerability using a scenario planning approach which included one chronic event (winter/ice storm) and a catastrophic event (9.0 Earthquake).

Chronic Hazard: Winter/Ice Storm

Participants indicated that a winter storm could lead to flooding, further compounding damage and harm. ODOT identified that winter storms have significant impacts on their operations as it interrupts emergency, commercial, and personal vehicle capability. In 2014, the mid-Willamette Valley experienced a significant winter storm. ODOT has identified gaps in their response and has planned for future events accordingly. All five ODOT regions have a winter storm plan. There are now also electronic copies, in addition to paper copies.

Keizer School District is also highly sensitive to a winter storm. Decisions around how and when to shelter students or cancel school follow a very specific plan. An area of concern is in regard to bus drivers' hesitance to drive in snow and ice and whether there will be enough drivers and keeping students safe on buses if they are stuck on roads in severe winter conditions. Diesel gelling in extremely cold weather is also a concern for bus operation.

Salem Public Works reported low sensitivity to a winter storm and that their staff and equipment are prepared for this type of event. Their County counterpart, Marion County Public Works, has a yearly test of equipment and staff assignments. Salem-Keizer Transit has a snow plan that facilitates their determination of service capability during a winter storm event.

Catastrophic Hazard: Cascadia Earthquake Event

All participants report extremely high sensitivity to a Cascadia Earthquake with widespread impacts. ODOT in particular reported extreme sensitivity to a Cascadia earthquake event. Much of interstate highway system is not seismically retrofitted and it is likely that Interstate-5 would fail. ODOT has plans to mitigate seismic impacts, but lacks funding to execute.

The Sherriff's Office identified a need to maintain the Courthouse operations and balance law enforcement duties. Of particular concern is moving a population of 3,700 incarcerated individuals if the jail structure is damaged.

Several participants have already begun hazard mitigation and have regular planning meetings. While Salem-Keizer Transit does not have a formal plan, but has begun assessing capabilities and limitations.

Mitigation Opportunities

The transportation sector representatives identified a number of potential mitigation opportunities.

Add Lifeline Corridors to Transportation System Plan

The Marion County Transportation System Plan is "a planning tool that is used to identify transportation projects throughout rural Marion County – this includes roads, transit, bicycles, pedestrians, rails, ferries, freight, and air." In short, it outlines medium- and long-term investments in transportation infrastructure. Although it was recently updated in 2013, the TSP does not specifically identify lifeline corridors or utilize lifeline corridors as a factor in determining TSP project priority. Aligning critical infrastructure mitigation with standard planning activities is one way to better ensure implementation and increase resilience.

Designate Critical Facilities and Employers in City and County TSP

Similar to lifeline corridors, city and county TSPs do not currently include comprehensive assessments of critical facilities and employers. Therefore, transportation investments are not necessarily being targeted to ensuring critical facility and employer transportation access before, during and after disaster events. Integrating hazard mitigation considerations related to critical facilities and employers with standard transportation planning activities is one way to ensure implementation and increase resilience.

Designate Priority Transportation Routes in Marion County

Sector participants highlighted the need to prioritize transportation planning routes in Marion County. The group discussed a "hub and spoke" approach to ensure that resources can be distributed throughout the county from known centralized assembly points (e.g. the Oregon Army National Guard – Army Aviation Support Facility at the Salem Airport). Once routes are prioritized, the county can use that framework to focus transportation related vulnerability assessments (e.g. bridge structural assessments for seismic) and capital improvement plan investments.

Identify Local Funding Sources

While some additional prioritization and integration is warranted, as outlined above, participants also acknowledged that many plans already ID transportation related mitigation projects. These are evident across multiple departments and agencies. Participants identified funding, primarily local sources, as a key barrier to implementation. Participants encouraged efforts to identify local sources of funding to support transportation related mitigation projects.

24-Month Preparation and Outreach Campaign

Participants acknowledged that without increased awareness and preparation, no amount of planning will be enough. The group proposed a targeted and focused 24-month Preparation and Outreach Campaign. The goal of the campaign could be to increase awareness about the vulnerability of the transportation sector in Marion County. Key outcomes could be to increase the level of preparation on the part of citizens, businesses and agencies related to transporation.

Partner with the Marion County Farm Bureau

Participants briefly discussed opportunities to coordinate with the Marion County Farm Bureau on transportation related mitigation projects. The Farm Bureau has not traditionally been a partner in the county's mitigation efforts. However, the Farm Bureau represents a constituency that is highly dependent on access to multiple transportation modes. Collaboration with the Farm Bureau on issues of mutual benefit could be a way to increase awareness and political buy-in.

Water is critical to life. After three days without water, a person will experience severe dehydration, which may lead to death if not reversed. Alone, the intrinsic need for water qualifies the water sector as a lifeline. Water is something our family, friends, emergency personnel, healthcare professionals, and whole community is dependent upon.

Assessment Snapshot

Water Sector Summary

Critical Interdependencies:	**Crucial Vulnerabilities:**
Systems of all types are dependent on other systems in order to function. In order to operate, the water sector is particularly <u>DEPENDENT ON</u>: • Electricity • Communication • Transportation • Liquid Fuel **Other critical lifeline sectors that <u>DEPEND ON</u> the water sector to operate include:** • Fire and EMS • Business and industry • Electricity	**Each sector has a number of vulnerabilities. The transportation sector is particularly vulnerable to the following:** • The water sector in Marion County consists of numerous local and regional systems. • Several reservoirs, transmission lines and the Salem Treatment Facility are vulnerable to multiple hazards. • Aquifer storage capacity not sufficient to meet need as a backup source.
Major Findings: • People living in unincorporated areas of Marion County rely on wells and septic tanks. • Low water reserves and low river flow pose a serious threat to the water supply. • Some infrastructure pertaining to water systems are old which increases the risk vulnerability to withstand a Cascadia event. Impacted infrastructure located near rivers could cause service disruptions and flooding during an event or incident. Power is vital to the water facilities. • Generators are co-located at critical facilities and need to be maintained requiring various fuel types in order to support redundancy. • Road access is vital to conduct damage assessments and or repair impacted facilities.	

Introduction

For the purposes of this assessment, the water sector includes information pertaining to drinking water, stormwater, and wastewater. Stakeholder participants included a range of local and regional infrastructure and service providers. The information provided in this summary is based on research of the county's water resources and infrastructure.

Ready access to virtually unlimited amounts of clean drinking water is often taken for granted, particularly here in the Pacific Northwest. Water is vital for basic daily living, for business and industry especially including agriculture, for fire protection and medical service provision, and for wastewater management. In addition, stormwater facilities provide critical protection from a variety of localized flood risks. FEMA Emergency Support Function #3 covers public works, including water, wastewater and stormwater services. Ensuring that all water related public works infrastructure is operational is critical to the function of any community.

Primary Agencies and Organizations

The following organizations and agencies participated in this assessment:

- Public Works
- City of Stayton
- City of Turner
- City of Salem
- Marion County
- City of Keizer
- North Santiam Watershed Council

The North Santiam Water Council (NSWC) provides resources and knowledge to Marion County. The NSWC is currently working on a Drought Contingency Plan. This will allow the NSWC to better understand the availability and general magnitude of available water resources.

Sector Description

The water sector consists of three primary sub-sectors: drinking water, wastewater and stormwater. Common elements of the drinking water system include source water, intakes, treatment, reservoir storage, transmission, and distribution. Common elements of the wastewater system include collection and treatment. Stormwater systems are primarily collection systems.

Because each jurisdiction has their own infrastructure with similar components additional information specific to each of the participating jurisdictions is included below.

City of Salem

People living in unincorporated areas of Marion County mainly rely on wells and septic tanks.

Marion County Storm and Surface water drainage system includes urbanized East Salem Service District infrastructure, as well as rural roadside drainage ditches. The Service District was established for sewer and lighting, and is now also serving as a stormwater service area. There is a wastewater treatment plant near Keizer. The County Board of Commissioners also serves as the District Board.

City of Aurora

The City of Aurora relies on a groundwater system and the Pudding River to provide access to water. It is located at the end of the Troutdale watershed.

Stayton

Stayton's sanitary sewer, stormwater and water systems are bound within the City limits of Stayton. The City buys water from the Santiam Water Control District and draws water off of a Santiam ditch intake. The City of Stayton also has two wells, which each store enough water for one day. Both of Stayton's drinking water facility and wastewater facility are located near the Santiam River. The drinking water facility used a slow sand filtration system and is currently working on looping the system.

Turner

The City of Turner buys water from the City of Salem. Its water system is capable of serving its 2000 residents and is comprised of two water tanks, two pump stations, 15 miles of pipes, and 200 hydrants. Turner's two water tanks gravity feed the city and are located on a "cliff." Turner also hosts one of Salem's reservoirs.

Salem

As the County seat and capitol of the State of Oregon, Salem plays a significant role in the water sector. The City owns water rights in the North Santiam Watershed and its treatment facility is located on Geren Island, just east of Stayton. Water is conveyed through two large transmission mains to reservoirs, pump stations, and customer taps. There are 17 miles of transmission mains that separate Geren Island from the City of Salem. There are 18 finished water reservoirs. Salem utilizes SCATA, which detects problems in the distribution system. The City of Salem is 70 percent gravity fed and uses a slow sand filtration system to purify its water. The water is also tested upstream. The system is also protected by two valves that are able to isolation sections of the system.

Salem also provides water to three wholesale customers: City of Turner, Suburban East Salem Water District, and Orchard Heights Water Association. The City also operates an Aquifer Storage and Recovery (ASR) system in south Salem. The ASR is replenished in winter rains and stored for the dry days of summer.

Adaptive Capacity

Adaptive Capacity refers to a system's ability to accommodate a new or changing environment, exploit beneficial opportunities, or moderate negative effects.

In general terms, the transportation sector has a low level of adaptive capacity. This is primarily due to the large scale and fixed nature of the infrastructure itself. Highways, roads, bridges, airports, and railroads are expensive to construct and not easy to relocate. The political, financial and policy issues related to transportation work as further limits to adaptation. Furthermore, when transportation infrastructure is damaged or otherwise impacted, it takes significant time and investment to fix. Similarly, a huge portion of the sector is completely reliant on fossil fuels to operate. In a state with significant fuel vulnerability, fuel availability becomes a single point of failure for much of the sector even if the physical infrastructure is not

impacted. Finally, the entrenched set of sub-sector or mode-specific subsidies, incentives or disincentives pose significant challenges to sector diversification, particularly at the local level.

Interdependencies

Systems of all types are dependent on other systems in order to function. In order to operate, the transportation sector is particularly *dependent on*:

Vulnerabilities

The assessment team evaluated the water sector's vulnerability using a scenario planning approach which included one chronic event (winter/ice storm) and a catastrophic event (9.0 Earthquake).

Chronic Hazard: Winter Storm

The drought conditions of 2015 caused great concern and pointedly raised awareness of the water's vulnerability to drought. Low water reserves and low river flow pose a serious threat to the ability to supply water. In addition, with low water levels water quality is of concern. Even with a normal pollutant load, the pollutant concentration will be higher than normal due to the lack of water to dilute.

Winter storms did not pose a high threat to the water sector, but the potential flooding to follow was a major vulnerability. Many of the Cities' infrastructure is located near a river. Flooding could shut down operations creating supply issues. A flood may also wash pollutants into the water sources. However, the predictability of a flood allows for the sector to mitigate and prepare for the hazard event. Lastly, flooded roads and bridges could create an access issue in trying to reach facilities.

Catastrophic Hazard: Cascadia Earthquake Event

Much of the water sector's necessary infrastructure and facilities are old and it is unknown how they will fare in an earthquake event. Some underground transmission lines are over 80 years old and none of the treatment facilities were known to be seismically retrofitted. The location of drinking water treatment facilities and wastewater facilities along riverbanks poses a threat as the soil underneath is subject to liquefaction. If any water supply is available, it will only be used for priority usage including drinking water and water for fighting fires.

The water sector's large uncertainty of how the earthquake will impact their operations parallels their uncertainty of how they will respond and recover. The staff's first reaction will be to secure their own families and then try to find a way to communicate with their colleagues. However, regular communication pathways might be shut down and other options are instead being considered, such as satellite and HAM radio.

Secondly, communities will need to identify points in the system that have been broken, which relies on their ability to access roads and bridges. Currently, supplies, tools, and machinery are not equally distributed throughout the County, which could lead to difficulty in staff accessing and repairing isolated facilities if roads, communications, or energy is inaccessible. Overall, the response and recovery of the water sector will hinge on the ability of staff to access the section of the system needing fixed and having the right resources to fix it.

Wastewater treatment plants pose a health risk. A prime example is the Marion County wastewater treatment plant, just outside of the Keizer city limits. If the Marion County

wastewater treatment plant shuts down, the sewage will become backlogged and spill out into the streets of Keizer. This may pose a health and safety hazard, while also potentially contaminating freshwater supplies.

In addition, earthquakes may cause landslides into rivers, causing high turbidity and a potential of high pollutant loads. There are also a number of railroad lines located along river ways, and a hazardous spill that contaminates a relied upon watercourse could result in serious consequences.

Mitigation Opportunities

The water sector representatives identified a number of potential mitigation opportunities. Notably, the need to increase diversity and redundancy were key themes throughout the water sector conversations.

Complete and Implement Drought Contingency Plan

Participants indicated that water quantity will continue to grow as a key issue. Participants acknowledged the work being done to develop a drought contingency plan for the county and applauded the collaborative, multi-agency effort currently underway. The group indicated that completing and moving quickly to implementing the Drought Contingency Plan should be the highest priority for the water sector in Marion County.

Add risk assessment and hazard mitigation information to water master plans

Participants noted that most water master plans do not integrate risk assessment and hazard mitigation strategies. Generally speaking, water master plans outline a program to ensure customers have access to quality drinking water. These include medium- and long-term investments in water infrastructure. Aligning critical infrastructure mitigation with standard planning activities is one way to better ensure implementation and increase resilience.

Increase diversity and redundancy of equipment

Sector stakeholders noted throughout the discussion, that increasing the diversity and redundancy of equipment is critical to the provision of water. Single points of failure, whether at an intake, pump station, or transmission line can take the entire system off-line. Therefore, the group emphasized the need to ensure critical components of the system are backed up.

Increase diversity and redundancy of information

Participants noted that much of the detailed information about water systems is now held in digital or on-line files. Should the electronic system be down or access to electronic files be limited, water system managers would not have access to even basic information about the processing, transmission and distribution systems. Participants indicated that maintaining paper copies of key information and maps should be common practice.

Develop a pre-determined "shut down" process, procedure and prioritization

If multiple systems need to be shut down, the county does not currently have a good understanding of the order and priority. The group discussed the need to predetermine a process, procedure and prioritization scheme. As part of this effort, determining points of contact and communication protocols is important.

Continue to evaluate infrastructure mitigation opportunities

Participants outlined several examples of water infrastructure that is old, out of date. In other cases, participants cited partial progress on resilience where additional investments are still needed.

The energy sector is critical to modern life. Electricity is vital for virtually all household, business and emergency operations; liquid fuel is used for transportation, facility construction and repair, and backup power; natural gas is used for electricity generation, heating, cooking, powering vehicles, and other uses. The resilience, redundancy, and interdependencies of the energy sector will largely determine the timeline for emergency response and long-term community recovery. Diverse and redundant energy supply and distribution can significantly increase regional resilience.

Assessment Snapshot

Energy Sector Summary

<table>
<tr>
<td>Critical Interdependencies:
Systems of all types are dependent on other systems in order to function. In order to operate, the communication sector is particularly <u>DEPENDENT ON</u>:
• Transportation
• Communication
Other critical lifeline sectors that <u>DEPEND ON</u> the communication sector to operate include:
• Public Safety and Emergency Management
• Transportation
• Water
• Communication
• Economy</td>
<td>Critical Vulnerabilities:
Each sector is vulnerable to a variety of impacts. The energy sector is particularly vulnerable to the following:
• Consumption consists almost entirely of one of three forms: electricity, liquid fuels, natural gas.
• Dependence on BPA for electric power; Marion County produces very little power locally.
• Lead time for ordering critical system components (e.g. transformers)
• Concentration of liquid fuel storage facilities in Portland; limited local fuel storage and supply.
• Lack of capability to pump fuel locally without power.
• Reliance on supply and distribution facilities located outside Marion County.</td>
</tr>
<tr>
<td colspan="2">Major Findings:
• Generators are co-located by equipment and are used at critical infrastructure throughout the county; however, require various fuel types depending on the unit.
• Oregon’s fuel storage facilities are located in Portland and are susceptible to failure due to soil liquefaction. The storage capacity on a normal day is six days; therefore, it is anticipated that fuel will be an undersupplied commodity during a Cascadia event. It will take 3-6 weeks to reacquire fuel.
• Energy is critically interdependent with the transportation, communication, and water sectors. For example, not having access to roads nor having the ability to communicate with responders leaves the energy sector extremely vulnerable. In addition, there is a need for energy in powering water treatment plants. These</td>
</tr>
</table>

vulnerabilities are particularly heightened in areas where accesses via bridges or singular roads are susceptible to failure.

- The EPA regulates energy in terms of emissions limiting the capacity to produce additional energy resources.
- Damage assessments will be critical to capture the impacts to this lifeline. Downed trees, accumulating ice, and high winds can impact the resiliency of energy as a lifeline.
- The energy sector also prepares and mitigates against human-made disasters, such as cyberattacks.
- The energy sector grants people with uninterrupted services due to medical status during non-catastrophic events.
- An estimated 1-3 months of electrical service interruption during a Cascadia event.

Who participated?

The following organizations and agencies participated in this assessment:

- Pacific Gas and Electric (PGE)

Sector Description[2]

The energy sector is one of the most crucial lifelines in Marion County, providing electricity, liquid fuel and natural gas to residents and businesses from Aurora to Stayton and Salem to Idanha. Energy supports a wide array of community needs from charging cellphones to powering lifesaving medical equipment. Furthermore, other lifeline sectors rely on energy to provide many basic services. The resilience of this sector in a natural hazard event will greatly influence response capabilities. Furthermore, post-event recovery operations and success will depend in large part on the length of time it takes the energy sector to come back on line.

Electricity

The electric sector in Marion County is comprised of two local providers (Salem Electric and Pacific Power), and a federal power agency (Portland General Electric (PGE)). These three companies provide electricity to over 300,000 people in Marion County. Electric facility construction and maintenance is a key component of this sector's responsibility. The local agencies are primarily responsible for the distribution of electricity to residential, commercial, industrial and institutional customers. The vast majority of electricity generation is provided by the Bonneville Power Administration (BPA). Their resiliency and ability to respond in a hazard event is vital to reestablishing other important lifelines and facilities. For the purpose of this analysis, the information included primarily pertains to PGE, which is the largest distributor of electricity in Marion County.

PGE's critical infrastructure is located throughout Marion County and the larger Willamette Valley region. Currently, all of PGE's major hydroelectricity facilities are located outside of Marion County, in Timothy Lake, Clackamas River, and Estacada. Most of Oregon's liquid fuel is stored in reserves along the bank of the Willamette in the Portland Metro area. Notably, PGE

[2] Due to limited stakeholder involvement, portions of this section are informed by the City of Salem Local Energy Assurance Plan and the Marion County Commodity Flow Study.

maintains a local critical facilities list that consists of key emergency response, industry and public agency partners.

Participants emphasized that the sector is actively working to increase the diversity and redundancy of local electricity supply and distribution through a number of innovative projects. The Salem Smart Power Center, hosted by PGE, is intended to be the hub of "one of the most advanced electrical systems in the country."[3] Consisting of a 5-megawatt lithium-ion battery and inverter system, the Smart Power Center is intended to provide backup power to the regional grid. In conjunction with this project, the sector is working on a number of additional "micro-grid" projects. To date, the sector has identified seven potential sites micro-grid throughout the county. One of those sites, located at the Oregon Department of Public Safety Standards and Training facility in Salem, is currently being explored as a pilot project. Additionally, the sector is evaluating distributed satellite generation (DSG) siting opportunities throughout the region. Collectively, the vision for these electric supply and distribution projects is to create a "triangle of control" that significantly increases local electricity resilience.

Liquid Fuel

The petroleum supply chain consists of extracting crude oil, transporting it to refineries, processing it into petroleum products, and finally transporting it to consumers, often via intermediate suppliers. After being extracted, crude oil is refined into a number of petroleum products, including:

- Motor fuel, primarily gasoline;
- Distillate fuel, including diesel fuels, industrial fuels, and heating fuels;
- Liquefiable Petroleum Gas, including ethane, propane, butane, and others;
- Jet fuel, used in aircraft engines;
- Residual fuel oil, a by-product of the refinement process often used to produce heat or electricity; and
- Other products such as asphalt, kerosene, and lubricants.

According to the Oregon Resilience Plan, over 90% of Oregon's liquid fuel supply originates in the Puget Sound area in Washington. All of that fuel passes through the Critical Energy Infrastructure Hub north of Portland before it is distributed throughout the state. Marion county has limited liquid fuel supply reserves. According to the Salem Energy Assurance Plan, the Salem area has roughly 2.5-3.7 million gallons of fuel storage capacity. Assuming an average fuel storage volume, this equates to between three- and five-days of fuel availability.

Natural Gas

The primary natural gas supply chain consists of the extraction and processing of natural gas; the transportation of that gas via pipeline; and the underground storage or direct use of the gas for heating, fuel, electricity generation, or other uses. Approximately one in three Oregonians rely on natural gas as the primary source for heating their homes.[4] Oregon produces no natural gas of its own and must import its entire supply from out-of-state. Oregon's natural gas is produced in British Columbia, Alberta, Wyoming, Colorado, and New Mexico, and is transmitted to Oregon via an interstate pipeline system.

[3] https://www.portlandgeneral.com/our-company/energy-strategy/smart-grid/salem-smart-power-center

[4] U.S. Energy Information Administration, *State Energy Data System* (Washington, DC: U.S. Energy Information Administration, 2011).

Marion County has two major gas transmission pipelines. Distribution lines are located throughout the county.

Summary Considerations:

- Oregon imports 100 percent of its petroleum and natural gas, but generates most of its own electricity.
- Salem generates almost no electricity, and over half of its electricity supply is dependent on fossil fuels.
- Local generation and storage of electricity through on-site generators, solar panels, fuel cells, battery arrays, and other technologies can provide a way for individual facilities to diminish their vulnerability to electrical supply disruptions. Adoption of these technologies is far from universal; a widespread or long-term electrical outage would likely have severe consequences.
- The Puget Sound refineries provide more than 90 percent of Oregon's refined petroleum products, and it operates at about 95 percent capacity.
- About one-third of Oregonians residents use natural gas for heating, and Salem's natural gas supply is dependent a on a single pipeline.
- Salem depends on the road network for deliveries of petroleum products, and for deliveries of liquefied natural gas (LNG) if the natural gas network is disrupted. A petroleum pipeline travels through Salem but has no outlet there.

Vulnerabilities and Risk Assessment

The energy sector's vulnerability was assessed through scenario planning, which included a chronic event and a catastrophic event.

Chronic Hazard: Winter/Ice Storm

The energy sector has fared well in recent winter storm events. On its own, a winter storm poses risk, but the negative impacts are often geographically isolated, limited to the electricity, and easily recovered from. For example, a winter storm might bring freezing rain, sleet, and ice which accumulates on tree branches, causing them to break and possibly damage power lines. Flooding as a result of snow melt poses a potential risk primarily due to impacts on the transportation system.

Damaged transportation infrastructure or the potential for limited road access in the event of a winter storm is the energy sector's primary vulnerability. Transportation access is particularly a concern in rural areas that are accessible via bridges or singular roads. Energy providers must coordinate with transportation departments and public works crews to ensure roadways are passable prior to responding to damage or power outages.

Overall, energy sector recovery occurs relatively quickly during winter storm events as there are established protocols, trained personnel and equipment needed to respond and adapt to the event.

Catastrophic Hazard: Cascadia Earthquake Event

Currently, the energy sector is extremely sensitive to a Cascadia subduction zone event or other large local earthquake. Energy infrastructure and facilities are highly sensitive to violent shaking and liquefaction. Notably, significant portions of Marion County are susceptible to liquefaction

during a large magnitude earthquake. An event of this size is expected to have significant impacts to all energy transmission, distribution, and storage facilities. The unpredictability of the Cascadia event stems from the inability to properly estimate individual facility impacts. As a result, the energy sector must work towards establishing hazard mitigation, infrastructure resilience, and coordinated response efforts that anchor their ability to provide service. The following vulnerabilities demonstrate points of weakness and opportunities for mitigation within the energy sector.

First, damaged transportation infrastructure or the potential for limited road access in the event of a Cascadia earthquake leaves the energy sector extremely vulnerable. This is particularly a concern in rural areas that are accessible via bridges or singular roads. Some of these roads and bridges are not seismically sound, or are located in areas that would be difficult to get supplies and repair vehicles and personnel to.

Marion County lacks energy independence; it is reliant on hydroelectric power, liquid fuel, and natural gas inventories that are supplied from outside of the County. Generators can be used in an emergency event. However, these depend on fuel to run. As a result of Oregon's current practices for storing fuel, a large earthquake event will lead to drastically lessened access to fuel. It is highly likely the fuel supply will be significantly limited and prioritized for emergency response and recovery following an event.

Mitigation Opportunities

The energy sector assessment identified several potential mitigation opportunities.

Compare, crosswalk and maintain critical facilities lists

BPA, Marion County and other state and local partners maintain lists of critical facilities. Some agencies prioritize those critical facilities for emergency response and recovery resources, including electricity and other energy sources. Participants expressed a desire to compare and coordinate those critical facilities lists to ensure consistency.

Develop and maintain a "no-disconnect" list

At present, electric and natural gas utilities disconnect service after periods of non-payment. Vulnerable populations, particularly those that require electricity for medical equipment, can be placed a significant risk if service is disconnected. Developing a strategy to ensure that critically vulnerable populations are not disconnected from electrical service, even if they are unable to pay for service, is needed.

All-hazard risk assessment for critical energy infrastructure

Stakeholders indicated that additional risk assessment information is needed across a range of hazards and infrastructure sectors. Specifically, there is a desire for a "bulk upload spreadsheet" where assessment information can input.

Source additional funding for tree trimming projects

Participants acknowledged that additional funding is needed for hazard-tree trimming projects. Because power outages disproportionately impact vulnerable populations, these funds should be prioritized for improving electrical system resilience for vulnerable populations.

Innovation project: Utilize used batteries tied to solar generation for backup power

Sector participants discussed how innovation could be used to increase local or micro-energy resilience. One participant observed that forklift, golf-cart and other batteries are often replaced prior to the end of their useful life. Batteries of this size are capable of storing significantly more

power than smaller car batteries. This project would assess the feasibility of utilizing used industrial batteries for backup power.

LIFELINE SECTOR: COMMUNICATION

The communication sector facilitates the rapid exchange of information across a broad range of systems and technologies. These include: broadcast television and radio, telephone, cellular phone, cable, internet, two-way radio, and Ham (or amateur) radio.

Assessment Snapshot

Communication Sector Summary

Critical Interdependencies:	**Critical Vulnerabilities:**
Systems of all types are dependent on other systems in order to function. In order to operate, the communication sector is particularly <u>DEPENDENT ON</u>: • Electricity • Energy (fuel) • Transportation **Other critical lifeline sectors that <u>DEPEND ON</u> the communication sector to operate include:** • Water (SCADA) • Electricity • Public Safety and Emergency Management • Transportation • Economy	**Each sector is vulnerable to a variety of impacts. The communications sector is particularly vulnerable to the following:** • All systems rely on electricity for operation and maintain generators for backup power. Generators rely on fossil fuels to operate leading to questions about what systems and services would be prioritized for gasoline/diesel fuel use if there were a disruption to fuel supply. Also, some generates operate on propane or natural gas, neither of which are included in state or federal energy assurance plans. • All systems rely on infrastructure (towers, antennae) spread across large areas, often in remote locations. Road access to repair equipment is a primary concern • 911 service and other emergency communication relies on line-of-site microwave transmission. Even small changes in antennae alignment can disrupt transmission and require recalibration to re-establish connections between towers. Fiber infrastructure is vulnerable to earthquake damage, in particular where lines are connected to bridge spans.

Major Findings:

- Many providers share infrastructure and or have their infrastructure co-located.
- Stakeholders are well prepared to address winter storms and other disasters as long as there is access to their facilities. Transportation, water, and energy are equally dependent on communication infrastructure. In addition, trees, wind and ice are hazards that can impact this lifeline.
- During a power outage, battery and generator backups provide limited power for a varying duration of time depending on the fuel source and capacity. Redundancy is a needed resource for critical infrastructure that requires access and the supply of multiple fuel types, primarily gasoline and diesel. Notably, propane is a fuel source for some generators; however, propane will not be provided through state resources. Some generates operate on propane or natural gas, neither of which are included in state or federal energy assurance plans.
- All providers anticipate a 75-100% shut-down after a Cascadia event. Due to the roads and bridges being impassable, network connections could be severed.
- Largest barriers to respond in a Cascadia event include: staff ability to respond, access to facilities, shortage of supplies to repair infrastructure, time, funding, and political support.
- Stakeholders recognize that their staff and families need to be prepared. To address this need, they are supporting a proactive approach to disasters. In particular, the Communications sector is working to train employees to be prepared for disasters so they can address their own immediate needs before safely addressing the needs of the sector post-event.
- Some towers have fiber optic lines as a redundancy. However, these lines are vulnerable in a catastrophic earthquake, in particular where lines are connected to bridge spans.
- Water infrastructure systems rely on communication for operations and maintenance through a “Supervisory Control and Data Acquisition” (SCADA) system. The system provides remote monitoring and control of the water system components. Radio system capability is needed for these systems to operate effectively. Much of this infrastructure is isolated. For example, Salem’s infrastructure is located on an island.
- Amateur Radio provides critical back up to public safety radio communications in a disaster, but does not provide the necessary capacity to meet emergency management needs. Jurisdictions should consider investing in satellite voice and data capabilities.
- Local servers may be damages in an earthquake. Jurisdictions should consider "cloud based" data storage solutions to backup vital records.

Introduction

Communication is an essential aspect of virtually all public and private sector activities. The ability to communicate is especially critical during an emergency. Notably, FEMA's Emergency Support Function #2 – Communications specifically supports the restoration of communications infrastructure. The scope of ESF #2 includes, "restoration of public communications infrastructure" and assisting "State, tribal, and local governments with emergency communications and restoration of public safety communications systems and first responder networks."[5]

This assessment focusses on (1) the adaptive capacity of the communications sector, (2) hazard-specific vulnerabilities to communication infrastructure, and (3) mitigation opportunities that can support uninterrupted or rapid restoration of communication capability during or following emergency or disaster event.

Primary Agencies and Organizations

The following organizations and agencies participated in this assessment:

- Capital Community Television (CCTV)
- Amateur Radio Emergency Service (ARES)
- Marion Area Multi-Agency Emergency Telecommunications Dispatch Center (METCOM 911)
- Santiam Canyon Phone
- Willamette Valley Communications Center (WVCC)
- Frontier
- Verizon
- Oregon Statewide Inoperability Coordinator (SWIC)
- Service Master of Salem
- Pacific Gas and Electric Company (PGE)

Sector Description

The communication sector consists of many primary infrastructure components, including microwave and radio frequency antennas, cable and fiber optic lines, routers, switches, and more.

Many communication providers share infrastructure, poles and lines, or have their infrastructure collocated. Additionally, energy providers often share poles and wires with communication providers. While local private-sector communication providers often have emergency response agreements with their national or parent organization (e.g. Frontier and Verizon) most public sector communication providers (e.g. ARES and METCOM 911) have to maintain and repair their own networks in the event a hazard disrupts service.

A point heavily emphasized to the project team, particularly by METCOM 911 (which dispatches and maintains communication links for 29 different agencies throughout Marion County), is that their entire network is connected through microwave transmission. This infrastructure relies on networks of relay stations that require line-of-site connections to operate. Therefore, a single

[5] FEMA, Emergency Support Function #2 – Communications Annex. 2008. https://www.fema.gov/pdf/emergency/nrf/nrf-esf-02.pdf.

point failure resulting from a loss of relay station alignment could mean that a large portion of the network is down until the facility can be accessed and repaired.

Additionally, some communication providers have systems that rely on selective routing. This means that their cell towers send signals to an electric router in Portland and then back to Marion County. The providers who use this method have limited control over this portion of the process until it reaches their facility. For those who use or can access C4 routing, 80 percent of the calls are wireless.

The HAM/amateur radio network (ARES) utilizes VHF/UHF technology. VHF/UHF utilizing a repeater enables communication ranges of 100+ miles; HF facilitates communication from 100+-3000+ miles w/o a repeater. There are 100 or more repeaters across the state, which are managed through the State Repeater Coordinating Council, an independent HAM radio body. The channels are open and are non-secure. However, the HAM radio network can establish repeater sites, which allow the portable network to link over hills and create a statewide network that can be linked remotely with radio. These radio repeaters are often collocated with 911 towers and have a battery life of six to twelve hours. Some operators have cross band repeaters, which can extend their communication range anywhere from three to forty miles, depending on where repeaters are placed. HAM radios can also use digital signals and non-voice communication, which sends information in a format similar to email. At this moment, there is a long waiting list for volunteers to access a limited number of frequencies. Locations and frequencies are managed on a first come, first serve basis through the State Repeating Coordinating Council.

Adaptive Capacity

Adaptive Capacity refers to a system's ability to accommodate a new or changing environment, exploit beneficial opportunities, or moderate negative effects.

In general, the communications sector exhibits a high degree of adaptive capacity. This is primarily the result of the diverse and redundant nature of communication infrastructure. For example, sector stakeholders indicated that much of the communication equipment is redundant across the system. Further, many of the systems components (e.g. towers, switches, etc.) have both primary and secondary power sources. This facilitates signal rerouting when needed. Further, the mix of deployed technologies, public and private sector vendors, and redundant equipment all contribute to the sector's ability to adapt to a range of potential impacts.

Within specific geographic areas (such as the Santiam canyon) or infrastructure components (e.g. cable), some adaptive capacity is lost. Participants reported that this is primarily due to single points of failure or lack of redundant equipment.

System Vulnerabilities

The assessment team evaluated the communication sector's vulnerability using a scenario planning approach which included one chronic event (winter/ice storm) and a catastrophic event (9.0 Earthquake).

Interdependencies

Systems of all types are dependent on other systems in order to function. In order to operate, the communication sector is particularly *dependent on*:

Energy: Electricity and Fuel

Communication equipment requires power to operate. If the power grid is down and backup power is not available through generators, batteries or other sources, system components will not function. During a power outage, battery and generator backups provide limited power for a varying duration of time depending on the fuel source and capacity. Energy redundancy is a needed resource for critical infrastructure that requires access and the supply of multiple fuel types, primarily gasoline and diesel. Notably, propane is a fuel source for some generators; however, propane will not be provided through state resources.

Transportation

Sector stakeholders indicated that if they can get repair crews, equipment and power to their system components, they can generally restore service quickly. However, many system components are located in remote locations with limited access under normal circumstances. Any disruption to the transportation network can limit or delay restoration of the communication network. Further, where communication infrastructure is collocated within the transportation network (e.g. buried cable within a road right-of-way), damage to the transportation facility can disrupt communication service.

Water

Water infrastructure systems rely on communication for operations and maintenance through a "Supervisory Control and Data Acquisition" (SCADA) system. The system provides remote monitoring and control of the water system components. Radio system capability is needed for these systems to operate effectively. Much of this infrastructure is isolated. For example, Salem's infrastructure is located on an island.

Vulnerabilities

Chronic Hazard: Winter/Ice Storm

Many stakeholders indicated that they are well prepared to address winter storms. Winter storms are common in the region and communication providers have significant experience maintaining and repairing infrastructure during such events. Further, the Communications sector actively mitigates storm related impacts through ongoing risk reduction actions. For example, communication service providers often partner with utility providers to trim trees near above-ground communication lines. Downed trees were also a concern and therefore, monitoring tree health and stability is a part of this maintenance program.

Another factor that may affect addressing the impacts of a winter storm on service is the ability of communication agencies to access critical facilities and infrastructure via roads. While this is a minor concern, as Marion County Public Works has a number of snow plows and snow cats, many communications providers recalled the 2008 winter storm in which Interstate 5 was largely inaccessible. However, this can be remedied by the ability to take alternative routes and if necessary, using snow chains or snowmobiles to access sites. That being said, residents of Marion County who live in rural areas may experience communications outages for up to a week until utility providers can repair their systems.

Power disruptions are also a concern for this sector because their ability to deliver service and respond to emergencies is contingent on consistent access to power. If the power goes out, there is limited battery backup and available generators, which could generate power for up to ten hours. For example, Frontier stated that while rural facilities have batteries, they do not have portable generators and teams must travel to those facilities to deploy emergency generators. Yet, many providers have disaster checklists and train their staff on how to implement their internal and external crisis communications plans. Their reaction depends on the size of the storm and providers have the capability to scale up or down as needed. Additionally, restoring communications is prioritized based on the importance of the infrastructure. Ensuring hospitals, police and fire departments, and other critical community assets have access to communications is prioritized over restoring residential communications.

Another concern in regard to a winter storm is that those who work for communications providers may not live nearby and therefore could have trouble getting to work. This means that these providers may be working with limited staff, making it more difficult to restore and maintain operations. Although some providers do require their staff to have emergency kits at home, this is implemented on an ad hoc basis.

Catastrophic Hazard: Cascadia Earthquake Event

There was overwhelming consensus that the communication sector in general is not adequately prepared for a Cascadia earthquake event. Many expressed a range of concerns, including:

- "The State of Oregon is unprepared. DOGAMI mentions almost every bridge and road. Salem does have several mobile-com centers, which is the only positive."
- "Nobody knows. It depends on how devastating [Cascadia is]."
- "It would cost millions to replace the system. Equipment replacement would be costly and would take weeks to acquire the necessary replacements."
- "We have a lack of redundancy in the communication system. There is a time delay to activate backup systems and we have a training deficiency."

Every provider and agency in the meeting is anticipating a 75 to 100 percent shutdown in operations in the event of a Cascadia earthquake. While many are taking steps to prepare for Cascadia, these efforts are slow moving and limited by a variety of factors. Steps that have been taken or are being taken to reduce vulnerability to a Cascadia earthquake event include:

- Plans for system improvements to infrastructure over next fifty years
- Establishing similar timing and synchronism with other sectors
- Developing a standard set of planning assumptions
- Implementing a system for fuel coordination with other communications agencies and ensuring that sites have an emergency fuel supply
- Each entity will take on the responsibility of re-establishing a priority system or infrastructure piece

The biggest barriers for adequately responding to a Cascadia earthquake event include:

- Lack of regulations and decision-making protocol,
- Funding for operations and maintenance (particularly for public systems),
- Access to capital for mitigation activities, and
- Political will to prioritize mitigation activities.

While there are limited state and federal resources, these are not always readily accessible or easy to obtain due to availability or priority.

One of the largest concerns raised by the group was the lack of coordination across the sector. The mix of public, private, and volunteer entities compounds the issue. Sector participants indicated that there are very few conversations focused on building partnerships and relationships within the communications sector. For many, the sector meeting was the first time they had met or talked to representatives from other agencies, companies or groups. The group agreed that coordinated partnership building and collaboration will be necessary in order to mitigate hazard impacts across the sector. This is particularly true in the case of planning for a Cascadia earthquake event. Building partnerships also provides an opportunity to pool resources and potentially labor, especially since many of the agencies and organizations that were interviewed have collocated facilities.

Another concern was the ability to maintain service in the event of a hazard. Many discussed the importance of determining how to access locations that are blocked in the event of a hazard; how to maintain critical service connections, particularly after a catastrophic event; how to get signals out if landlines are disrupted; and, how to get labor from facilities and out to citizens. Further, sector representatives anticipate that they will experience staff shortages following an event.

Other concerns included education and outreach, particularly on educating the public on what is an emergency and what isn't. Moreover, organizations, such as ARES, struggle with recruiting new volunteers and training individuals on HAM radio operation. Additionally, while they do have a volunteer base, they lack equipment.

Mitigation Opportunities

The communications sector representatives identified a number of potential mitigation opportunities.

Joint Utility Liaison

Sector representatives indicated that creating a Joint Utility Liaison position could be an important first step in promoting coordination. The purpose of the position would be to share information across sector providers and coordinate regular meetings. Many representatives indicated that the primary value of the risk assessment process was the simple act of sitting down together to discuss the issues – system vulnerabilities, mitigation priorities and lessons learned. However, the group noted that "meeting for the sake of meeting" would not be productive. Further, the group indicated that regular coordination was unlikely without a person dedicated to coordinating sector stakeholders and facilitating the discussion. The group expressed support for a quarterly meeting schedule.

This action was deemed a high priority by the communication sector participants. When this action is implemented with the communication sector, CPW recommends instituting a facilitation approach such as the Purdue University "Strategic Doing" model.[6] Strategic Doing, "teaches groups how to form collaborations quickly, move them toward measurable outcomes and make adjustments along the way." The model is intended to design and guide networks that generate innovative solutions. With Strategic Doing, people:

[6] Strategic Doing is, "a new strategy discipline specifically designed for open, loosely-connected networks. Unlike strategic planning that was designed primarily to guide strategic activity in hierarchical organizations, Strategic Doing is designed for situations in which nobody can tell anybody else what to do. Collaboration is the only way to move forward."

- Link and leverage their assets to create new opportunities
- Convert high-priority opportunities into measurable outcomes
- Define pathfinder projects that move toward these outcomes

In short, the Strategic Doing is designed for open, loosely connected networks like what currently exists within the communications lifeline sector in Marion County.

Special Communication District

Because funding was cited as an issue (particularly for public agency representatives) some stakeholders suggested exploring the feasibility of a Communication District. The purpose of the district would be to generate funds needed for ongoing system maintenance, equipment modernization and hazard mitigation activities (such as site hardening, redundant power supplies and training).

FirstNet Resources

Signed into law as part of the February 22, 2012 Middle Class Tax Relief and Job Creation Act, the First Responder Network Authority (FirstNet) has a mission to, "build, operate and maintain the first high-speed, nationwide wireless broadband network dedicated to public safety."[7] The FirstNet vision is to provide a single interoperable platform for emergency and daily public safety communications. Marion County communication sector representatives support mitigation actions that leverage FirstNet funding to support the "hardening" of local communication infrastructure. This approach would meet FirstNet's task to leverage existing telecommunications infrastructure and assets. The approach also includes the exploration of public/private partnerships, which is consistent with the Joint Utility Liaison approach advocated above.

Leverage Department of Energy Clear Path IV Exercise and ESF 12

The Department of Energy is facilitating a series of exercises across the nation to address hazard impacts and other challenges to the energy sector. Because the communications sector is so heavily dependent on electricity and fuel (primarily gasoline and diesel), stakeholders indicated that participation in the Clear Path IV Cascadia Subduction Zone (CSZ) exercise could help focus attention on needed public/private sector collaboration.

UPDATE: ClearPath IV occurred April 19-20, 2016. Marion County participated directly in the exercise. While communication sector stakeholders are not specifically listed in the exercise participant list, one on the key recommendations includes improved coordination with, "agencies and organizations providing critical services in support of energy restoration."[8]

Training

Participants identified the need for additional training of staff and personnel. In some cases, there are limited numbers of technicians with the expertise needed to repair specific communication components. Further, the number of HAM operators is declining. Finally, fewer young people are entering the communication trades. Stakeholders expressed a need for additional training of the existing workforce, as well as the need to encourage new interest in the industry.

Coordinate Planning Assumptions

[7] http://www.firstnet.gov/about

[8] U.S. Department of Energy. *Clear Path IV Energy-Focused Disaster Response Exercise – Exercise Summary Report*. 2016. http://energy.gov/sites/prod/files/2016/08/f33/ClearPathIV_Exercise%20Summary%20Report_Public%20Release.pdf

Communication sector stakeholders indicated that agreement about hazard planning assumptions is needed. While there was general consensus about the range of vulnerabilities across the sector, assumptions about specifics varied. Stakeholders identified energy availability (including fuel), staff/personnel availability, and infrastructure impacts as potential planning topics that could benefit from shared understanding for planning purposes.

Networks

The primary theme in the assessment of the communication sector was the critical importance of networks. Because of the interconnected nature of communication technology and the sector's reliance on energy and transportation, as well as its critical importance to the water system, developing and maintaining relationships was identified as a critical strategy. Stakeholders reinforced the importance of pre-event relationship building. This can only occur through regular interaction, common operating assumptions and co-production of strategy options. Using a State Homeland Security Grant, Marion County will develop a Marion County Communications Plan in FY17-18. This planning will provide an opportunity to develop a comprehensive strategy to build capability and mitigate vulnerabilities as well as sustain further stakeholder engagement.

APPENDIX G: COMMUNITY SURVEY

Survey Purpose and Use

The purpose of this survey was to gauge the overall perception of natural disasters, determine a baseline level of loss reduction activity for residents in the community, and assess citizen's support for different types of individual and community risk reduction activities.

Data from this survey directly informs the natural hazards mitigation planning process. Salem can use this survey data to enhance action item rationale and ideas for implementation. Other community organizations can also use survey results to inform their own outreach efforts. Data from the survey provides the City with a better understanding of desired outreach strategies (sources and formats), and a baseline understanding of community perceptions of natural hazards and resilience.

Background

Citizen involvement is a key component in the NHMP planning process. Citizens should have the opportunity to voice their ideas, interests and concerns about the impact of natural disasters on their communities.

According to Bierle[1], the benefits of citizen involvement include the following: (1) educate and inform public; (2) incorporate public values into decision making; (3) substantially improve the quality of decisions; (4) increase trust in institutions; (5) reduce conflict; and (6) ensure cost effectiveness.

The NHMP planning process provided opportunities for the public to engage through an on-line survey disseminated by Salem.

Methodology

In the spring of 2017, the Oregon Partnership for Disaster Resilience (OPDR) administered the survey via the on-line tool (Qualtrics). The survey was distributed via social media and the City's website. Survey respondents were received from a total of 101 respondents (97 responses were complete and four responses were incomplete). Of the complete responses, 94 (97%) lived in Salem, three (3%) did not live in Salem.

The survey consisted of seven questions. Salem designed the survey to determine public perceptions and opinions regarding natural hazards and mitigation priorities.

[1] Bierle, T. 1999. "Using social goals to evaluate public participation in environmental decisions." *Policy Studies Review*. 16(3/4), 75-103.

The intent of this survey was not to be statistically valid but instead to gain the perspective and opinions of residents regarding natural hazards in the region. Our assessment is that the results reflect a range attitudes and opinions of residents throughout the City.

Survey Results

This section presents the compiled data and analysis for the 2017 Salem NHMP Public Opinion Survey. We provide a copy of the survey instrument is provided as Attachment A.

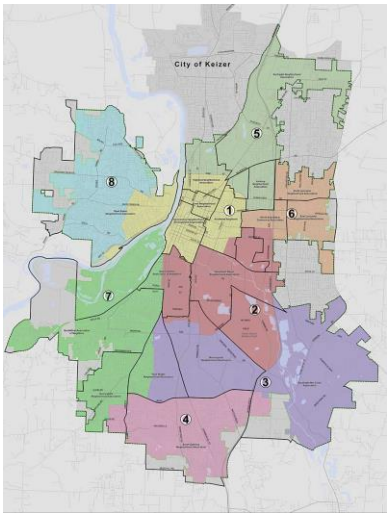
Respondent Characteristics

Most respondents (97%) indicated that they live in Salem. The four wards with the most respondents were: Ward 8 (22 respondents), Ward 1 (20 respondents), Ward 7 (17 respondents), and Ward 4 (11 respondents).

Table G-1 Respondent Place of Residence (97 respondents)

Answer	Count	Percent
Ward 1	20	20.6%
Ward 2	5	5.2%
Ward 3	9	9.3%
Ward 4	11	11.3%
Ward 5	2	2.1%
Ward 6	4	4.1%
Ward 7	17	17.5%
Ward 8	22	22.7%
I do not know which ward I live in	4	4.1%
I do not live in Salem	3	3.1%
Total Responses	**97**	**100%**

Source: 2017 NHMP Public Opinion Survey

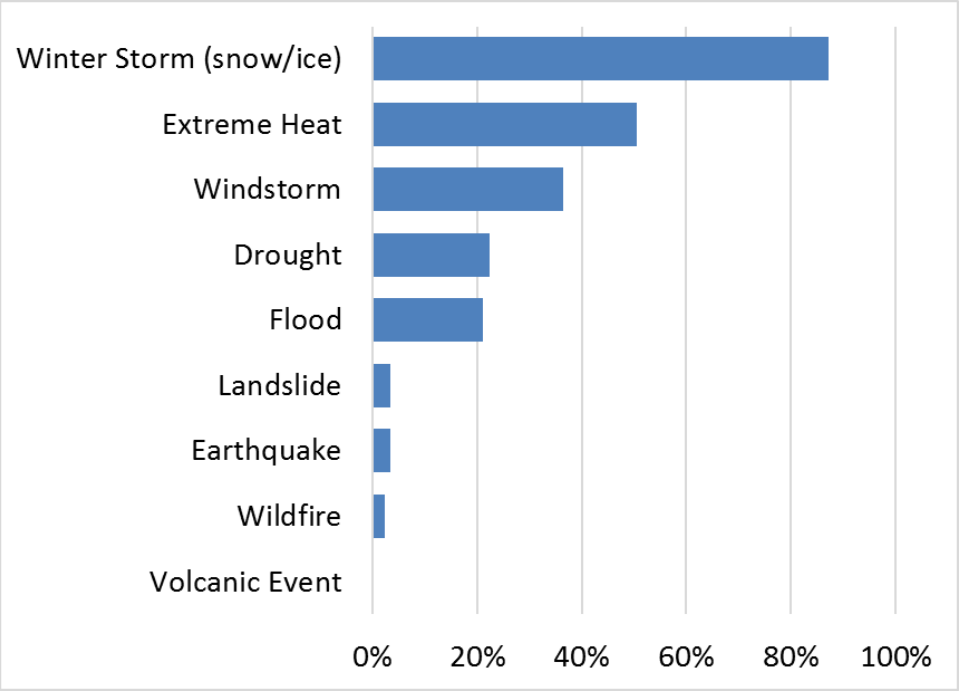


Natural Hazard Information

This section reports the experiences of survey respondents involving natural hazards, and their exposure to preparedness information.

The survey asked respondents to indicate which natural hazards they, or a member of their household, has experienced in the past ten (10) years. Figure G-1 shows that 87% of respondents have experienced a winter storm (snow/ ice) event in the previous 10 years, while substantial percentages of respondents have experienced extreme heat (51%), and windstorms (36%). Fewer respondents have experienced droughts (22%), and floods (21%). Few respondents have experienced landslides (4%), earthquakes (4%), or wildfires (2%). No respondents experienced a volcanic event.

Figure G-1 Household Natural Hazard Experience previous 10 Years
(85 respondents)



Source: 2017 NHMP Public Opinion Survey, analysis by OPDR

The survey asked respondents to indicate their level of concern about natural hazards that impact Salem. Table G-2 shows that the hazards of highest concern for respondents include earthquakes (84% Very Concerned and Somewhat Concerned), and winter storms (snow/ ice, 68% Very Concerned or Somewhat Concerned). Approximately half of all respondents were also Very Concerned or Somewhat Concerned about the extreme heat, drought, windstorm, and flood hazards. Respondents were least concerned about the volcanic event, landslide, and wildfire hazards.

Table G-2 Hazards that Concern Respondent the Most

Hazard	Very Concerned	Somewhat Concerned	Not Very Concerned	Not Concerned	Total Responses
Drought	13%	**41%**	**31%**	16%	95
Earthquake	**51%**	33%	14%	2%	96
Extreme Heat	15%	**40%**	**35%**	10%	94
Flood	16%	**34%**	**38%**	12%	94
Landslide	12%	21%	**32%**	**36%**	92
Volcanic Event	5%	13%	**40%**	**41%**	92
Wildfire	9%	**25%**	**39%**	**27%**	92
Windstorm	12%	**41%**	33%	15%	95
Winter Storm (snow/ice)	14%	**54%**	**27%**	5%	96

Source: 2017 NHMP Public Opinion Survey, analysis by OPDR

Mitigation Efforts

The survey asked respondents to indicate what types of facilities are most important to them. Hospitals (95% Extremely Important and Very Important), fire stations (91% Extremely Important and Very Important), police stations (85% Extremely Important and Very Important), and major bridges (83% Extremely Important and Very Important) were rated the most important. About 75% of the respondents also rated housing and schools as Extremely Important or Very Important.

Table G-3 Facilities Ranked by Level of Importance to Respondent

Facility Category	Extremely important	Very important	Moderately important	Slightly important	Not at all important	Total Responses
Elder-care facilities	25%	**32%**	28%	9%	5%	95
Schools (K-12)	**44%**	31%	16%	4%	5%	95
Hospitals	**73%**	22%	3%	2%	0%	97
Major bridges	**61%**	22%	13%	4%	0%	95
Fire Stations	**65%**	26%	7%	1%	1%	96
Police Stations	**55%**	30%	10%	3%	2%	97
Historic Buildings	5%	19%	**40%**	20%	15%	94
Large employers	5%	23%	**42%**	20%	9%	95
Small businesses	10%	**35%**	**35%**	18%	2%	94
Housing	**42%**	**34%**	16%	7%	1%	96
Other	**54%**	13%	7%	4%	22%	46

Source: 2017 NHMP Public Opinion Survey, analysis by OPDR

A total of 46 “Other” responses were provided by respondents. Below is a list of the facility categories that were list as “Other”:

- Animal Shelters
- Bike infrastructure
- Bikeways
- Churches and Other Community Gathering Places
- Drinking water supply
- Ecological resources
- Equality and justice in mitigation
- Ferrying
- Food supply
- Fuel supply
- Grocery stores/ supply chains
- Healthcare for poor
- Highways, including I-5
- Hospitals - medical and mental
- Houselessness recourses
- Hunger
- Infrastructure
- Library
- natural areas
- Pet care
- Poverty reduction
- Power Plants - electricity
- Power supply
- Prepared neighbors
- Prisons/jails
- Public Library
- Public parks
- Public Utilities - Water, Sewer, Electricity
- resources - Water & electricity
- Roads
- Sidewalks
- Social services
- Utilities
- Utility Centers
- Ways to get around without a car

Table G-4 shows respondent level of agreement to a variety of regulatory and non-regulatory mitigation activities/approaches. In general, respondents strongly agreed and agreed with the majority of listed mitigation activities/approaches. Slightly more than half (57% strongly agree or agree) of the respondents support regulatory approaches to reducing risk, while slightly less the half (44% strongly agree or agree) support non-regulatory approaches to reducing risk. About three-quarters (73% strongly agree or agree) support a mix of regulatory and non-regulatory approaches to reduce risk. While 83% of respondents strongly agree or agree with policies to prohibit development in areas subject to natural hazards, only 18% strongly agree or agree with the use of tax dollars to compensate land owners for not developing in areas subject to natural hazards. Conversely, just over 75% of respondents strongly agree or agree with the use of tax dollars to reduce risks and losses from natural disasters. Just over half (55% strongly agree or agree) of respondents support protecting historical and cultural resources. Over 90% of respondents (92% strongly agree or agree) would be willing to make their home more disaster resilient. The vast majority of respondents support safeguarding the local economy following a disaster event (85% strongly agree or agree). Respondents also support safeguarding local schools (92% strongly agree or agree) and maintaining a local inventory of at-risk buildings and infrastructure (85% strongly agree or agree).

Table G-4 Level of Support for Regulatory and Non-Regulatory Mitigation Activities

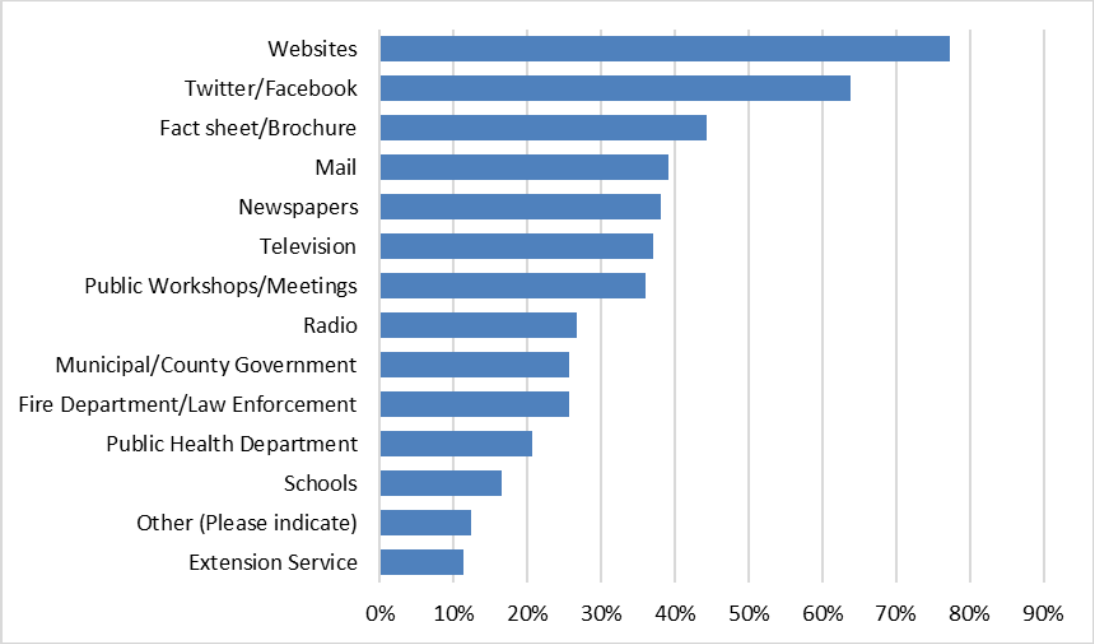
Mitigation Activity/Approach	Strongly agree	Agree	Neither agree nor disagree	Somewhat disagree	Disagree	Not sure	Total Responses
I support a regulatory approach to reducing risk	**28%**	**29%**	19%	10%	8%	5%	96
I support a non-regulatory approach to reducing risk	19%	25%	**31%**	11%	6%	7%	96
I support a mix of both regulatory and non-regulatory approaches to reducing risk	**38%**	**35%**	11%	4%	7%	4%	96
I support policies to prohibit development in areas subject to natural hazards	38%	**45%**	9%	5%	2%	1%	94
I support the use of tax dollars (federal and/or local) to compensate land owners for not developing in areas subject to natural hazards	5%	13%	**26%**	**24%**	**29%**	2%	95
I support the use of local tax dollars to reduce risks and losses from natural disasters	26%	**50%**	6%	12%	4%	2%	94
I support protecting historical and cultural structures	11%	**45%**	24%	9%	11%	1%	94
I would be willing to make my home more disaster-resistant	**44%**	**48%**	5%	0%	2%	1%	96
I support steps to safeguard the local economy following a disaster event	**36%**	**49%**	11%	0%	3%	1%	95
I support improving the disaster preparedness of local schools	**56%**	**35%**	3%	2%	2%	1%	96
I support a local inventory of at-risk buildings and infrastructure	**48%**	**37%**	9%	2%	3%	0%	95

Source: 2017 NHMP Public Opinion Survey, analysis by OPDR

Communication

Finally, the survey asked respondents to indicate which form of communication is most effective for them to receive information about reducing the impacts of natural disasters. Respondents could choose as many options as applied. As shown in Figure G-2, most respondents (77%) indicated that websites were their preferred method of communication, followed by social media (Twitter/Facebook, 64%). Next, respondents preferred fact sheets/brochures (44%), mail (39%), newspapers (38%), television (37%), and public workshops/meetings (36%).

Figure G-2 Respondent Preferred Communication Method



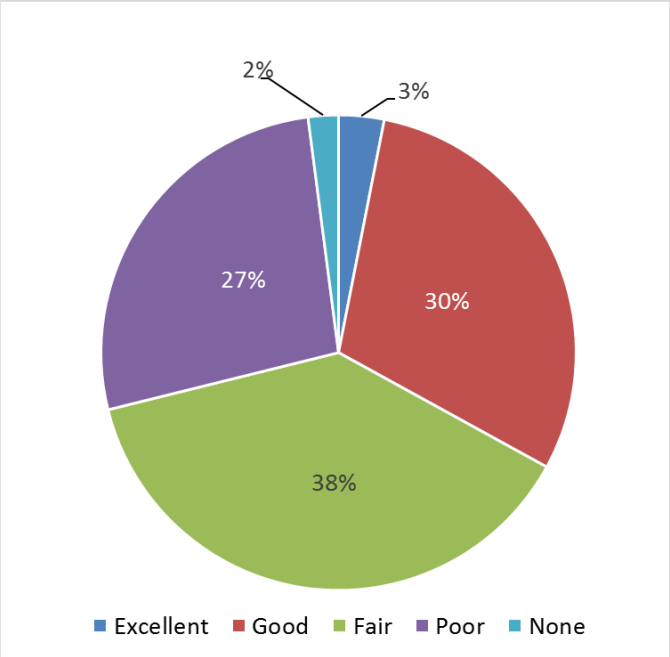
Source: 2017 NHMP Public Opinion Survey, analysis by OPDR

There were a number of respondents that listed "other" as their preferred communication method. The following are the responses provided for "other":

- Books
- Done in One
- Email
- email
- Neighborhood association meeting
- Neighborhood associations, neighborhood watch
- Next door.com
- Red Cross
- Salem Chamber
- Text
- Websites with video information on various topics perhaps about 7-10 minutes in length for each topic. I think it would be better to have multiple short topic videos than to have longer ones which half of the people won't watch.
- YouTube

The survey asked the respondents to indicate how well the city is doing to educate people of the natural hazards they may face. Figure G-3 shows that about 70% of survey respondents believe their community is doing an "excellent" (3%), "good" (30%), or fair (38%) job educating the public about natural hazards. Just under 30% of respondents indicated that they feel that the city is doing a "poor" (27%) job at educating people about the natural hazards that they may face (2% of respondents felt the city was not educating people, "none").

Figure G-3 Respondent Perception of Community Natural Hazard Education Performance (97 respondents)



Source: 2017 NHMP Public Opinion Survey, analysis by OPDR

Respondents to this question were asked to explain their response as shown below:

- There is almost nothing on any local media. The city webpage is hard to navigate and to find good information. The overall plan for preparedness is not made available. It seems that there is little or no real plan of how to address such major disasters such as an earthquake.
- I moved in October (8 months ago) and have received no information regarding the risks to my area
- All the education I have on disasters is through browsing the internet or listening to talk radio. Lars Larson has guests that come on who talk about that kind of stuff.
- Have not seen much
- Earthquake preparedness through the Statesman Journal has been excellent, but I have seen little else.
- I think more resources should be used to get people on board regarding disaster preparedness. More forums, visiting neighborhood associations, having a place where people can come to get information and see what kinds of suppl[i]es they need & more information on actions that can help.
- Occasional outreach by CERT and Police/Fire are a good start but serious preparedness is not occurring.
- I've seen some preparedness tips in the news but not much else.
- This survey. CERT
- I have seen more information regarding this topic now that I am a City employee but never noticed anything about this topic while just being a citizen of the city.
- I do not agree with the fear generated by state and city employees over trivial weather events and possible events that never come to pass.

- Only because I have not/don't recall information specifically about hazards in Salem. I have not gone looking for info either so some personal responsibility is part of it. But for folks who are struggling with basic needs daily, disaster prep is so intangible and therefore unnattainable.
- I do not recall ever receiving a piece of mail from the city in this issue.
- Efforts occur but are underattended
- I see the City allowing development in flood prone and landslide prone areas, without much if any mitigation. There is a big gap between what is said and what is done. The mantra seems to be "development is good, whenever, wherever.
- One person is responsible for the City of Salem's emergency management. The local newspaper did an extensive series on emergency/earthquake preparedness over several months. How many people subscribe to the paper? My mother is in a memory care facility and, until I brought it up, they hadn't given much thought to earthquake preparedness, other than have something in a manual. I don't think the schools are prepared to house students until parents can get to the school and get them. I don't think multi-storied schools are prepared to evacuate students out windows via rope ladders if the exits are impassible. How are they going to reach parents with cell towers down and computers not functioning. Do they have paper records? I live near the state hospital and two prisons; I'm concerned that the physical structures might not withstand an earthquake. Staff at all of the above are going to be conflicted: be with family or go to work. I know that there have been a few events focused on emergency preparedness. I wish that EVERY community event throughout the city would have a representative there with materials to reach more people (i.e., movies in the park, festivals at the large city park, art fair). In order to get disaster preparedness information, one must be proactive, searching for classes, which are generally held during the day. Schools could reach so many families, not only with information sent home with students, but with students sharing what they are learning about disaster preparedness in classes/work shops, but at school events. Let the students educate their families. Knowing what to expect and what to do reduces anxiety and fear.
- I am a CERT member. I know our community tries, but with the limited resource provided, it only goes so far.
- Salem is not working to educate or protect its resident about the dangers of climate change and earthquakes. The City appears to be driven by short term business interests and is not oriented toward developing a long term vision of resilience. Neighborhoods do not work together toward disaster preparedness (as in neighborhoods in the Bay area or Seattle, for example). Salem does not incentivize homeowners or workplaces to improve their preparedness. Salem is failing in these areas, and will suffer greatly when a large natural disaster strikes.
- The area CERT team is trying to spread the word to the city, but the program needs to be more of a priority.
- Not much going on that I know of.
- We have had several trainings at our church and have an Emergency Preparedness Committee.
- I am a state medical volunteer with SERV-OR. I am shocked that Salem has no plan as far as I know for reaching medical personnel for rapid response
- I've heard very little explicit discussion of natural hazards (response or preparedness) in Salem

- Keeping earthquake preparedness in the public eye.
- They are too worried about business and income to even see or investigate these things in salem
- We had a hard winter and I felt I was properly informed by the city of what to expect.
- I've never been educated on the topic
- I have not seen anything.
- CERT training, stream flow data online, speakers at neighborhood associations
- Could do better.
- The government should not have to babysit its residents. Provide the information and then it's my responsibility to be prepared.
- Public notices and alerts go out, decent news coverage
- The city of Salem seems to be ignoring emergency preparedness especially for the Cascadia earthquake. The library, cooperative extension and local non-profits have been very good about holding programs and making information available.
- "It's based on the fact that I do not see any communication to the public regarding topics of disasters. I do not get the newspaper and newspaper subscription has declined so I think it's important to get the word out in other ways. Due to the fact that half of our population is basically functionally illiterate according to NAEP, I think it is important to have information presented in easy to read content and visually informative. That's why I think a ton of YouTube videos would be extremely helpful along with a media blitz on Facebook and PSA announcements on the local radio referring people to a catchy website link that is very easy to remember and to spell. In this day and age when people have about a 2 minute attention span before getting bored, it's going to be tricky to get the information out to the people who need it the most..... those who won't read and look it up without being prompted to do so."
- I haven't seen any education.
- Too many people are not prepared for natural disasters. Would be good to have neighborhood groups that have plans and resources.
- Almost no information and little training by the city
- There is basic preparedness and conversation, but I am mainly concerned about the bridge to west salem.
- This is an issue I have studied for several years. Feel I am somewhat prepared, but I am always surprised when I learn some one doesn't prepare at all. I have no way of knowing how prepared other households are for a disaster.
- I have no information on what our resources are if a bridge goes out and my family is stuck in West Salem.
- I'm honestly not sure because we don't watch TV and I haven't seen anything online regarding preparedness in Salem/Marion County.
- As a CERT member for more than a decade I feel that Roger Stevenson (the Emergency Manager for the city of Salem) is doing an incredible job reaching out to the community.
- I don't think there's any information about preparing for disasters.
- Salem has a large inventory of unreinforced mason structures which pose a life-safety risk during an earthquake. No tangible effort has been made to develop an inventory of buildings, post warnings, provide rehab grants, etc. In the event of a large-scale earthquake hundreds or thousands of Salem residents could potentially

lose their lives in these structures and more effort should be made to ensure business owners and the public truly understand the risk. Some areas of California even require warning placards be placed on seismically deficient structures.

- Our community send out notices with basic information, and holds meetings once in awhile. However, I think more extensive mailings or notifications with details on how to prepare would be more helpful. Most people don't know how to get past the basic steps and don't necessarily have time for local meetings.
- We don't advertise or let the public know about anything. The city says no money. There is no incentive for anyone to get or stay trained. The disaster team is all volunteer except the city employee that is in charge of everything. Sad, there is no help.
- I believe there is a fine line between disaster preparedness and panic. The advertisements I have seen for "The big shake" are borderline panic inducing. Its important when finding ways to communicate the need of disaster-readiness to not over-do it. A more objective and informative approach might be helpful.
- "Fair" was as close as I could come to "I don't really know."
- The city and local paper has done a good job of at least getting preparedness on people's radar
- This email and survey is the first time that I have seen anything about the City's disaster preparedness planning

Conclusion

In general, the survey responses reinforced information collected by the plan update team. As indicated in the survey there are a significant percentage of respondents who feel that they city could do more to outreach to the community about natural hazards. The steering committee reviewed the survey results and incorporated the findings into discussions about the mitigation plan update. Specifically, the survey helped to inform the priority actions and contributed to the overall assessment of risk in the Salem.

ATTACHMENT A: SURVEY

Thank you for taking the time to complete this survey! The Oregon Partnership for Disaster Resilience at the University of Oregon is working with community leaders in Salem to update their Natural Hazard Mitigation Plan.

Mitigation plans outline community risk to natural hazards and outline potential actions the city can take to reduce risks to people, property and the local economy BEFORE the next hazard event (e.g., wildfire, winter storm, flood, earthquake, etc.) strikes.

Developing hazard mitigation plans enables state, tribal, and local governments to:

Increase education and awareness around threats, hazards, and vulnerabilities; Build partnerships for risk reduction involving government, organizations, businesses, and the public; Identify long-term, broadly-supported strategies for risk reduction; Align risk reduction with other state, tribal, or community objectives; Identify implementation approaches that focus resources on the greatest risks and vulnerabilities; and Communicate priorities to potential sources of funding.

To review the draft and existing Salem NHMP, please visit: http://opdr.uoregon.edu/salem_nhmp

We estimate that this survey should take about 10-15 minutes to complete.

If you have questions regarding this survey, please contact Michael Howard, Assistant Program Director with the University of Oregon's Community Service Center (mrhoward@uoregon.edu).

Q1. In the past 10 years, have you or someone in your household experienced any of the following natural hazards in this community? (Please check all that apply.)

- ❑ Drought
- ❑ Earthquake
- ❑ Extreme Heat
- ❑ Flood
- ❑ Landslide
- ❑ Volcanic Event
- ❑ Wildfire
- ❑ Windstorm
- ❑ Winter Storm (snow/ice)

Q2. Please indicate your level of concern about the following natural hazards.

	Very Concerned	Somewhat Concerned	Not Very Concerned	Not Concerned	Don't Know
Drought	❍	❍	❍	❍	❍
Earthquake	❍	❍	❍	❍	❍
Extreme Heat	❍	❍	❍	❍	❍
Flood	❍	❍	❍	❍	❍
Landslide	❍	❍	❍	❍	❍
Volcanic Event	❍	❍	❍	❍	❍
Wildfire	❍	❍	❍	❍	❍
Windstorm	❍	❍	❍	❍	❍
Winter Storm (snow/ice)	❍	❍	❍	❍	❍

Q3. Next, we would like to know what specific types of community assets are most important to you. (make one selection for each asset)

	Extremely important	Very important	Moderately important	Slightly important	Not at all important
Elder-care facilities	❍	❍	❍	❍	❍
Schools (K-12)	❍	❍	❍	❍	❍
Hospitals	❍	❍	❍	❍	❍
Major bridges	❍	❍	❍	❍	❍
Fire Stations	❍	❍	❍	❍	❍
Police Stations	❍	❍	❍	❍	❍
Historic Buildings	❍	❍	❍	❍	❍
Large employers	❍	❍	❍	❍	❍
Small businesses	❍	❍	❍	❍	❍
Housing	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍

Q4. A number of activities can reduce your community's risk from natural hazards. These activities can be both regulatory and non-regulatory. Please check the box that best represents your opinion of the following strategies to reduce the risk and loss associated with natural disasters.

	Strongly agree	Agree	Neither agree nor disagree	Somewhat disagree	Disagree	Not sure
I support a regulatory approach to reducing risk	❍	❍	❍	❍	❍	❍
I support a non-regulatory approach to reducing risk	❍	❍	❍	❍	❍	❍
I support a mix of both regulatory and non-regulatory approaches to reducing risk	❍	❍	❍	❍	❍	❍
I support policies to prohibit development in areas subject to natural hazards	❍	❍	❍	❍	❍	❍
I support the use of tax dollars (federal and/or local) to compensate land owners for not developing in areas subject to natural hazards	❍	❍	❍	❍	❍	❍
I support the use of local tax dollars to reduce risks and losses from natural disasters	❍	❍	❍	❍	❍	❍
I support protecting historical and cultural structures	❍	❍	❍	❍	❍	❍
I would be willing to make my home more disaster-resistant	❍	❍	❍	❍	❍	❍
I support steps to safeguard the local economy following a disaster event	❍	❍	❍	❍	❍	❍
I support improving the disaster preparedness of local schools	❍	❍	❍	❍	❍	❍
I support a local inventory of at-risk buildings and infrastructure	❍	❍	❍	❍	❍	❍

Q5. What are the most effective ways for you to receive information on how to protect your household and property from damage due to natural hazards? (Please Check all that apply).

- ❑ Newspapers
- ❑ Television
- ❑ Radio
- ❑ Websites
- ❑ Twitter/Facebook
- ❑ Schools
- ❑ Mail
- ❑ Fact sheet/Brochure
- ❑ Extension Service
- ❑ Public Workshops/Meetings
- ❑ Fire Department/Law Enforcement
- ❑ Public Health Department
- ❑ Municipal/County Government
- ❑ Other (Please indicate) _____

Q6. How do you feel your community is doing to educate people of the natural hazards that they may face?

- ❍ Excellent
- ❍ Good
- ❍ Fair
- ❍ Poor
- ❍ None

Please explain your response to the question above:

Q7. Where do you live in Salem?

- ❍ Ward 1
- ❍ Ward 2
- ❍ Ward 3
- ❍ Ward 4
- ❍ Ward 5
- ❍ Ward 6
- ❍ Ward 7
- ❍ Ward 8
- ❍ I do not know which ward I live in
- ❍ I do not live in Salem

Thank you for completing this survey!

You will now be directed back to the Salem Emergency Management website with a link to the city's NHMP. We encourage you to review and comment on the plan.