Volume III: Appendices

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Appendix A: High Priority Action Item Forms

Table 1 is an accounting of the status (complete or not complete) and major changes to actions since the previous NHMP. Actions identified as still relevant are included in the updated action plan (Volume I, Section 3, Table 25)

Table 1 Status of All Hazard Mitigation Actions in the Previous Plan

2018 Action Item	2024 Action Item	Status	Still Relevant? (Yes/No)
Multi-Hazard #1	MH #1	Not Complete, revised	Yes
Multi-Hazard #2	-	Not Complete	No
Multi-Hazard #3	-	Not Complete	No
Multi-Hazard #4	MH #2	Not Complete, revised	Yes
Multi-Hazard #5	MH #2	Not Complete, revised	Yes
Multi-Hazard #6	MH #3	Not Complete, revised	Yes
Multi-Hazard #7	-	Not Complete	No
Multi-Hazard #8	MH #4	Not Complete, revised	Yes
Multi-Hazard #9	-	Not Complete	No
Multi-Hazard #10	MH #5	Not Complete, revised	Yes
Multi-Hazard #11	MH #3	Not Complete, revised	Yes
-	MH #8	New	-
Earthquake #1	EQ #1	Not Complete, revised	Yes
Earthquake #2	MH #7	Not Complete, revised	Yes
Earthquake #3	MH #3	Not Complete, revised	Yes
Earthquake #4	EQ #2	Not Complete, revised	Yes
Flood #1	FL #1	Not Complete, revised	Yes
Flood #2	FL #2	Not Complete, revised	Yes
Flood #3	FL #3	Not Complete, revised	Yes
Flood #4	FL #4	Not Complete, revised	Yes
Flood #5	FL #5	Not Complete, revised	Yes
Flood #6	FL #6	Not Complete, revised	Yes

2018 Action Item	2024 Action Item	Status	Still Relevant? (Yes/No)
Flood #7	FL #7	Not Complete, revised	Yes
Flood #8	MH #7	Not Complete, revised	Yes
Flood #9	-	Not Complete	No
Landslide #1	LS #1	Not Complete, revised	Yes
Landslide #2	LS #2	Not Complete, revised	Yes
Landslide #3	LS #3	Not Complete, revised	Yes
Landslide #4	LS #4	Not Complete, revised	Yes
Severe Weather #1	-	Not Complete	No
Severe Weather #2	SW #1	Not Complete, revised	Yes
Severe Weather #3	SW #2	Not Complete, revised	Yes
Severe Weather #4	MH #6	Not Complete, revised	Yes
Volcanic Event #1	VE #1	Not Complete, revised	Yes
Volcanic Event #2	VE #2	Not Complete, revised	Yes
Volcanic Event #3	VE #2	Not Complete, revised	Yes
Wildfire #1	WF #1	Not Complete, revised	Yes
Wildfire #2	WF #2	Not Complete	Yes
-	WF #3	New	-

Summary of Action Changes

Below is a list of changes to the action items since the previous plan.

Previous NHMP Actions: Complete

None of the previous NHMP actions are considered complete.

Previous NHMP Actions: Not Complete, No Longer Relevant.

Multi-Hazard Action #2: "Identify and pursue funding opportunities to develop and implement local and county mitigation activities" was removed because it is part of normal operations that support Clackamas County.

Multi-Hazard Action #3: "Establish a formal role for the Clackamas County Natural Hazards Mitigation Committee to develop a sustainable process for implementing, monitoring, and evaluating countywide mitigation activities" was removed because it is part of normal operations that support Clackamas County.

Multi-Hazard Action #7: "Strengthen emergency services preparedness and response by linking emergency services with natural hazard mitigation programs and enhancing and implementing public education programs on a regional scale" was removed because

Multi-Hazard Action #9: "Enhance strategies for debris management" was removed because

Flood #9: "Develop a floodplain management plan as a standalone for the CRS program" was removed because Clackamas County no longer participates in the CRS program.

Severe Weather #1: "Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe weather" was removed because it is part of normal operations that support Clackamas County.

Previous NHMP Actions: Combined

MH #4 and MH #5 were combined and renumbered MH #2

MH #6, MH #11, and EQ #3 were combined and renumbered MH #3

EQ #2 and FL #8 were combined and renumbered MH #7

VE #2 and VE #3 were combined and renumbered VE #2

Previous NHMP Actions: Updated/Number Change

MH #8 was renumbered as MH #4

MH #10 was renumbered as MH #5

SW #4 was renumbered as MH #6

EQ #4 was renumbered as EQ #2

SW #2 was renumbered as SW #1

SW #3 was renumbered as SW #2

Acronyms

BCD – Oregon Building Codes Division

DOGAMI – Oregon Department of Geology and Mineral Industries

SB – Senate Bill

Leads and Partners

Below are listed definitions for potential leads and partners identified in the action item forms and actions in Table 25 (Volume I, Section 3).

CFM – Certified Floodplain Manager

DLCD – Oregon Department of Land Conservation and Development

DM – Department of Disaster Management

DTD – Department of Transportation and Development

GIS – Clackamas County Geographic Information Services

HMAC – Clackamas County Hazard Mitigation Advisory Committee

NWS – Northwest Weather Service

ODF – Oregon Department of Forestry

OSFM – Oregon State Fire Marshall

PGE – Pacific Gas and Electric Company

WES – Water Environmental Services

Potential Funding Sources

Below are listed acronyms for funding sources identified in the action item forms and actions in Table 25 (Volume I, Section 3). For more information on funding sources see Volume II, Appendix F.

HMA – Hazard Mitigation Assistance

HMA BRIC – Building Resilience Infrastructure and Communities

HHPD – Rehabilitation of High Hazard Potential Dam Grant Program

HMGP – Hazard Mitigation Grant Program

HMGP-PF – Hazard Mitigation Grant Program – Post Fire

FMA – Flood Mitigation Assitance

OWEB – Oregon Watershed Enhancement Board

Metro – Regional agency that services Clackamas, Multnomah, and Washington counties

SHSP – State Homeland Security Program

OSRG – Oregon Savings Growth Plan

ODF – Oregon Department of Forestry

OSFM – Oregon State Fire Marshal

USFS – US Forest Service

CWDG – Community Wildfire Defense Grant

HUD – US Department of Housing and Urban Development

EPA – US Environmental Protection Agency

Action Item Forms

Each action item has a corresponding action item worksheet or table describing the activity, identifying the rationale for the project, identifying potential ideas for implementation idetnifying potentail mitigatiion funds, and assigning lead organizations or agencies. The action item worksheets can assist the community in pre-packaging potential projects for grant funding. The worksheet components are described below.

Action Item Description

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 several sources, including participants in the planning process, noted deficiencies in local capability, or issues identified through the risk assessment.

Ideas for Implementation (High Priority)

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

Lead Organization or Agency

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.

Potential Funding Source

Where possible potential funding sources have been identified. Example funding sources may include: Federal Hazard Mitigation Assistance programs, state funding sources such as the Oregon Seismic Rehabilitation Grant Program, or local funding sources such as capital improvement funds or general funds. An action item may include several potential funding sources.

Climate Change Related (High Priority)

The impacts of climate change includes not just changes in the severity and regularity of natural hazards, but also changes in population patterns (migration, density, and the makeup of socially vulnerable populations), and changes in land use and development. While climate adaptation efforts may be undertaken separately or in addition to the all-hazards mitigation planning process, hazard mitigation and climate adaptation are complementary efforts that have the same goal: long-term risk reduction for people and increased safety for communities. Consider how the impacts of the Action Item will enhance climate change adaptation and how by implementing these strategies will reduce e risk to and mitigate impacts from actual or expected causes of climate change.

Community Lifelines (High Priority)

Community lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function. Consider which lifelines your project reduces the most risk to, and in turn, enhances the overall resilience of your community. Community Lifelines include the following categories and examples:

Safety and Security

- Law enforcement/security
- Fire service
- Government Service (e.g., EOC, schools, historic/cultural resources)
- Community Safety (e.g., flood control, protective actions)

Food, Water, Shelter

- Food (e.g., Food distribution and supply chain)
- Water (e.g., drinking water utilities, wastewater systems)
- Shelter (e.g., housing, commercial facilities)
- Agriculture

Health and Medical

- Medical care (e.g., hospitals, pharmacies, veterinary services)
- Public Health
- Medical supply chain

Energy

- Power grid
- Fuel (e.g., fuel storage, fuel distribution)

Communications

- Infrastructure
- Finance (e.g., Banking services)

Transportation

- Highway/Roadway/Motor Vehicle
- Mass Transit
- Railway
- Aviation

Hazardous Material

- Facilities

Population Impact (High Priority)

Action Items have the potential to affect the community and the population to some extent, either by reducing the impact of natural hazards on social and economic issues or enhancing the accessibility of marginalized populations to resources and services related to disaster preparedness and mitigation. However, an Action Item may produce unintended consequences and contribute to disproportionate environmental stressors and burdens on marginalized communities. For example, recommendations for changes to development codes may adversely affect low-income housing locations. Therefore, it is important to consider the impact of an Action Item on the community because of its implementation, whether it be negative or positive. Below is a list of potential community aspects that the Action Item may impact, whether positively or negatively.

- Limited water and sanitation access and affordability
- High and/or persistent poverty
- Rural community
- Jobs lost through the energy transition

- High energy cost burden and low energy access
- Racial and ethnic segregation particularly where the segregation stems from discrimination by government entities
- High unemployment and underemployment
- High housing cost burden and substandard housing
- Low income
- Limited access to health care
- Linguistic isolation
- Distressed neighborhoods
- Disproportionate impacts from climate
- All geographic areas within Tribal jurisdictions
- High transportation cost burden and/or low transportation access
- Disproportionate environmental stressor burden and high cumulative impacts

Community Impact

This section examines and assesses how the Action Item will affect the broader community by summarizing the content presented in the High Priority Action Item Template sections: Climate Change Related, Community Lifelines, and Population Impact. The Community Impact categories align with the NHMP Mission and Goals (listed above) and the categories and description are as follows:

Protect Life: Does the Action Item strive to protect life and reduce injuries to community members from natural hazards?

Community Lifelines: Does the Action Item impact/benefit one of the Community?

Climate Adaptation: Does the Action Item integrate/align natural hazards mitigation and climate adaptation efforts based on the evolving understanding of the interrelationships between climate change and climate-related natural hazard events?

Enhance Communication: Enhance communication, collaboration, and coordination among agencies at all levels and region of government, sovereign tribal nations, the private sector, and community members to mitigate natural hazards.

Vulnerable Populations: Does the Action Item mitigation the inequitable impacts of natural hazards to the vulnerable populations and the communities that reside or utilize your community?

Encourage Resilient Development: Does the Action Item strive to encourage new development to adhere to more resilient practices, so as to promote more functional recovery?

Environmental Impact: Does the Action Item minimize natural hazards' impact on environmental and ecological systems?

Historical and Cultural: Does the Action Item minimize the damage from natural hazards to historic and cultural resources?

Repetitive Losses: Does the Action Item reduce/minimize the damage to/exposure of structures and properties that are identified as repetitive and severe repetitive flood losses?

Dams Posing Risk: Minimize or eliminate potential impacts from dams posing the greatest risk to people, property, and infrastructure?

Timeline

All broad scale action items have been determined to be ongoing, as opposed to short-term (0 to 2 years), medium-term (3 to 4 years), and long-term (5 or more years). This is because the action items are broad ideas, and although actions may be implemented to address the broad ideas, the efforts should be ongoing.

Estimated Cost

A rough estimate of the cost for implementing each action item is included. Costs are shown in general categories showing low, medium, or high cost. The estimated cost for each category is outlined below:

Low - Less than $50,000

Medium - $50,000 – $100,000

High - More than $100,000

Table 2 Natural Hazard Action Item – Multi-Hazard #1

				☒ High Priority Action
☒ Multi-Hazard	☐ Drought	☐ Earthquake	☐ Flood	☐ Landslide
☐ Volcanic Event	☐ Wildfire	☐ Extreme Heat	☐ Winter Storm	☐ Windstorm

Statement	Integrate the goals and action items from the Clackamas County Natural Hazard Mitigation Plan into existing regulatory documents and programs.
Description	By continuing to work with the county on integrating action items for the NHMP into regulatory documents and programs, this will assist in facilitating opportunities for public and private collaboration and partnership
Potential Implementation	• Use the mitigation plan to update the county's Comprehensive Land Use Plan that addresses State Land Use Planning Goal 7, designed to protect life and property from natural disasters and hazards through planning strategies that limit development in areas of known hazards; • Integrate the county's mitigation plan into current capital improvement plans; and • In collaboration with other organizations and agencies that share similar goals, promote the improvement of state-level building codes that emphasize functional recovery standards.
Lead	Disaster Management, DTD Planning
Potential Funding Source	County General Fund
Climate Change Related	Integration across existing documents and programs provides the opportunities to support projects and strategies that enhance climate change adaption and resilience across the county.
Community Lifelines	Integration across existing documents and programs provides the opportunities to reduce risk to a wide-range of Community Lifelines.
Population Impact	Has the potential to improve construction standards for low-income housing.

Estimated Cost	**Timeline**
☒ Low (Less than $50,000) ☐ Medium ($50,000 to $100,000) ☐ High ($100,000 or more)	☒ Ongoing ☐ Short Term (0 to 2 years) ☐ Medium Term (3 to 5 years) ☐ Long Term (More than 5 years)

Table 3 Natural Hazard Action Item – Multi-Hazard #4

				☒ High Priority Action
☒ Multi-Hazard	☐ Drought	☐ Earthquake	☐ Flood	☐ Landslide
☐ Volcanic Event	☐ Wildfire	☐ Extreme Heat	☐ Winter Storm	☐ Windstorm

Statement	Utilize knowledge of natural ecosystems and hazards to link natural resource management and land use organizations with potential mitigation activities and provide technical assistance in high-risk locations.
Description	Mapping high-risk areas, such as landslides, floodplains and channel migration zones, will identify areas in need of potential mitigation projects, as well as emphasizing where to educate property owners about ecosystem functions and related hazards.
Potential Implementation	• Review ordinances that protect natural systems and resources to mitigate for natural hazards for possible enhancements; • Pursue vegetation and restoration practices that assist in enhancing and restoring the natural and beneficial functions of watersheds; and • Develop education and outreach programs that focus on protecting natural systems as a mitigation activity.
Lead	DTD (Planning) Support: DM, WES, and GIS
Potential Funding Source	HMA, County General Fund, Oregon Watershed Enhancement Board, Metro
Climate Change Related	Implement mitigation project in identified areas that are particularly vulnerable and high risk due to the impact of the changing climate on hazards.
Community Lifelines	Transportation, Food Water and Shelter
Population Impact	Support connecting natural resource management agencies and organizations that serve historically marginalized populations to establish mitigation projects in their community.

Estimated Cost	Timeline
☐ Low (Less than $50,000) ☐ Medium ($50,000 to $100,000) ☒ High ($100,000 or more)	☒ Ongoing ☐ Short Term (0 to 2 years) ☐ Medium Term (3 to 5 years) ☐ Long Term (More than 5 years)

Table 4 Natural Hazard Action Item – Multi-Hazard #6

				☒ High Priority Action
☒ Multi-Hazard	☐ Drought	☒ Earthquake	☐ Flood	☐ Landslide
☐ Volcanic Event	☒ Wildfire	☒ Extreme Heat	☒ Winter Storm	☐ Windstorm

Statement	Support/encourage electrical utilities to use underground construction methods where possible.
Description	This will assist in reducing the overall number of power outages from windstorms, winter storms and prevent wildfire ignitions, as well as reduce the needs for Public Safety Power Shut-off events, all of which are becoming more and more prevalent due to changes in climate.
Potential Implementation	Mt. Hood Corridor and other areas with increasing rates of Public Safety Power Shutoff (PSPS) events
Lead	DM, can partner with DTD and/or PGE
Potential Funding Source	HMA (BRIC), County Capital Funds
Climate Change Related	As climate-affected hazards, such as wildfire, become more common, the number of PSPS occurrences have increased, which results in the loss of residential power and communications. Placing electrical utilities underground, reduces the risk of a wildfire ignitions and removes the need for PSPS events,
Community Lifelines	Energy, Communication, Food Water and Shelter, Health and Medical
Population Impact	More reliable and consistent communication access for rural communities.

Estimated Cost	Timeline
☐ Low (Less than $50,000) ☐ Medium ($50,000 to $100,000) ☒ High ($100,000 or more)	☒ Ongoing ☐ Short Term (0 to 2 years) ☐ Medium Term (3 to 5 years) ☐ Long Term (More than 5 years)

Table 5 Natural Hazard Action Item – Multi-Hazard #8

				☒ High Priority Action
☒ Multi-Hazard	☐ Drought	☐ Earthquake	☐ Flood	☐ Landslide
☐ Volcanic Event	☐ Wildfire	☐ Extreme Heat	☐ Winter Storm	☐ Windstorm

Statement	Develop and maintain risk assessment and Emergency Operation Plans for state-regulated dams identified as high hazard potential dams (private, public, and non-profit).
Description	The National Dam Safety Program Act authorizes FEMA to provide HHPD rehabilitation funding assistance for the rehabilitation of dams that fail to meet minimum dam safety standards and pose unacceptable risk to life and property, as long as the eligible dams are within a jurisdiction that has an approved local hazard mitigation plan that includes all dam risks and complies with the Robert T. Stafford Act.
Potential Implementation	Identify state-regulated dams considered high-hazard potential dams (HHPD) that do not have an EOP currently in place and seek to collaborate with dam operators to implement an EOP. Clackamas County has two HHPD identified (Mompano and Buche) but both are currently in compliance and not eligible for Rehabilitation Grant funding.
Lead	DM
Potential Funding Source	HHPD (Rehabilitation of High Hazard Potential Dam Grant Program), HMGP, BRIC, FMA, SHSP (State Homeland Security Program)
Climate Change Related	As storms deliver more intense and frequent rainfall events, leading to potentially greater risk of flooding, it is important to have properly maintained and operating infrastructure in place that is capable of storing increased amounts of water.
Community Lifelines	Energy, Hazardous Material, Safety and Security
Population Impact	High-hazard dams expose risk to those who live and/or recreate downstream within the estimated inundation zone, thus posing an unknown level of risk and potential damage.

Estimated Cost	Timeline
☒ Low (Less than $50,000) ☐ Medium ($50,000 to $100,000) ☐ High ($100,000 or more)	☒ Ongoing ☐ Short Term (0 to 2 years) ☐ Medium Term (3 to 5 years) ☐ Long Term (More than 5 years)

Table 6 Natural Hazard Action Item – Flood #1

				☒ High Priority Action
☐ Multi-Hazard	☐ Drought	☐ Earthquake	☒ Flood	☐ Landslide
☐ Volcanic Event	☐ Wildfire	☐ Extreme Heat	☐ Winter Storm	☐ Windstorm

Statement	Identify opportunities to raise public awareness and implement education campaigns for community members within Clackamas County's public and private flood-prone properties.
Description	Flood education and awareness campaigns for those living on and/or owning property in flood-prone areas can provide community members with information about flood risk, safety and mitigation precautions, public alerts, and resources for how to prepare for floods.
Potential Implementation	Use the National Flood Insurance Program's inventory of identified Repetitive Loss and Severe Repetitive Loss properties or use floodplain mapping to identify areas with community members within high-risk flood areas.
Lead	DM, DTD (Planning). Water Environment Services
Potential Funding Source	FMA, HMGP, BRIC, OWEB
Climate Change Related	Safety and well-being education prior to a natural hazard, such as flooding, occurring will better ensure that communities are more resilient, which is vital as the occurrences and impact of climate-hazards increase due to changes in the overall climate.
Community Lifelines	Potentially increases in need for Health and Medical CLs (Medical care) as more hazards occur.
Population Impact	Establishing educational opportunities geared toward communities that carry a disproportionate amount of environmental stressor burdens will promote more equitable education access.

Estimated Cost	Timeline
☒ Low (Less than $50,000) ☐ Medium ($50,000 to $100,000) ☐ High ($100,000 or more)	☒ Ongoing ☐ Short Term (0 to 2 years) ☐ Medium Term (3 to 5 years) ☐ Long Term (More than 5 years)

Table 7 Natural Hazard Action Item – Flood #2

				☒ High Priority Action
☐ Multi-Hazard	☐ Drought	☐ Earthquake	☒ Flood	☐ Landslide
☐ Volcanic Event	☐ Wildfire	☐ Extreme Heat	☐ Winter Storm	☐ Windstorm

Statement	Recommend revisions to the requirements, limitations, and exclusions for new development within the floodplains that have designated channel migration zones (CMZ).within the floodplain
Description	Acquisition is the preferred approach for CMZ areas. The primary hazard in CMZ areas is rapid erosion or avulsion, where a stream channel relocates its course during high water. Home foundations are undercut so elevation is not a viable form of mitigation.
Potential Implementation	Consider adopting regulations specific to mapped channel migration zones such as along the Sandy River and potentially on the Zig Zag and Molalla Rivers.
Lead	DTD (Land Use and Zoning), DM
Potential Funding Source	HMGP, BRIC, FMA, HUD and OWEB
Climate Change Related	Glacial retreat, landslides, and wildfires all increase upstream sedimentation that accelerates channel migration downstream.
Community Lifelines	Health and Safety, Transportation
Population Impact	Since there is no recognition of CMZ hazards in Oregon or by FEMA, there is no requirement for disclosure to home buyers, unlike the requirements for homes inside the mapped FEMA flood zones.

Estimated Cost	Timeline
☒ Low (Less than $50,000) ☐ Medium ($50,000 to $100,000) ☐ High ($100,000 or more)	☒ Ongoing ☐ Short Term (0 to 2 years) ☐ Medium Term (3 to 5 years) ☐ Long Term (More than 5 years)

Table 8 Natural Hazard Action Item – Flood #3

				☒ High Priority Action
☐ Multi-Hazard	☐ Drought	☐ Earthquake	☒ Flood	☐ Landslide
☐ Volcanic Event	☐ Wildfire	☐ Extreme Heat	☐ Winter Storm	☐ Windstorm

Statement	Improve and refine existing flood warning systems by integrating flood monitoring, detection, and alert/notification systems.
Description	Clackamas County Disaster Management used DR-1956-OR HMGP 5% project to install five electronic river gauges in the upper Sandy Basin on five County-owned bridges. Technical and communication problems have prevented the full implementation of this project. Currently HMGP-5327-PF is funding a 5% upgrade project for dedicated electric power and broadband communications for enhanced service and reliability to four of the five sites.
Potential Implementation	The County is working with Portland General Electric (PGE) on getting electric power delivered and using the County's Broadband CBX service for communication.
Lead	DM, DTD
Potential Funding Source	HMGP, FMA, BRIC, NWS, County General Fund
Climate Change Related	As the level of precipitation increases, leading to potentially greater risk of flooding, it is important to have systems in place to provide as much information and pre-emptive warning for potential flooding disasters.
Community Lifelines	Communications, Energy, Safety and Security, Food Water and Shelter
Population Impact	Enhance flood safety and life and property of residents in more vulnerable housing, including manufactured homes in high-risk floodplains (such as Carver Mobile Home Ranch).

Estimated Cost	Timeline
☐ Low (Less than $50,000) ☒ Medium ($50,000 to $100,000) ☐ High ($100,000 or more)	☐ Ongoing ☐ Short Term (0 to 2 years) ☐ Medium Term (3 to 5 years) ☒ Long Term (More than 5 years)

Table 9 Natural Hazard Action Item – Flood #5

				☒ High Priority Action
☐ Multi-Hazard	☐ Drought	☐ Earthquake	☒ Flood	☐ Landslide
☐ Volcanic Event	☐ Wildfire	☐ Extreme Heat	☐ Winter Storm	☐ Windstorm

Statement	Encourage and facilitate the use of mitigation strategies in the management of existing flood-prone properties, either through home elevation or property acquisition.
Description	There are many benefits to acquiring and/or elevating properties at high risk of flood, including providing open space for water run-off, improving water quality in the floodplain and surrounding properties, and minimizing the physical, financial, and emotional strains that accompany flood events.
Potential Implementation	Identify potential mitigation opportunities by using the National Flood Insurance Program's inventory of identified Repetitive Loss and Severe Repetitive Loss properties to identify sites for potential flood mitigation projects, such as structural elevation and/or participate in home buy-outs.
Lead	Disaster Management, Planning, CFM, WES
Potential Funding Source	FMA, County General Fund, OWEB
Climate Change Related	Due to an increase in precipitation related to climate change, it is essential to enhance water storage capacity and floodplain management strategies and provide more accessible and open space for this extra water to safely run off and be absorbed back into the watershed, thereby reducing the damage and loss of properties and homes.
Community Lifelines	Safety and Security – Community Safety (Flood control), Food Water and Shelter, Health and Medical, Transportation (Roads and Bridges in floodplains)
Population Impact	Flood mitigation, particularly for high-risk structures and the people living there, may alleviate part of the disproportionate amounts of environmental stressor burden imposed on them as a result of their living conditions.

Estimated Cost	Timeline
☐ Low (Less than $50,000) ☐ Medium ($50,000 to $100,000) ☒ High ($100,000 or more)	☒ Ongoing ☐ Short Term (0 to 2 years) ☐ Medium Term (3 to 5 years) ☐ Long Term (More than 5 years)

Table 10 Natural Hazard Action Item – Flood #6

				☒ High Priority Action
☐ Multi-Hazard	☐ Drought	☐ Earthquake	☒ Flood	☐ Landslide
☐ Volcanic Event	☐ Wildfire	☐ Extreme Heat	☐ Winter Storm	☐ Windstorm

Statement	Identify and respond to problematic surface water drainage sites in all parts of unincorporated Clackamas County.
Description	In certain areas, such as in urban areas and areas that may become problematic due to climate change impacts, there is capacity-limited storm infrastructure that requires replacement and repair. To minimize the damage from such areas, these areas must be identified and addressed.
Potential Implementation	Create and maintain an inventory of problematic surface water drainage sites, such as culverts, that have historically created flooding problems and target those for mitigation projects, such as retrofitting. • A possible projects areas in Oak Grove community or in the Kellogg Creek and Mt Scott Creek basins.
Lead	DTD (Roads), WES, Watershed Councils (Partnership)
Potential Funding Source	County Capital Funds, FMA, OWEB
Climate Change Related	Due to an increase in precipitation intensity and frequency related to climate change, it is essential to address chronic flooding areas through mitigation, in order to minimize long-term damage.
Community Lifelines	Transportation, Hazardous Material, Food Water and Shelter
Population Impact	The incidence of flooding events may be higher in more vulnerable neighborhoods, such as low-income housing, manufactured homes, or poorly built and/or maintained housing.

Estimated Cost	Timeline
☐ Low (Less than $50,000) ☒ Medium ($50,000 to $100,000) ☐ High ($100,000 or more)	☒ Ongoing ☐ Short Term (0 to 2 years) ☐ Medium Term (3 to 5 years) ☐ Long Term (More than 5 years)

Table 11 Natural Hazard Action Item – Severe Weather #1

				☒ High Priority Action
☐ Multi-Hazard	☐ Drought	☐ Earthquake	☐ Flood	☐ Landslide
☐ Volcanic Event	☐ Wildfire	☒ Extreme Heat	☒ Winter Storm	☒ Windstorm

Statement	Maintain a public awareness campaign regarding severe weather mitigation measures and the importance of personal safety.
Description	Severe weather public awareness campaigns can provide the public with information about severe weather, safety precautions, public alerts, and resources for how to prepare for such events as winter storms or extreme heat.
Potential Implementation	Clackamas County has been recently designated as a Weather-Ready Ambassador by the NWS and is pursuing a designation as a Storm Ready community.
Lead	DM, NWS (Partner)
Potential Funding Source	County General Funds, BRIC, HMGP
Climate Change Related	Educating communities on safety and well-being before a natural hazard, such as extreme heat or a winter storm, contributes to enhancing community resilience, which is an increasing necessity as climate change amplifies the frequency and impact of weather-related hazards.
Community Lifelines	Potentially increases in need for Health and Medical CLs (Medical care) as more hazards occur, Energy, Food Water and Shelter
Population Impact	Establishing educational opportunities geared toward communities that carry a disproportionate amount of environmental stressor burdens will promote more equitable education access.

Estimated Cost	Timeline
☒ Low (Less than $50,000) ☐ Medium ($50,000 to $100,000) ☐ High ($100,000 or more)	☒ Ongoing ☐ Short Term (0 to 2 years) ☐ Medium Term (3 to 5 years) ☐ Long Term (More than 5 years)

Table 12 Natural Hazard Action Item – Severe Weather #2

				☒ High Priority Action
☐ Multi-Hazard	☐ Drought	☐ Earthquake	☐ Flood	☐ Landslide
☐ Volcanic Event	☐ Wildfire	☒ Extreme Heat	☒ Winter Storm	☒ Windstorm

Statement	Monitor and implement programs to mitigate potentially hazardous trees from endangering lives, property, and public infrastructure.
Description	Running programs geared toward reducing the risks associated with potentially hazardous trees allows the appropriate emergency management authority to intervene more effectively and efficiently either prior to a hazardous event - such as windstorms, winter storms, or extreme heat - or when a hazardous event does occur and leads to an incident involving these trees.
Potential Implementation	ODF Urban and Community Forestry Program supports the development and improvement of urban forestry practices for appropriate tree selection and maintenance.
Lead	DTD, Facilities, Utilities, DM (Support)
Potential Funding Source	HMA, County General Funds
Climate Change Related	Trees are critical aspects of healthy and resilient communities and are becoming increasingly vulnerable to climate change impacts, like cumulative heat stress, insect infestations, drought, and extreme weather events.
Community Lifelines	Energy, Communications, Transportation, Food Water and Shelter
Population Impact	People whose health depends on a reliable energy source will be disproportionately affected by power outages, including those with medications that require refrigeration, are undergoing dialysis, or rely on electrically powered medical equipment.

Estimated Cost	Timeline
☐ Low (Less than $50,000) ☒ Medium ($50,000 to $100,000) ☐ High ($100,000 or more)	☒ Ongoing ☐ Short Term (0 to 2 years) ☐ Medium Term (3 to 5 years) ☐ Long Term (More than 5 years)

Table 13 Natural Hazard Action Item –Wildfire #1

				☒ High Priority Action
☐ Multi-Hazard	☐ Drought	☐ Earthquake	☐ Flood	☐ Landslide
☐ Volcanic Event	☒ Wildfire	☐ Extreme Heat	☐ Winter Storm	☐ Windstorm

Statement	Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan.
Description	Working to incorporate and align actions established in the Clackamas County Community Wildfire Protection Plan provides more consistency across planning entities, as well as supports Action Item: Multi-Hazard #1.
Potential Implementation	New state wildfire safety programs from the 2021 Senate Bill 762 and 2023 Senate Bill 80. Guidance and funding available that applies across different state agencies.
Lead	Clackamas Wildfire Collaborative, DM
Potential Funding Source	HMGP Post Fire, BRIC, ODF, OSFM (Oregon State Fire Marshal), USFS Community Wildfire Defense Grants (CWDG)
Climate Change Related	Climate adaption and resilience requires more alignment and coordination across policies and actions to work towards mitigating wildfire risk as it continues to grow.
Community Lifelines	Safety and Security, Food Water Shelter
Population Impact	Has the potential to contribute positively to the development of revised and improved construction standards that promote using fire-retardant materials and smoke-proof installation, which will benefit people with health-related issues, as well as improve the general health and well-being of the public.

Estimated Cost	Timeline
☒ Low (Less than $50,000) ☐ Medium ($50,000 to $100,000) ☐ High ($100,000 or more)	☒ Ongoing ☐ Short Term (0 to 2 years) ☐ Medium Term (3 to 5 years) ☐ Long Term (More than 5 years)

Table 14 Natural Hazard Action Item –Wildfire #2

				☒ High Priority Action
☐ Multi-Hazard	☐ Drought	☐ Earthquake	☐ Flood	☐ Landslide
☐ Volcanic Event	☒ Wildfire	☐ Extreme Heat	☐ Winter Storm	☐ Windstorm

Statement	Encourage private landowners to create and maintain defensible space around homes and other buildings and make home hardening improvements.
Description	Along with a home's structural characteristics, a home's surroundings are the other most important factor in determining home ignitability in wildland-urban interface areas. Defensible space is the most effective way to reduce the risk of structural loss from wildfires that spread into residential areas. Proper implementation and maintenance of defensible space could significantly decrease risk to residential development.
Potential Implementation	Coordinate with various wildfire-focused organizations (such as the Mt. Hood Corridor Wildfire Partnership) for wildfire hazard and mitigation education programs to align information and goals.
Lead	Clackamas Wildfire Prevention Co-op, DM, OSFM, DTD (Planning and Building Codes)
Potential Funding Source	HMGP Post Fire, BRIC, ODF, OSFM (Oregon State Fire Marshal)
Climate Change Related	Education on property protection against natural hazards prior to a natural hazard, such as a wildfire, occurring will better ensure that communities are more resilient, which is vital as the occurrences and impact of climate-hazards increase due to changes in the overall climate.
Community Lifelines	Potentially increases in need for Health and Medical CLs (Medical care) as more hazards occur, Food Water and Shelter
Population Impact	Establishing educational opportunities geared toward communities that carry a disproportionate amount of environmental stressor burdens will promote more equitable education access.

Estimated Cost	Timeline
☐ Low (Less than $50,000) ☒ Medium ($50,000 to $100,000) ☐ High ($100,000 or more)	☒ Ongoing ☐ Short Term (0 to 2 years) ☐ Medium Term (3 to 5 years) ☐ Long Term (More than 5 years)

Table 15 Natural Hazard Action Item –Wildfire #3

				☒ High Priority Action
☐ Multi-Hazard	☐ Drought	☐ Earthquake	☐ Flood	☒ Landslide
☐ Volcanic Event	☒ Wildfire	☐ Extreme Heat	☐ Winter Storm	☐ Windstorm

Statement	Update county and jurisdiction wildfire codes and ordinances in accordance with guidelines provided by OSFM/DLCD/ODF/BCD as part of SB 762 (2021) and SB 80 (2023).
Description	Recent Oregon legislation following the 2020 wildfire disasters has brought a suite of new state wildfire mitigation programs with added staffing capacity and funding – to promote defensible space and home hardening standards based on updated wildfire hazard mapping and land use changes.
Potential Implementation	Clackamas County's Wildfire Prevention Cooperative has been re-established this year to provide a collective organization to share the planning and management for wildfire mitigation projects.
Lead	Clackamas Wildfire Prevention Co-op, DM, OSFM, DTD
Potential Funding Source	HMGP Post Fire, BRIC, ODF, OSFM (Oregon State Fire Marshal), USFS Community Wildfire Defense Grant (CWDG)
Climate Change Related	Climate change influences on increasing wildfire hazards along with development pressures in the WUI call for improved codes and ordinances for new structures.
Community Lifelines	Potentially increases in need for Health and Medical CLs (Medical care) as more hazards occur, Food Water and Shelter
Population Impact	Increase in community wildfire exposure may impact the homeowner's insurance markets with increased premiums that impact lower income residents.

Estimated Cost	Timeline
☒ Low (Less than $50,000) ☐ Medium ($50,000 to $100,000) ☐ High ($100,000 or more)	☐ Ongoing ☐ Short Term (0 to 2 years) ☒ Medium Term (3 to 5 years) ☐ Long Term (More than 5 years)

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Appendix B: Planning and Public Process

NHMP Update Changes

This memo describes the changes made to the 2019 Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP) during the 2024 NHMP update process.

Project Background

Clackamas County and the cities of Canby, Estacada, Gladstone, Happy Valley, Lake Oswego, Milwaukie, Molalla, Oregon City, Sandy, West Linn, and Wilsonville, Clackamas Fire District #1 Clackamas River Water Providers, Colton Water District, and Oak Lodge Water Services partnered with the Oregon Partnership for Disaster Resilience (OPDR) to update the multi-jurisdictional 2019 Clackamas County NHMP. The Disaster Mitigation Act of 2000 requires communities to update their NHMPs every five years to remain eligible for Building Resilient Infrastructure and Communities program funding, Flood Mitigation Assistance (FMA) program funding, and Hazard Mitigation Grant Program (HMGP) funding.

OPDR and the committees made several changes to the previous NHMP to consolidate and streamline the NHMP. The Colton Water District and Oak Lodge Water Services had addenda added to this version of the NHMP. Johnson City opted to not update their NHMP for the City.

Major changes are documented and summarized in this memo.

2024 NHMP Update Changes

The sections below discuss *major* changes made to the NHMPs during the 2023 NHMP update process. If a section is not addressed in this memo, then it can be assumed that no significant changes occurred.

Table 16 lists the 2019 NHMP section names and the corresponding 2023 section names, as updated (major Volumes are highlighted). This memo will use the 2023 NHMP update section names to reference any changes, additions, or deletions within the NHMP.

Table 16 Changes to Organization

2019 Clackamas County NHMP	2024 Clackamas County NHMP
Acknowledgements	Acknowledgements
Table of Contents	Table of Contents
Approval Letters and Resolutions	Approval Letter and Resolution
FEMA Review Tool	FEMA Review Tool
Volume I: Basic Plan	Volume I: Basic Plan
Plan Summary	Plan Summary
Section 1: Introduction	Section 1: Introduction
Section 2: Hazard Identification and Risk Assessment	Section 2: Hazard Identification and Risk Assessment
Section 3: Mitigaiton Strategy	Section 3: Mitigation Strategy
Section 4: Plan Implementation and Maintenance	Section 4: Plan Implementation and Maintenance
Volume II: Jurisdictional Addenda	Volume II: Jurisdictional Addenda
Canby	Canby
Estacada	Estacada
Gladstone	Gladstone
Happy Valley	Happy Valley
Johnson City	-
Lake Oswego	Lake Oswego
Milwaukie	Milwaukie
Molalla	Molalla
Oregon City	Oregon City
Sandy	Sandy
West Linn	West Linn
Wilsonville	Wilsonville
Clackamas Fire District #1	Clackamas Fire District #1
Clackamas River Water	Clackamas River Water
-	Colton Water District
-	Oak Lodge Water Services
Volume III: Appendices	Volume III: Appendices
Appendix A: Action Items Form	Appendix A: High Priority Action Items Form
Appendix B: Planning and Public Process	Appendix B: Planning and Public Process
Appendix C: Community Profile	Appendix C: Community Profile
-	Appendix D: Community Risk Profiles
Appendix D: Natural Hazard and Base Maps	Appendix E: Natural Hazard and Base Maps
Appendix E: Economic Analysis of Natural Hazard Mitigation Projects	Appendix F: Economic Analysis of Natural Hazard Mitigation Projects
Appendix F: Grant Programs and Resources	Appendix G: Grant Programs and Resources
Appendix G: Community Survey	Appendix H: Community Survey

As the table indicates the structure of the NHMP has changed significantly including the addition of several additional addenda. Content and changes are described below.

Template

- The NHMP's template has been updated and applied to the addenda as well

Front Pages

- The NHMP's cover has been updated.
- Acknowledgements have been updated to include the 2024 project partners and planning participants.
- Mission and Goals have been updated, which reference to Community Lifelines and equity and inclusion in mitigation planning
- The FEMA approval letter, review tool, and county resolutions of adoption are included.

Volume I: Basic Plan

Volume I provides the overall NHMP framework for the 2017 Multi-jurisdictional NHMP update. Volume I includes the following sections:

Plan Summary

The 2024 NHMP includes an updated NHMP summary that provides information about the purpose of natural hazard mitigation planning and describes how the NHMP will be implemented.

Section I: Introduction

Section 1 introduces the concept of natural hazard mitigation planning and answers the question, "Why develop a mitigation plan?" Additionally, Section 1 summarizes the 2024 NHMP update process, and provides an overview of how the NHMP is organized. Minimal changes were made beyond editing text and updating content.

Section 2: Hazard Identification and Risk Assessment

This section 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 time. Changes include:

- Hazard identification, characteristics, history, probability, vulnerability, and hazard specific mitigation activities were updated. Outdated and extraneous information was removed and links to technical reports were added as a replacement. With this update the Oregon NHMP is cited heavily as a reference to the more technical hazard material.
- The recently completed a multi-hazard risk assessment (Risk Report, DOGAMI) for Clackamas County is incorporated into this section and within applicable jurisdictional addenda.
- Updated vulnerability information is included, with special emphasis placed upon the hazards profiled in the Risk Report cited above, recent earthquake reports specifically the Cascadia Subduction Zone, Portland Hills Fault, and Mount Hood Fault), and volcanic hazards associated with Mount Hood.
- Links to specific updated hazard studies and data are embedded directly into the NHMP where relevant and available.
- NFIP information was updated.

- The hazard vulnerability analysis has been updated for the county and cities (city information is included with more detail within Volume II).
- Additional Climate Data was included into relevant climate hazards.

Section 3: Mitigation Strategy

This section provides the basis and justification for the mission, goals, and mitigation actions identified in the NHMP.

The 2019 mission and goals were evaluated by the HMAC and relevant changes where discussed and made.

- Mission was updated to include reference to Community Lifelines, community members (rather than citizens), and equity.
- 2019 goals were updated either by updating text and/or combining goals to produce a single more concise and straightforward goal. New goals were also included.
- Goal category titles were updated to better reflect their intended purposes.
- Goal category was added: "Equity and Inclusion". Two (2) new goals were developed under this category: Goal 6.1 and 6.2.
- New goal 4.2 was added under category 4: "Encourage Partnerships for Implementation"

Major changes to the mitigation strategies (actions) are discussed in Appendix A – Volume III.

The HMAC decided to modify the prioritization of action items in this update to reflect current conditions and needs.

Section 4: Plan Implementation and Maintenance

Clackamas County Disaster Management will continue to convene and coordinate the County Hazard Mitigation Advisory Committee (HMAC). Documentation for the City HMACs is contained below and within the jurisdictional addenda in Volume II.

Volume II: Jurisdiction Addenda

The jurisdictions of Canby, Estacada, Gladstone, Happy Valley, Lake Oswego, Milwaukie, Molalla, Oregon City, Sandy, West Linn, Wilsonville, Clackamas Fire District #1, and Clackamas River Water opted to participate and update their 2019 city addenda. The 2019 version of the jurisdiction addenda was provided as a "changes memo" for each participating city, in this update the jurisdiction addenda have been rewritten as complete addenda. Two new special districts, Colton Water District and Oak Lodge Water Services, joined in the 2023 NHMP update and were included with an addendum in this version of the NHMP. Johnson City elected to not participate. With future updates to the NHMP the City will be provided an opportunity to participate.

Where appropriate, information has been consolidated and a reference is provided within the addenda to the appropriate NHMP section. New data and hazard information was included for the participating cities and actions were reviewed, revised and prioritized as described in each addendum.

Volume III: Appendices

Below is a summary of the changes to the appendices included in the 2024 NHMP:

Appendix A: High Priority Action Item Forms

Action items were updated including the status as noted in Volume I, Section 3 changes section above.

The Action Item templates were updated to include relevant and applicable information that would provide essential information when applying to FEMA mitigation grants. Content was developed only for actions that are considered high priority. The following are the major changes made to align with HMA applications:

- A description of the Action Item was included to provide further detail on the Action Item, as well as provide rationale for its implementation
- Climate Change Related to address how the Action is support climate adaptation
- Community Lifelines and which types of CLs the Action Item will impact.
- Population Impact to address how the Action will support or hinder vulnerable populations and systems throughout the county.
- Community Impact was included for the shorter template to identify how Actions align with the NHMP Mission and Goals.

Appendix B: Planning and Public Process

This planning and public process appendix reflects changes made to the Clackamas County and documents the 2024 planning and public process.

Data analysis of survey was included in narrative form to better assess the accuracy, impact, and applicability of survey results.

Appendix C: Community Profile

The community profile has been updated for information and data.

A policy crosswalk table was added to the section Political Capacity presenting the existing plans and policies that intersect with Natural Hazard Mitigation Planning, as well as their specific areas of focus.

Subsection title change under the section "Physical Infrastructure" was updated from "Critical Infrastructure Profile" to "Community Lifelines and Critical Infrastructure Profile". Relevant information was included to define and connect Community Lifelines throughout the section.

Vulnerability Table where updated in order to define the type of impact a hazard would have on a vulnerable community asset, including direct and indirect impact.

Appendix D: Community Risk Profiles

Appendix D provides a list of Community Lifelines and their vulnerability status to the identified natural hazards per the DOGAMI Multi-Hazard Risk Report (O-XX-24).

Appendix E: Clackamas County Natural Hazard and Base Maps

Appendix E includes maps of natural hazards

Appendix F: Economic Analysis of Natural Hazard Mitigation Projects

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

Appendix G: Grant Programs and Resources

Updates were made to the grant programs and resources.

Appendix H: Community Survey

This survey was conducted with the 2024 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.

2024 NHMP Public Participation Process

Clackamas County is dedicated to directly involving the public in the review and update of the NHMP. Although members of the Hazard Mitigation Advisory Committee represent the public to some extent, the residents of Clackamas County and participating cities were also given the opportunity to provide feedback about the NHMP

During the update process, the planning team conducted public outreach and engagement. This was done in order to seek public input and comments about hazard risk and mitigation capabilities and priorities in Clackamas County. The purpose of this is to keep the public aware and attentive about how the county is implementing mitigation measures throughout the county, as well as to promote awareness of personal hazard risk and empower people to take action to reduce their risk or to assist others who may be unable to do so themselves.

Clackamas County made the NHMP available via their website (https://www.clackamas.us/dm/naturalhazard.html) throughout the update process and the updated NHMP was made available for public review and comment through the FEMA review period.

Public Involvement Summary

The public outreach strategy included:

- A countywide survey (Appendix H, Volume III) was distributed to residents of Clackamas County to gather information that would help inform the HMAC in identifying and developing updates to the risk assessment and mitigation strategies. There were a total of 2,529 survey respondents;
- Relasing the plan draft for a public comment period and incorporating the results into the plan's elements; and
- Developing and distributing engaging products to better communicate the information provided in this plan to communities across the county.

Public Comment Press Release

Media releases were distributed across the county to inform Clackamas County residents to participate in public comment on the NHMP. Releases were made by the Clackamas County Public and Government Affairs Department, the participating jurisdictions, and social and cultural organizations throughout the county.

During the public review period, there were XX comments provided. See jurisdictional addenda (Volume II) for city and special district public involvement information.

Media Release/Website Posting

To be provided

Clackamas County Hazard Mitigation Advisory Committee

HMAC members possessed familiarity with the Clackamas County community and how it's affected by natural hazard events. The HMAC guided the update process through several steps including goal confirmation and prioritization, action item review and development and information sharing to update the NHMP and to make the NHMP as comprehensive as possible. The HMAC met formally on the following dates:

Meeting #1: Kickoff, November 1st, 2022

During this meeting, the HMAC reviewed the previous NHMP, and were provided updates on hazard mitigation planning, the NHMP update process, and project timeline. They also provided updates on the history of hazard events in the county and cities and proposed updates to the plan.

Meeting #2: Risk Assessment, December 7th, 2022

During this meeting, the HMAC reviewed the existing risk assessment including community vulnerabilities and hazard information. Information attained during this meeting was used to inform the update of the hazard analysis, as well as inform updates to the development process and prioritization of action items for the 2024 NHMP.

Meeting #3: Mitigation Strategies, February 15th, 2023

The HMAC also reviewed their existing mitigation strategy (actions), discussed status updates, including potential deletions and additions. This was further reviewed via survey, in which HMAC members could provide feedback and recommendations on prior and potential action items. They also discussed potential updates to the Action Item template and prioritization process for the 2024 NHMP. They also reviewed NHMP's mission and goals, with the option of providing review via survey, in which HMAC members could provide feedback and recommendations on prior and potential goals, including updates to the mission.

Meeting #4: Implementation and Maintenance, March 29th, 2023

During this meeting, the previous NHMP's implementation and maintenance program was reviewed and any changes that were necessary were made as indicated in this appendix and Volume I, Section 4.

Jurisdictional Addenda Meetings:

The participating cities and special district participated in three (3) jurisdictional planning meetings.

During these meetings, the HMACs for each jurisdiction provided comments on draft updates, revised and prioritized their actions, and reviewed the NHMP implementation and maintenance schedule.

In addition to the formal meetings, there were numerous informal meetings and email exchanges between HMAC members, OPDR, the County, and other state agencies. For more information see jurisdictional addenda.

The following pages includes copies of meeting agendas and attendance sheets.

Clackamas County NHMP Update Kick-Off

CLACKAMAS COUNTY DISASTER MANAGEMENT

UNIVERSITY OF OREGON

OREGON DISASTER RESILIENCE

Agenda

Meeting: **Clackamas County NHMP Update - Kickoff**
Date: November 1, 2022
Time: 2:30pm – 3:30pm (1.0 hours)
Location: Zoom (Link)
Password: 994058

I. Welcome and Introduction — **5 minutes**

- Share name, title, jurisdiction, and department

II. NHMP Project Planning Overview — **25 minutes**

- Introduction to NHMP
- Scope of Work
- Goals of 2019 Update
- Project Timeline

III. Hazard Assessment — **10 minutes**

- Overview of hazards assessment

IV. Public Outreach Strategy — **10 minutes**

- Public Outreach Process and Strategies

V. Wrap Up and Next Steps — **10 minutes**

- Next Meeting Expectations
- Questions?

Kick-Off Meeting Attendance:

- *Convener*, Gianna Alessi, RARE AmeriCorps Member, Natural Hazard Mitigation Planning Specialist, Clackamas County Disaster Management
- *Convener*, Jay Wilson, Resilience Coordinator, Clackamas County Disaster Management
- Anna Feigum, State Hazard Mitigation Officer, Oregon Emergency Management
- Anthony Vendetti, Emergency Manager, Metro
- Aryka Hanto, Administrative Specialist, Clackamas County Disaster Management
- Beth McGinnis, Emergency Manager, Clackamas River Water
- Bonnie Hirshberger, Citizen Information Specialist, City of Lake Oswego
- Chris Randall, Public Works Director, Happy Valley Public Works
- Dan Harris, Events and Emergency Management Coordinator, City of Milwaukie
- Daniel Nibouar, Interim Director, Clackamas County Disaster Management
- David Bihr, Assistant Fire Management Officer, Mt. Hood National Forest
- Dylan Digby, Assistant to the City Manager, City of West Linn
- Eben Polk, Sustainability Supervisor, Clackamas County Sustainability and Solid Waste Program
- Elaina Turpin, Assistant City Manager, City of Estacada
- Elizabeth Bunga, Administrator, Clackamas County Deputy Building Codes
- Gerald Murphy, Hoodland Resident
- Hannah Shafer, RARE AmeriCorps Member, Natural Hazard Mitigation Planning Specialist, Lane County Emergency Management
- Jacque Betz, City Administrator, City of Gladstone
- Jeff Rubin, Chair of Clackamas County Emergency Preparedness Council and Member of Clackamas County Climate Action Task Force
- Jerry Nelzen, Public Works Director, City of Canby
- John Lewis, Public Works Director, City of Oregon City
- Joseph Murray, Planner, Oregon Emergency Management
- Kimberly Swan, Water Resource Manager, Clackamas River Water Providers
- Kirsten Ingersoll, Emergency Preparedness Coordinator, Clackamas County Public Health
- Laura Rost, Board Member, North Clackamas Watersheds Council
- Leah Johanson, Senior Civil Engineer, Clackamas Water Environment Services
- Lisa Kilders, Information and Outreach Coordinator, Clackamas County Soil and Water Conservation District
- Lowell Anthony, Geohazards Analyst, Department of Geology and Mineral Industries
- Martin Montalvo, Public Works Operations Manager, City of Wilsonville
- Matt Rozzell, Building Codes Administrator, Clackamas County Building Codes
- Michael Howard, Assistant Program Director, Oregon Partnership for Disaster Resilience
- Molly Caggiano, Community Planning Coordinator, Clackamas County Disaster Management
- Ron Wierenga, Assistant Director, Clackamas County Water Environment Services
- Shane Abbott, Director, Clackamas County Transportation Maintenance
- Steve Campbell, Director of Community Services & Public Safety, City of Happy Valley
- Teresa Bricker, District Commissioner, Colton Water District
- Tom Gaskill, Executive Director , Greater Oregon City Watershed Council

Clackamas County NHMP Update Meeting #2

CLACKAMAS COUNTY DISASTER MANAGEMENT

UNIVERSITY OF OREGON

Agenda

Meeting: Clackamas County NHMP Update – Meeting #2
Topic: Risk and Hazard Assessment
Date: December 7th, 2022
Time: 2:00 pm – 4:00 PM (2.0 hours)
Location: Zoom (link)

I. Welcome and Meeting Goals — **15 minutes**
- a. Committee Introductions
- b. Meeting agenda and goals
- c. Project Updates
- d. Assessed Natural Hazard

II. Community Profile — **5-10 minutes**
- a. Brief review of community profile
  - i. Jurisdiction specific

III. Hazard & Risk Assessment — **30 minutes**
- a. Risk Assessment Discussion
- b. Steps to conduct Risk Assessment
  - i. Hazard Profile
  - ii. Community Assets
    1. Community Lifelines
  - iii. Risk Analysis
  - iv. Vulnerability Assessment

IV. Hazard Analysis — **20 minutes**
- a. Hazard Analysis Scoring

V. Hazard Analysis Update Discussion — **30 minutes**
- a. Clackamas County Hazard Analysis and Risk Assessment

VI. Wrap Up and Next Steps — **5 minutes**
- a. Next Steps

Meeting #2 Attendance:

- *Convener*, Gianna Alessi, RARE AmeriCorps Member, Natural Hazard Mitigation Planning Specialist, Clackamas County Disaster Management
- *Convener*, Jay Wilson, Resilience Coordinator, Clackamas County Disaster Management
- Allan Wilson, City Planner, City of Estacada
- Amanda Watson, Sustainability Program Manager, City of Lake Oswego
- Anthony Vendetti, Emergency Manager, Metro
- Aryka Hanto, Administrative Specialist, Clackamas County Disaster Management
- Beth McGinnis, Emergency Manager, Clackamas River Water
- Bonnie Hirshberger, Citizen Information Specialist, City of Lake Oswego
- Chris Randall, Public Works Director, Happy Valley Public Works
- Daniel Nibouar, Interim Director, Clackamas County Disaster Management
- Dylan Digby, Assistant to the City Manager, City of West Linn
- Elaina Turpin, Assistant City Manager, City of Estacada
- Gerald Murphy, Hoodland Resident
- Jeff Ennenga, Wildland Program Manager, Clackamas Fire District #1
- Chair of Clackamas County Emergency Preparedness Council and Member of Clackamas County Climate Action Task Force
- Jeremy Goers, Assistant Fire Management Officer, United States Forest Service
- Jessica Morey-Collins, Senior Development Specialist, City of Lake Oswego
- Joseph Murray, Planner, Oregon Emergency Management
- Kirsten Ingersoll, Emergency Preparedness Coordinator, Clackamas County Public Health
- Laura Rost, Board Member, North Clackamas Watersheds Council
- Leah Johanson, Senior Civil Engineer, Clackamas Water Environment Services
- Lowell Anthony, Geohazards Analyst, Department of Geology and Mineral Industries
- Martin Montalvo, Public Works Operations Manager, City of Wilsonville
- Megan Phelan, Assistant City Manager, City of Lake O
- Michael Howard, Assistant Program Director, Oregon Partnership for Disaster Resilience
- Natalie Rogers, Climate and Natural Resources Manager, City of Milwaukie
- Steve Campbell, Director of Community Services & Public Safety, City of Happy Valley
- Teresa Bricker, District Commissioner, Colton Water District
- Tom Gaskill, Executive Director , Greater Oregon City Watershed Council
- Vance Walker, Assistant Public Works Director, City of Oregon City

Clackamas County NHMP Update Meeting #3

Agenda

Meeting: Clackamas County NHMP Update – Meeting #3
Topic: Mitigation Strategy
Date: February 15th, 2023
Time: 2:00 pm – 4:00 PM (2.0 hours)
Location: Zoom (link)

I.	**Welcome and Meeting Goals** a. Meeting agenda and objectives b. Project Progress	**10 minutes**
II.	**Risk Assessment Update** a. Natural Hazards to be Included	**15 minutes**
III.	**Mitigation Strategy Discussion** a. Briefly Review	**3 minutes**
IV.	**Mission & Goals** a. Review Mission and Goals b. Proposed Mission and Goals Update	**20 minutes**
V.	**Action Items** a. Review Action Items b. Reformatting Action Items	**30 minutes**
VI.	**Policy Crosswalk** a. Review Policy Crosswalk	**20 minutes**
VII.	**Community Engagement** a. Public Engagement Plan	**10 minutes**
VIII.	**Brief Intro to Next Phase: Plan Implementation and Maintenance**	**5 minutes**
IX.	**Wrap Up and Next Steps** a. Next Steps	**5 minutes**

Meeting #3 Attendance

- *Convener*, Gianna Alessi, RARE AmeriCorps Member, Natural Hazard Mitigation Planning Specialist, Clackamas County Disaster Management
- *Convener*, Jay Wilson, Resilience Coordinator, Clackamas County Disaster Management
- Allan Wilson, City Planner, City of Estacada
- Amanda Watson, Sustainability Program Manager, City of Lake Oswego
- Bonnie Hirshberger, Citizen Information Specialist, City of Lake Oswego
- Chris Randall, Public Works Director, Happy Valley Public Works
- Dan Harris, Events and Emergency Management Coordinator, City of Milwaukie
- Delorah Kerber, Public Works Director, City of Wilsonville
- Dylan Digby, Assistant to the City Manager, City of West Linn
- Elaina Turpin, Assistant City Manager, City of Estacada
- Hannah Shafer, RARE AmeriCorps Member, Natural Hazard Mitigation Planning Specialist, Lane County Emergency Management
- Jeff Ennenga, Wildland Program Manager, Clackamas Fire District #1
- Jeremy Goers, Assistant Fire Management Officer, United States Forest Service
- John Lewis, Public Works Director, City of Oregon City
- Joseph Murray, Planner, Oregon Emergency Management
- Justin Poyer, Public Works Utility Manager, City of Gladstone
- Kirsten Ingersoll, Emergency Preparedness Coordinator, Clackamas County Public Health
- Laura Rost, Board Member, North Clackamas Watersheds Council
- Martin Montalvo, Public Works Operations Manager, City of Wilsonville
- Megan Phelan, Assistant City Manager, City of Lake Oswego
- Michael Howard, Assistant Program Director, Oregon Partnership for Disaster Resilience
- Sean Lundry, Policy Lieutenant, City of Sandy
- Steve Campbell, Director of Community Services & Public Safety, City of Happy Valley
- Teresa Bricker, District Commissioner, Colton Water District
- Vance Walker, Assistant Public Works Director, City of Oregon City

Clackamas County NHMP Update Meeting #4

CLACKAMAS COUNTY DISASTER MANAGEMENT

UNIVERSITY OF OREGON

DISASTER RESILIENCE

Agenda

Meeting: Clackamas County NHMP Update – Meeting #4
Topic: Plan Maintenance and Implementation
Date: March 29th, 2023
Time: 2:00 pm – 4:00 PM (2.0 hours)

I. Welcome and Meeting Goals — **10 minutes**
- a. Meeting agenda and objectives
- b. Timeline Review
- c. Project Progress

II. Hazard Vulnerability Analysis Review — **5-10 minutes**
- a. 2024 County HVA Review

III. NHMP Template Update — **5 minutes**
- a. Changes in the NHMP Template

IV. Action Item Template Update — **5 minutes**
- a. Briefly Review

V. Vulnerability Assessment Tables Review — **5 minutes**
- a. Briefly Review

VI. Mission & Goals Update — **5-10 minutes**
- a. Introduce updated Mission
- b. Discuss goal updates

VII. Discussion with Devin from DTD — **15-20 minutes**
- a. Questions and Discussion

VIII. Plan Implementation and Maintenance — **15 minutes**
- a. Introduce phase
- b. Discuss timeline and components

IX. Community Engagement Updates — **5-10 minutes**
- a. Upcoming Public Engagement resources and opportunities

X. Wrap Up and Next Steps — **5 minutes**
- a. Next Steps

Meeting #4 Attendance

- *Convener*, Gianna Alessi, RARE AmeriCorps Member, Natural Hazard Mitigation Planning Specialist, Clackamas County Disaster Management
- *Convener*, Jay Wilson, Resilience Coordinator, Clackamas County Disaster Management
- Allan Wilson, City Planner, City of Estacada
- Amanda Watson, Sustainability Program Manager, City of Lake Oswego
- Bonnie Hirshberger, Citizen Information Specialist, City of Lake Oswego
- Chris Randall, Public Works Director, Happy Valley Public Works
- Dan Harris, Events and Emergency Management Coordinator, City of Milwaukie
- Delorah Kerber, Public Works Director, City of Wilsonville
- Devin Patterson, Engineering Technician, Clackamas County Department of Transportation and Development
- Elaina Turpin, Assistant City Manager, City of Estacada
- Jeff Ennenga, Wildland Program Manager, Clackamas Fire District #1
- Jeff Rubin, Chair of Clackamas County Emergency Preparedness Council and Member of Clackamas County Climate Action Task Force
- Jeremy Goers, Assistant Fire Management Officer, United States Forest Service
- Joseph Murray, Planner, Oregon Emergency Management
- Justin Poyer, Public Works Utility Manager, City of Gladstone
- Kirsten Ingersoll, Emergency Preparedness Coordinator, Clackamas County Public Health
- Laura Rost, Board Member, North Clackamas Watersheds Council
- Megan Phelan, Assistant City Manager, City of Lake Oswego
- Tom Gaskill, Executive Director , Greater Oregon City Watershed Council

Clackamas County NHMP Update Jurisdiction Meeting #1

Clackamas County NHMP Update:
Jurisdictional NHMP Addenda Planning Meeting

Topic: Planning and Guidance
Date: March 8th, 2023
Time: 9:00 am – 11:00 am (2.0 hours)
Location: Zoom (link)

I. Welcome and Meeting Goals
- a. Meeting agenda and objectives
- b. Identify Intended Meeting Outcome (what do you want out of the meting)

II. Potential Planning Subjects to Work On:

1) **Community Profile/Characteristic**
   - a. Review and update Community Assets Inventory

2) **Hazard Inventory**
   - a. Complete Jurisdictions Specific Hazard Inventories

3) **Review Existing Vulnerability Assets**
   - a. Update Vulnerability Assessment Tables

4) **Jurisdiction Specific Risk Assessment**
   - a. Review/Revise Jurisdiction Specific Hazard Vulnerability Analysis (HVA)

5) **Jurisdiction Specific Mitigation Strategy**
   - a. Review and Discuss Action Items
   - b. Review and Discuss Policy Crosswalk

III. Community Engagement
- a. Public Engagement Plan

IV. Action Plan
- a. Create Action Plan with Jurisdiction
- b. Identify and Manage Next Steps

Appendix C: Community Profile

The following section describes the county from several perspectives in order to help define and understand the county's sensitivity and resilience to natural hazards. Sensitivity and resilience indicators are identified through the examination of community capitals which include natural environment, social/demographic capacity, economic, physical infrastructure, community connectivity, and political capital. These community capitals can be defined as resources or assets that represent all aspects of community life. When paired together, community capitals can influence the decision-making process to ensure that the needs of the community are being met.

Sensitivity factors can be defined as those community assets and characteristics that may be impacted by natural hazards, (e.g., special populations, economic factors, and historic and cultural resources). Community resilience factors can be defined as the community's ability to manage risk and adapt to hazard event impacts (e.g., governmental structure, agency missions and directives, and plans, policies, and programs).

The Community Profile describes the sensitivity and resilience to natural hazards of Clackamas County, and its incorporated cities, as they relate to each capacity. It provides a snapshot in time when the plan was developed and will assist in preparation for a more resilient community. The information in this section, along with the hazard assessments located in Volume I, Section 2, should be used as the local level rationale for the risk reduction actions identified in Volume I, Section 3. The identification of mitigation strategies and actions that reduce the county's sensitivity and increase its resiliency assist in reducing overall risk of disaster.

The U.S. Census delineates areas of settled population concentrations that are identifiable by name but are not legally incorporated as Census Designated Places (CDPs). There are 11 CDPs in Clackamas County as shown in Table 17 and Figure 1.

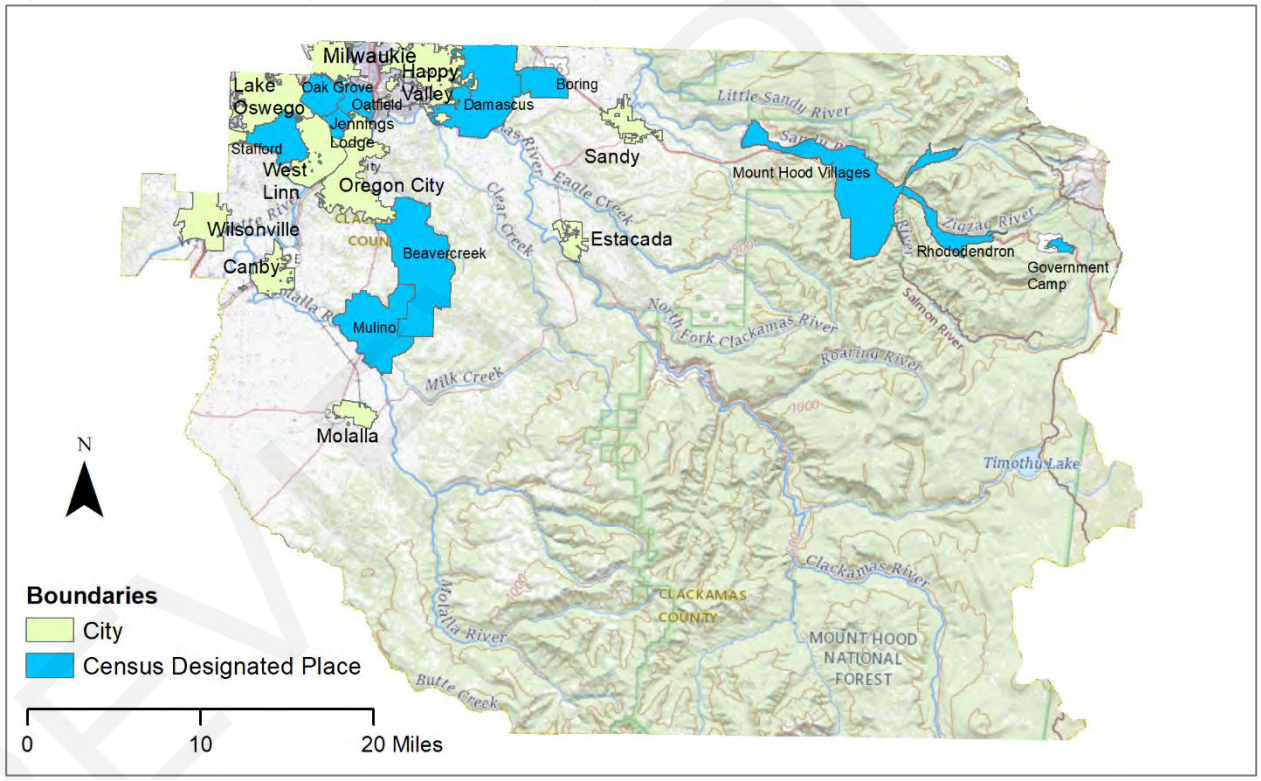
The remainder of this appendix will provide detailed information for the unincorporated communities and summarized data for the incorporated cities. Detailed information for each incorporated city participating in this NHMP is provided within each city's addendum (Volume II).

Table 17 Clackamas County Cities and Census Designated Places

Incorporated Cities		Unincorporated Census Designated Places	
Barlow	Molalla	Beavercreek	Mulino
Canby	Oregon City	Boring	Oak Grove
Estacada	Portland (part)*	Damascus	Oatfield
Gladstone	Rivergrove (part)	Government Camp	Rhododendron
Happy Valley	Sandy	Jennings Lodge	Stafford
Johnson City	Tualatin (part)*	Mount Hood Village	
Lake Oswego (part)	West Linn		
Milwaukie	Wilsonville (part)		

Source: Portland State University Population Research Center, U.S. Census Bureau Tiger Lines Files
Notes: * - Most of the Portland and Tualatin populations are outside of Clackamas County and are not profiled in this plan.
**-Mount Hood Village CDP is noted elsewhere in this report as The Villages at Mt. Hood.

Figure 1 Clackamas County Cities and Census Designated Place



Source: OPDR, 2021, U.S. Census Bureau Tiger Lines Files

Political Capacity

Political capacity is recognized as the government and planning structures established within the community. In terms of hazard resilience, it is essential for political capital to encompass diverse government and non-government entities in collaboration; as disaster losses stem from a predictable result of interactions between the physical environment, social and demographic characteristics and the built environment.[1] 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

Clackamas County is governed by a five-member Board of Commissioners. The Commissioners are elected to four-year terms and serve as the governing body which directs the general administration of county government. The county encompasses all or part of 16 cities, and four county urban renewal districts which include Clackamas Industrial Area, Clackamas Town Center, Government Camp and the North Clackamas Revitalization Area. The Commissioners set policies, enact ordinances, and establish and manage budgets to perform the services that state law and citizens of the county requires.

Beyond the valuable function of emergency (disaster) management, all departments within the county governance structure have some degree of responsibility in building overall community resilience. Each department plays a critical role in ensuring that county functions and normal operations resume after an incident, and that the needs of the population are met.

Some divisions and departments of Clackamas County government that have a role in hazard mitigation are:

- Department of Disaster Management: Develops, coordinates and implements a comprehensive all-hazards countywide program to minimize the impact of incidents or disasters which can potentially threaten the safety and welfare of citizens. Aside from being the first county in the country to have a FEMA-approved hazard mitigation plan, the Disaster Management Department also oversees emergency operations, damage assessments, disaster exercises, trainings, public education and outreach, and a city liaison program.
- Department of Transportation and Development: The DTD has a wide-range of county services that it is involved in and is responsible for, including land use planning and permitting, building permits, county code enforcement, sustainability, and road construction and maintenance.
    - Building Codes: This division is able to collaborate to do outreach with owners of structures that were not built up to modern, resilient code. Professionals from Buildoing Codes could even be called on to help survey buildings after an incident.
    - Planning and Zoning: This division conducts both short and long-range plans that determine much of the built, physical community. Through the county Comprehensive Plan and subsequent polices, Planning and Zoning guides decisions about growth, development, and conservation of natural resources. They can be partners in mitigation by developing, implementing, and monitoring polices such as ensuring homes, businesses, and other buildings are built to current seismic code and out of the flood zones.

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

    - **Transportation Maintenance:** This division is responsible for maintaining the integrity and safety of over 1,413 miles of county roads, 186 bridges, 2,400 miles of rock shoulder, 40,000 road signs and operates the Canby Ferry for more than 85,000 vehicles a year.[2] As transportation and infrastructure is a critical component of mobility, Transportation Maintenance should be considered in hazard mitigation principles to ensure that residents and safety personnel are able to safely move about in the event of a disaster.
- **Department of Health, Housing and Human Services:** The mission of the Health, Housing and Human Services Department is to promote and assist individuals, families and communities to be safe, healthy and thrive.[3]
    - **Public Heath:** Provides community-wide health promotion and disease prevention services to assure the physical and mental well-being of county residents.[4] As an inherently mitigation focused department, Public Health can be an ally in preparing the community for natural hazards. Public Health likely has a distribution network established for information and supplies and these connection to the community will be to encourage personal preparedness and also during incident response.
- **Commission for Children and Families:** Plans, advocates, and engages the community around issues on behalf of families and children, often thought of as vulnerable populations due to increased sensitivity to the impacts of hazard incidents. Because this comission is in frequent contact with a vulnerable population, it would be a natural partner in mitigation actions for outreach efforts and to build the county's awareness of the needs of children and families.
- **Technology Services:** This departments focuses on providing high quality, innovative, cost-effective technology for citizens, county departments, and county commissioners to conduct daily business.[5] Without this critical component, the county could not effectively serve the residents. Mitigation efforts from this department would not likely involve citizens at all, but would go a long way to ensuring uninterrupted services during hazard incidents.
- **Geographic Information Systems**: This department develops and maintains the Geographic Information System (GIS) programming for Clackamas County and has the ability to assist in the decision making process by providing an additional tool to analyze and compare numerous geographic data layers along with traditional databases.[6] GIS is capable of developing and maintaining relevants maps and associated databases, as well as has the capabilities to conduct exposure analyses for risk assessments. Building and maintaining robust data that catalogues not only the county's risk and vulnerability, but also resources and response capability can ensure efficient and effective mitigation activities.
- **Sheriff's Office:** The mission of the Clackamas County Sheriff's Office is to provide a number of services such as patrol, investigation, civil process corrections services and jail operations in a professional, ethical, and fiscally responsible manner. Life safety is the first goal of mitigation and response. Public Safety interacts with the vulnerable aspects of the community on a day-to-day basis and can help identify areas for focused mitigation.[7]

[2] Clackamas County Website. Transportation Maintenance. https://www.clackamas.us/roads.

[3] Clackamas County Website. Department of Health, Housing and Human Services. https://www.clackamas.us/h3s

[4] Clackamas County Website. Public Health. https://www.clackamas.us/publichealth.

[5] Clackamas County Website. Technology Services. http://www.clackamas.us/ts/.

[6] Clackamas County Website. Geographic Information Systems. https://www.clackamas.us/gis.

[7] Clackamas County Website. Sheriff. https://www.clackamas.us/sheriff.

Regulatory Context: Oregon Statewide Planning Goal 7

Since 1973, Oregon has maintained a strong statewide program for land use planning. The foundation of that program is a set of 19 statewide planning goals that express the state's policies on land use and on related topics, such as citizen involvement, land use planning, and natural resources.

Most of the goals are accompanied by "guidelines," which are suggestions about how a goal may be applied. Oregon's statewide goals are achieved through local comprehensive planning. State law requires each city and county to adopt a comprehensive plan and the zoning and land-division ordinances needed to put the plan into effect. The local comprehensive plans must be consistent with the statewide planning goals. Plans are reviewed for such consistency by the state's Land Conservation and Development Commission (LCDC). When LCDC officially approves a local government's plan, the plan is said to be "acknowledged." It then becomes the controlling document for land use in the area covered by that plan.

Statewide Planning Goal 7

Goal 7: Areas Subject to Natural Disasters and Hazards has the overriding purpose to "protect people and property from natural hazards." Goal 7 requires local governments to adopt comprehensive plans (inventories, policies and implementing measures) to reduce risk to people and property from natural hazards. Natural hazards include floods, landslides, earthquakes, tsunamis, coastal erosion, and wildfires.

To comply with Goal 7, local governments are required to respond to new hazard inventory information from federal or state agencies. The local government must evaluate the hazard risk and assess the:

- frequency, severity, and location of the hazard;
- effects of the hazard on existing and future development;
- potential for development in the hazard area to increase the frequency and severity of the hazard; and
- types and intensities of land uses to be allowed in the hazard area.

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.

<u>Goal 7 Planning Guidelines</u>

- In adopting plan policies and implementing measures for protection from natural hazards, local governments should consider:
- the benefits of maintaining natural hazard areas as open space, recreation, and other low density uses;
- the beneficial effects that natural hazards can have on natural resources and the environment; and
- the effects of development and mitigation measures in identified hazard areas on the management of natural resources.

- Local governments should coordinate their land use plans and decisions with emergency preparedness, response, recovery and mitigation programs.

Goal 7 Implementation Guidelines

Goal 7 guides local governments to give special attention to emergency access when considering development in identified hazard areas.

- Consider programs to manage stormwater runoff to address flood and landslide hazards.
- Consider non-regulatory approaches to help implement the goal.
- When reviewing development requests in high-hazard areas, require site specific reports, appropriate for the level and type of hazard. Reports should evaluate the risk to the site, as well as the risk the proposed development may pose to other properties.
- Consider measures exceeding the National Flood Insurance Program.

Synthesis

Recognized as the government and planning structures established within the community, Political Capital is an essential component of hazard resilience. Allowing the county to collaborate with several different county departments as well as outside entities makes the NHMP more diverse. Because the NHMP is composed with input from government and non- government parties, it seeks to ensure that all parties that might be involved in a disaster have a way to become more resilient. It is important that the NHMP reaches out to as many entities as possible as disasters have no boundaries and can affect everyone and anyone. Being aware of hazard mitigation ahead of time will allow all parties to prepare and become more resilient.

Clackamas County works with several departments to include them during the hazard mitigation planning process which allows the plan to be diverse and include input from a variety of entities. Likewise, other planning documents and polices throughout the county refer to the NHMP as there is some overlap and balance in how the county deals with mitigation-related issues.

Natural Environment Capacity

Natural environment capacity is recognized as the geography, climate, and land cover of the area such as, urban, water and forested lands that maintain clean water, air and a stable climate. Natural resources such as wetlands and forested hill slopes play significant roles in protecting communities and the environment from weather-related hazards, such as flooding and landslides. However, natural systems are often impacted or depleted by human activities, which in turn adversely affects community resilience.

Geography

Clackamas County has an area of 1,879 square miles and is located along the Willamette River in Northwestern Oregon. About one-eighth of the land area in Clackamas County is incorporated, while a majority is unincorporated. More than three-fourths of the county's area lies within the lower Willamette River basin. The Clackamas, Molalla, Pudding, and Tualatin rivers are major tributaries which flow into the Willamette. The remaining one-fourth of the county is within the Lower-Columbia-Sandy River basin, a tributary of the Columbia River.

Elevations in the county range from a high of 11,235-feet at the peak of Mount Hood (the highest point in the state) to a low of 55-feet in Oregon City, which located along the shores of the Willamette River. There are a variety of complex eco-regions, including high-altitude forests, foothills, lowlands and valleys, prairie terraces, and riparian forest. Clackamas County also has two major physiographic regions that should be considered in planning for natural hazards: the Willamette River Valley, and the Cascade Range Mountains. The Willamette Valley, in western Clackamas County, is the most heavily populated portion and is characterized by flat or gently hilly topography. The Cascade Range, in eastern and southern Clackamas County has a relatively small population and is characterized by heavily forested slopes.

Clackamas County has a long growing season and mild temperatures, which lead to a wide range of agricultural activities. Seasonal flooding, high ground water levels, and soil erosion cause most of the non-urban drainage problems in the county. When maintained in their natural state, Clackamas County's wetlands control runoff and decrease soil erosion and water pollution while reducing potential damage from flooding and helping to recharge water supplies.

Cascade Mountains

Mount Hood borders the eastern edge of Clackamas County and rises to 11,235 feet, and is one a many dormant volcanos that are located along the west coast of North America. Other dormant and active volcanoes along the Cascade Range include Mount St. Helens, Mount Adams, and Mount Jefferson. Mount Hood has had at least four major eruptive periods in the past 15,000 years, with the most recent one taking place around 1805, shortly before the arrivals of Lewis and Clark. These eruptions produced deposits that were primarily distributed along the Sandy and Zigzag rivers in Clackamas County. As one of the major volcanoes in the Cascade Range, it contributes to valuable water, scenic, and recreational resources which help to sustain agricultural and tourist segments throughout the region. When Mount

Hood erupts again, volcanic ash is expected to fall and severely affect areas on its flanks as well as downstream in the major river valleys that lie in the path of the volcano.[8]

Willamette River

The Willamette River Basin covers 11,500 square miles, encompassing 16,000 miles of streams and is about 187 miles long and is the 13th largest river by volume in the U.S.[9] The river is unique because it flows from the south to the north, originating in the mountains of west central Oregon, passing through Oregon City and over Willamette Falls, passing through the City of Portland and then emptying out into the Columbia River.[10] The Willamette River is a vital, multi-purpose waterway that touches the lives of millions of people along its banks throughout the Pacific Northwest. The Willamette River has generated economic growth and promoted quality of life for the past 150 years. It is a source of power, irrigation, forestry, agriculture, and recreation. However, to achieve these benefits, the structure and integrity of the river have been compromised with increased population growth and development.

Clackamas River

Located west of the Cascade Range, the Clackamas River flows through a steep-walled canyon lined with dense forest and basalt crags as it heads towards its confluence with the Willamette River near Gladstone and Oregon City.[11] This river was added to the Federal Wild and Scenic River System in 1988, and qualifies as "outstandingly remarkable" in five different resource categories—recreation, fish, wildlife, historic, and vegetation.[12]

The Clackamas River Basin is largely forested but has large areas of pasture used for grazing. More than 300,000 people depend on the Clackamas River for their drinking water.[13] Parts of three streams/rivers within the watershed are listed as "water-quality limited" on the state's 303(d) list, mostly for high water temperatures in the summer. These include the: lower Clackamas River (river mouth to River Mill Dam), Fish Creek (mouth to headwaters), and Eagle Creek (mouth to wilderness boundary). Occurrences of taste and odor problems in drinking water from the river have increased in recent years, apparently due to blue- green algae blooms. Upon request of a local consortium of drinking water providers, a proposal was developed to examine nutrient, algae, and water quality conditions basin wide.[14]

The Clackamas River and its tributaries provide numerous spawning and rearing areas for steelhead, as well as Coho and Chinook salmon. However, the Endangered Species Act listed the river's steelhead as "threatened" on March 13th, 1998. The watershed is home to two wilderness areas: the Salmon-

[8] U.S. Geological Survey, The Cascade Range, "*Description: Mount Hood Volcano*". Accessed 19 December 2011. http://vulcan.wr.usgs.gov/Volcanoes/Hood/description_hood.html.

[9] Willamette Riverkeeper, "Facts of the WIlamette River", http://willamette-riverkeeper.org/facts

[10] Willamette River Water Coalition. "About the Willamette River." Accessed 25 April 2023. https://www.willametteriver.org/wrwc/page/about-willamette-river-water-coalition

[11] National Wild and Scenic Rivers System. Accessed 25 April 2023. https://www.rivers.gov/rivers/clackamas.php

[12] Ibid.

[13] Clackamas River Water Providers, "About the Clackamas River Watershed", Accessed 19 May 2023. https://www.clackamasproviders.org/about-the-clackamas-river-watershed/

[14] U.S. Geological Survey, Oregon Water Science Center, "Clackamas River Basin Water Quality Assessment". Accessed 1 December 2011. http://or.water.usgs.gov/clackamas/or176.html.

Huckleberry Wilderness and the Bull of the Woods Wilderness. More than 72 percent of land in the watershed is publicly owned, predominantly by the U.S. Forest Service.[15]

Sandy River

The Sandy River originates high on the slopes of Mount Hood, located about 50 miles east of Portland. The headwaters are beneath Reid and Sandy Glaciers at 6,000 feet in elevation.

From there the river flows due west through the Hoodland Corridor. It cascades past the communities of Welches, Brightwood, and Sandy, then turns north to enter the Columbia River near Troutdale, which is 10 miles east of Portland, Oregon. Two separate sections of the Sandy River have been designated as Federal Wild and Scenic Waterways. Riverside trails offer spectacular scenery, easily observable geologic features, unique plant communities, and other wilderness experiences. Just outside Portland, the lower Sandy flows through a deep, winding, forested gorge known for its anadromous fish runs, botanical diversity, recreational boating, and beautiful parks.[16]

Climate

Situated in the northern portion of the Willamette Valley, Clackamas County experiences a relatively mild climate with cool, wet winters and warm, dry summers. Temperatures in the valley can exceed 90°F in the summer, with increasingly more days reaching over 100°F, or drop below 30°F in the winter but are generally more moderate than temperatures at higher elevations. Average temperatures in the summer range from the mid-80s down to the low 50s, while average temperatures in the winter range from the mid-40s to the low 30s.[17] Because of these mild temperatures, the average growing season in Clackamas County generally lasts for 150-180 days in the lower valley and for 110-130 days in the foothills (i.e. roughly above 800–feet in elevation).[18]

The most important determinant of precipitation is elevation. Because Clackamas County widely spans from the valley floor of Oregon City at 55 feet to the top of Mount Hood at 11,235 feet, it is no surprise that there is considerable variation of precipitation totals in the form of rain and snow, throughout the county. Map 2 in Volume III, Appendix E shows the annual average precipitation throughout the county.

The monthly and annual averages of snowfall show that the valley floor experiences a mild winter with annual averages of 1-10 inches of snow per year, while the communities in the lower Cascades surrounding Mount Hood, such as Government Camp, are covered with snow for a majority of the winter months (annual average of 250 inches).[19]

Total precipitation in the Pacific Northwest region may remain similar to historic levels but climate projections indicate the likelihood of increased winter precipitation and decreased summer precipitation.

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[15] U.S. Geological Survey, Oregon Water Science Center, "Clackamas River Basin Water Quality Assessment". Accessed 1 December 2011. http://or.water.usgs.gov/clackamas/or176.html.

[16] National Wild and Scenic Rivers System. Accessed 25 April 2023. https://www.rivers.gov/rivers/sandy.php

[17] NOAA National Centers for Environmental Information, Climate at a Glance: County & Divisional Time Series, published May 2023, retrieved on May 2, 2023 from https://www.ncdc.noaa.gov/cag/.

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

[19] Ibid

Increasing temperatures is already being felt throughout Clackamas County, particularly by the hydrology in the region. Spring snowpack has substantially decreased throughout the western part of the United States, particularly in areas with milder winter temperatures, such as the Cascade Mountains. In other areas of the West, such as east of the Cascades Mountains, snowfall is affected less by the increasing temperature because the temperatures are already cold and more by precipitation patterns. It has been estimated that Clackamas County has warmed at a rate of 2.2°F per century since 1895, and will continue to increase in average temperature upwards of 5.0°F by the 2050s. Additionally, the number, duration, and intensity of extreme heat events in Oregon and Clackamas County is projected to increase due to continued warming temperatures, with a projection that the number of days per year with a maximum temperature of 90°F or higher will rise to 7.3-12.4 days by the 2050s. Additionally, the greatest temperature increases will continue to occur in the summer, increasing the risk and frequency of extreme heat and heatwaves, which put stress on human and ecological health, and agricultural maintenance and output. Precipitation is expected to increase during the spring and winter and decrease in the summer months, which further increases the risks for both flooding and drought. Furthermore, with the combination of both extreme heat and drought, the risk of forest fires increases.[20]

Hazard Severity

Situated in the Willamette Valley with the Cascades just off to the east, the county is susceptible to a variety of storms that can affect community members and residents, damage property, and disrupt ecological systems. Typical hazards to affect the county include droughts, floods, extreme heat events, landslides, wildfires, severe winter storms, windstorms, earthquakes, and volcanic eruptions. While the entire county is susceptible to all these types of natural hazards, the hamlets and villages located around the Mount Hood vicinity seem to be most affected by a variety of hazards, including seasonal floods, which are characterized by periods of heavy rains over a short amount of time, or are due to hard snowfall and ice storm that is immediately followed by warm temperatures, causing the fresh snow to melt at a faster rate. Furthermore, large amounts of volcanic sediment has settled in the streams and valleys over the years since Mount Hood's last eruption, and have been even developed on. The houses located in this vicinity and on this soil type are more vulnerable to landslides and floods as the water permeates in the soil more easily; another factor to consider is the erosive behavior of the Sandy River's migrating channel. Furthermore, this part of the county is heavily forested, which provides ample fuel for wildfire, as seen during the 2020 Riverside Wildfire.

Ownership and Land Cover

More than half of the land in Clackamas County is federally owned by either the BLM (6%) or the US Forest Service (45%). Another 46% is privately owned, while 1% is owned by the state.[21]

The eastern portion of the county is primarily rural and comprises most of the US Forest Service owned land. The western portion of the county, on the contrary, is more urbanized and h as a higher percentage of privately owned land. The western portion also includes zoning for agriculture, forest,

[20] Fleishman, E., editor. 2023. Sixth Oregon climate assessment. Oregon Climate Change Research Institute, Oregon State University, Corvallis, Oregon. DOI: 10.5399/osu/1161.

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

rural exception, and the urban growth boundary - a vast majority of this portion of the county is either included in the Urban Growth Boundary or is designated as rural reserve.[22]

According to the *Willamette Valley Land Use/Land Cover Map Informational Report*, a majority of the land cover that includes farmland used for production of tree fruits, vineyards, berries, Christmas trees, and nursery stock can be found in Clackamas County.[23] The report goes on to discuss that the valley portion of the county can be characterized by row crops in the bottomland along the Willamette, Pudding, and Molalla Rivers, with its upland areas characterized by a combination of all the agricultural cover types.[24] Because this area is interlaced with all types and sizes of creeks and swales, the land drains better here, than the rest of the Willamette Valley.[25] The foothill areas leading into the Cascade Range can be characterized by rural non-farm small parcels that are agriculture lands with little or no management, as well as large parcels that are being, or have been, broken to make smaller ranches for single-family dwellings.[26] The foothill area in the Cascade Range has also seen a conversion from all types of forested areas to Christmas tree plantations and solid Douglas Fir Forest.[27]

Minerals and Soils

The characteristics of the minerals and soils present in Clackamas County indicate the potential types of hazards that may occur. Rock hardness and soil characteristics can determine whether or not an area will be prone to geologic hazards such as earthquakes and landslides. Some of Oregon's richest soils are located in areas surrounding Canby, Sandy, Molalla, and Wilsonville. In fact, 87% of non-urban soil is classified as productive, agricultural land. These deep alluvial soils are rich in minerals and are great for agriculture, but serve to amplify the effects of earthquakes. Steep slopes toward the Cascade Range increase the potential for landslides. The four mineral and soil types in Clackamas County are valley fill and semi-consolidated sedimentary rocks, basaltic lavas, marine sedimentary rocks, and Eocene-age volcanic and sedimentary rocks.[28]

The surface material includes unconsolidated, fine-grained deposits of Willamette silt, sand, gravel, and recent floodplain deposits. Torrential flood events can introduce large deposits of sand and gravel. Sandy silt and silt containing clay are moderately dense and firm, and are primarily considered to be prone to liquefaction, an earthquake related hazard. Basaltic lava consists mainly of weathered and non-weathered, dense, fine-grained basalt. Though the characteristics of this lava may offer solid foundation support, landslides are common in many of these areas where weathered residual soil overlies the basalt. Understanding the geologic characteristics of Clackamas County is an important step in mitigation and avoiding at-risk development.[29]

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

[23] "Willamette Valley Land Use/Land Cover Map Informational Report," Pg. 25. Accessed April 25 2023. https://digital.osl.state.or.us/islandora/object/osl:18785

[24] Ibid

[25] Ibid

[26] Ibid

[27] Ibid

[28] Schlicker, Herbert G. and Deacon, Robert J., Engineering geology of the Tualatin Valley Region, Oregon (1967), (Bulletin 60). Oregon: Department of Geology and Mineral Industries.

[29] Schlicker, Herbert G. and Deacon, Robert J., Engineering geology of the Tualatin Valley Region, Oregon (1967), (Bulletin 60). Oregon: Department of Geology and Mineral Industries.

Other Significant Geologic Features

Clackamas County, like most of the Pacific Northwest, lies over the area of Cascadia Subduction Zone where the North American crustal plate overrides the Juan de Fuca plate underneath the earth's crust. The fault along these two plates creates a structural sag at the Willamette River Valley. Volcanoes are present along this structural sag, and the activity on these mountains is caused by the buoyant melted rock of the Juan de Fuca plate, as it rises to the surface.

Synthesis

This natural environment capacity section is composed of elements known as natural capital, which ar essential to sustaining all forms of life, including human life, and plays an often underrepresented role in natural hazard risk and community resiliency.

With mild temperatures and diverse terrain, the most common natural hazards that affect Clackamas County are widespread heavy rain events followed by major flood events, extreme heat events, and wildfire. With eminent hazard events such as these, it is important that the county is able to adaquately respond to disruptive events, such as damage/impact to the county's water supply, which is supplied by several of the major rivers flowing throughout, and has the potential to be heavily affected by disaster.

Highlighting natural capitals such as key river systems and ecosystems, as well as temperature and precipitation patterns, will allow the county to identify key hazard areas and issues that need to be better prepared for and mitigated against, which will assist in building community and county resiliency.

Table 18 indicates where natural environment and related infrastructure vulnerabilities exist in relation to each of the natural hazards profiled in Volume I, Section 2. Impacts of the natural hazards is identified as either a direct impact (impacts occuring as a direct result of a hazard) or an indirect impact (impacts occur at a later time as a result of a hazard), or both.

Table 18 Clackamas County Natural Environment Vulnerabilities

Direct / Indirect / Both — Clackamas County Asset	Identified Hazard Exposure								
	Drought	Earthquake	Extreme Heat	Flooding	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Forest/woodland areas	D		B	D	D	I	B	D	D
Streams/riparian zones (property damage, bridges/culverts)	I	B	I	B	I	I	B		I
County/City parks	I	D	I	D		B	B	D	D
General groundwater issues	D	B				I	I		
Groundwater and surface water contamination from industrial area disruption		D		D		I	B		

Source: Clackamas County HMAC

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

Clackamas County is part of the tri-county metro area comprised of Multnomah, Clackamas, and Clackamas Counties. The tri-county metro area experienced population growth between 2017-2021 (Table C-4). Clackamas County's population grew 5% from 2017-2021 and is the third most populous Oregon county.

The tri-county metro area accounts for roughly 44% of Oregon's population. Clackamas County accounts for just under one-quarter of the tri-county metro area's population. Lake Oswego (41,148) and Oregon City (37,786) are the county's largest cities.

The unincorporated area of the county accounts for about 46% of the overall population (194,356) and is growing slower than the incorporated cities (1.1% AAGR).

Oak Grove (17,382), Oatfield (12,993), and Damascus (10,878) are the largest unincorporated communities (CDPs) in Clackamas County.

Since 2014, Portland State University's Population Research Center has created coordinated population forecasts for counties and cities across the state (Table 19). According to the most recent forecast for 2045, Clackamas County's population is expected to increase to over 526,000, a 24% increase from the 2020 estimate.

Table 19 Population Forecast for Tri-County Metro Area

Jurisdiction	2020		2045		Change		
	Number	Percent	Number	Percent	Number	Percent	AAGR
3-County Area	1,876,155	100%	2,226,974	100%	447,729	25%	1.2%
Clackamas County	**426,515**	**23%**	**526,837**	**23%**	**100,322**	**24%**	**1.1%**
Multnomah County	829,560	44%	970,485	44%	140,925	17%	0.0
Washington County	620,080	33%	828,985	34%	208,905	34%	1.5%

Source: Portland State University, Population Research Center, "Annual Population Estimates", 2020; Oregon Metro Portland Area 2045 Population and Housing Forecasts, March 26, 2021

Table 20 Population Estimates and Change (2016 and 2022)

	2016		2022		Change (2016-2022)		
Jurisdiction	Number	Percent	Number	Percent	Number	Percent	AAGR
Oregon	4,076,350	100%	4,281,851	100%	205,501	5%	0.8%
3-County Area	1,779,245	44%	1,849,882	43%	70,637	4%	0.7%
Clackamas County	404,980	23%	430,421	23%	25,441	6%	1.0%
Multnomah County	790,670	44%	810,242	44%	19,572	2%	0.4%
Washington County	583,595	33%	609,219	33%	25,624	4%	0.7%
Unincorporated^	**194,008**	**48%**	**188,545**	**44%**	**-5,463**	**-3%**	**-0.5%**
Beavercreek	4,034	1%	4,026	1%	-8	0%	0.0%
Boring	-	-	1,999	0%	-	-	-
Damascus	10,842	3%	10,878	3%	36	0%	0.1%
Government Camp	121	0%	84	0%	-37	-31%	-5.9%
Jennings Lodge	7,727	2%	7,953	2%	226	3%	0.5%
Mount Hood Village	5,231	1%	4,408	1%	-823	-16%	-2.8%
Mulino	2,797	1%	2,251	1%	-546	-20%	-3.6%
Oak Grove	16,848	4%	17,382	4%	534	3%	0.5%
Oatfield	13,592	3%	12,993	3%	-599	-4%	-0.7%
Rhododendron	-	-	173	0%	-	-	-
Stafford	1,945	0%	1,999	0%	54	3%	0.5%
Not Within a CDP	130,871	32%	124,399	29%	-6,472	-5%	-0.8%
Incorporated	**210,972**	**52%**	**241,876**	**56%**	**30,904**	**15%**	**2.3%**
Barlow	135	0%	138	0%	3	2%	0.4%
Canby	16,420	4%	18,979	4%	2,559	16%	2.4%
Estacada	3,155	1%	5,373	1%	2,218	70%	9.3%
Gladstone	11,660	3%	12,170	3%	510	4%	0.7%
Happy Valley	18,680	5%	26,689	6%	8,009	43%	6.1%
Johnson City	565	0%	527	0%	-38	-7%	-1.2%
Lake Oswego (part)	34,855	9%	38,524	9%	3,669	11%	1.7%
Milwaukie	20,510	5%	21,305	5%	795	4%	0.6%
Molalla	9,085	2%	10,298	2%	1,213	13%	2.1%
Oregon City	34,240	8%	37,786	9%	3,546	10%	1.7%
Portland (part)	766	0%	767	0%	1	0%	0.0%
Rivergrove (part)	459	0%	506	0%	47	10%	1.7%
Sandy	10,655	3%	12,991	3%	2,336	22%	3.4%
Tualatin (part)	2,911	1%	3,129	1%	218	7%	1.2%
West Linn	25,615	6%	27,420	6%	1,805	7%	1.1%
Wilsonville (part)	21,260	5%	25,274	6%	4,014	19%	2.9%

Source: Portland State University, Population Research Center, "Annual Population Estimates", 2020; Social Explorer, Table T1, U.S. Census Bureau, 2017-2021 American Community Survey Estimates and 2012-2016 American Community Survey Estimates. Jurisdictions in bold are participating in this plan.
Notes: Most of the Portland and Tualatin populations are outside of Clackamas County and are not profiled in this plan.
^ - Population information is from the American Community Survey 5-Year Estimates
CDP = Census Designated Place

Tourism

Tourists are not counted in population statistics; and are therefore considered separately in this analysis. The table below shows the estimated number of person nights in private homes, hotels and motels, and other types of accommodations. The table shows that, between 2016-2021, approximately 70% of all visitors to Clackamas County lodged in private homes, with 20% staying in hotels/motels, the remaining visitors stay on other accommodations (vacation homes/campgrounds).

Table 21 Annual Visitor Estimates in Person Nights

	2016p		2018p		2019p		2021p	
	Person-Nights (1,000's)	Percent	Person-Nights (1,000's)	Percent	Person-Nights (1,000's)	Percent	Person-Nights (1,000's)	Percent
All Overnight	7,392	100%	7,383	100%	6,234	100%	7,106	100%
Hotel/Motel	1,496	20%	1,473	20%	1,319	21%	1,319	21%
Private Home	5,275	71%	5,285	72%	4,275	69%	4,275	69%
Other	621	8%	625	9%	640	10%	640	10%

Source: Oregon Tourism Commission, Oregon Travel Impacts: 2003-2021, Dean Runyan Associates

Tourists' lodging in private homes suggests these visitors are staying with family and friends. For hazard preparedness and mitigation purposes, outreach to residents in Clackamas County will likely be transferred to these visitors in some capacity, whether through word of mouth or shared resources. Visitors staying at hotel/motels are less likely to benefit from local preparedness outreach efforts aimed at residents.

Vulnerable Populations

Most vulnerable populations tend to be historically marginalized groups, which includes, but are not limited to disabled community members, women, children, seniors, and racial minorites, as well those people living in poverty or are unhoused. These groups 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.

Additionally, FEMA's Office of Equal Rights addresses these needs by suggesting that agencies and organizations planning for natural hazards must identify and engage with vulnerable populations, make recovery centers more accessible and inclusive to needs, and review practices and procedures to remedy any discrimination in relief application or assistance.

In 2022, FEMA passed the FEMA Agency Equity Action Plan, which seeks to integrate equity into its strategic planning, goals and priorities, programming and acrtivies, and its foundational documents and processes. This aims to ensure that underserved and vulnerable populations are better able to access and leverage relevant resources to hazard mitigation and recovery that meet their needs, and ensure that resources are directed towards eliminating disparities in outcomes.[30] In this way, the Equity Action Plan is to minimize risk and exposure to socially vulnerable populations, in which social vulnerability describes the characteristics or factors that can disproportionately affect a person during a hazard

[30] FEMA, "Agency Equity Access Plan Executive Summary", Accessed 19 May 2023, https://www.fema.gov/sites/default/files/documents/fema_equity-action-plan.pdf

event. Being disproportionately affected can describe either a heightened risk factor during a hazard event or a characteristic that can affect a person or community's ability to recover from a disaster.

While population size itself is not an indicator of vulnerability, characteristics that are more significant and critical to assess as indicators of vulnerability and social vulnerability include location, community composition, and the capacity of the population within the community to respond to disasters. Social science research has also demonstrated that human capital indices such as language, race, age, income, education, health, and ability can further affect the integrity and connectivity of a community. Therefore, human capitals can positively influence community resilience to natural hazards.

Additional information on vulnerable populations is available vie Clackamas County Public Health's Community Health Assessment and Blueprint for a Healthy Clackamas County.

Language

Special consideration must 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 and information 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 and engagement techniques and materials.

There are various languages spoken across Clackamas County; the primary language is English (Table 22).

Table 22 Clackamas County Language Barriers

Jurisdiction	Population 5 years and over	English Only		Multiple Languages		Limited or No English	
		Number	Percent	Number	Percent	Number	Percent
Oregon	3,983,562	3,374,934	85%	608,628	15%	214,087	5%
Clackamas County	396,817	348,351	88%	48,466	12%	16,122	4%
Beavercreek	3,803	3,643	96%	160	4%	51	1%
Boring	1,979	1,949	98%	30	2%	15	1%
Damascus	10,562	9,262	88%	1,300	12%	463	4%
Government Camp	84	84	100%	0	0%	0	0%
Jennings Lodge	7,490	6,324	84%	1,166	16%	459	6%
Mount Hood Village	4,258	4,112	97%	146	3%	55	1%
Mulino	2,194	2,108	96%	86	4%	31	1%
Oak Grove	16,519	14,462	88%	2,057	12%	1,063	6%
Oatfield	12,160	10,899	90%	1,261	10%	380	3%
Rhododendron	173	173	100%	0	0%	0	0%
Stafford	1,906	1,852	97%	54	3%	0	0%

Source: Social Explorer, U.S. Census Bureau, 2017-2021 American Community Survey Estimates, Table 16002.

Approximately 12% of the Clackamas County population speaks a language other than English, Spanish is the second most widely spoken language with about 6% of the population 5 years and over speaking Spanish, (8% of Jennings Lodge's and 5% of Mulino's populations speak Spanish at home). Overall, about 4% of the Clackamas County population is not proficient in English. Outreach materials and community

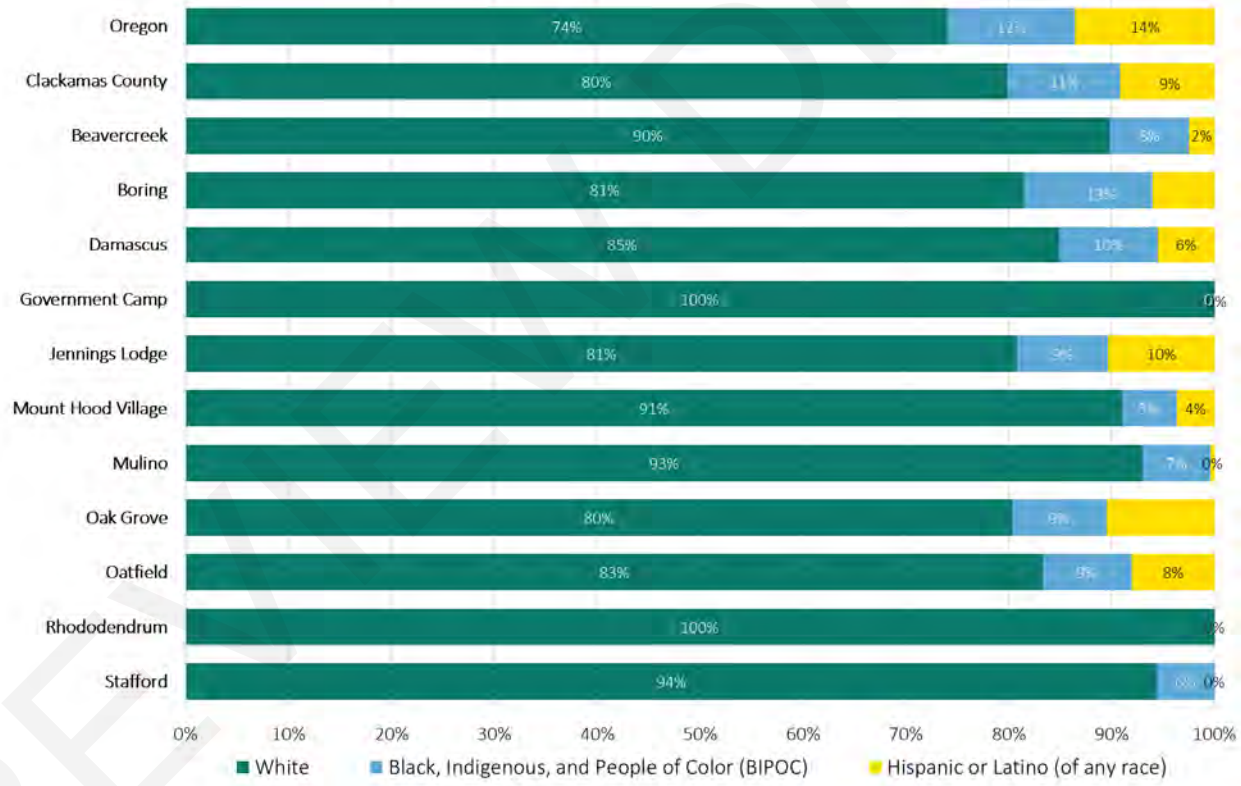
engagement oppurtunities used to communicate with, plan for, and respond to non-English speaking populations must take into consideration the language needs of these populations.

Race and Ethnicity

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 are disproportionately more vulnerable to natural disaster events.[31] This is not reflective of individual characteristics; instead, historic patterns of inequality and inequity, coupled with racial or ethnic disparities, have often resulted in minority communities often being forced into substandard housing options, dependent on degrading infrastructure, or deprived of access to public services that were developed and delivered in accordance with their unique needs and differences.

While the majority of the population in Clackamas County is racially white (Figure 2). Boring, Damascus, and the incorporated areas of the County have the largest percentages of Black, Indigenous, and People of Color (BIPOC). About nine percent (9%) of the county population identifies as Hispanic or Latino.

Figure 2 Race and Hispanic or Latino



Source: Social Explorer, Table T14, U.S. Census Bureau, 2017-2021 American Community Survey Estimates.

It is important to identify specific ways to support all parts of the community through hazard mitigation, preparedness, and response. Culturally appropriate, and effective outreach can include both methods

[31] Berberian AG, Gonzalez DJX, Cushing LJ. Racial Disparities in Climate Change-Related Health Effects in the United States. Curr Environ Health Rep. 2022 Sep;9(3):451-464. doi: 10.1007/s40572-022-00360-w.

and messaging targeted to diverse audiences. One such method to connect with historically disenfranchised populations is through connecting and collaborating with already trusted sources (e.g., community leaders, cultural organizations, etc.), or providing educational handouts and presentations in the languages spoken by the population. Employing culturally-appropriate and relevant materials and resource can help by further increasing overall community resilience and disaster preparedness and recovery by ensuring that everyone in the community, regardless or race, language(s) spoken, and identity.

Gender

Clackamas County has slightly more females than males (Female 51%, Male: 49%), whileJennings Lodge (55%), Oakfield (55%) and Damascus (51%) have the highest male to female ratios comprising their populations. This information is important to recognize because women more often have to reckon with greater institutionalized obstacles than men, especially during the recovery period, due to sector-specific employment, lower wages, and family care responsibilities (often more influenced by social norms and expectations).

Age

Of the factors influencing socio demographic capacity, the most significant indicator in Clackamas County may be age of the population. Depicted in Table C-7 as of 2020, 18% of the county population is over the age of 64, a percentage that is projected to rise to 22% by 2045.

Table 23 Population by Vulnerable Age Groups

		< 15 Years Old		> 64 Years Old		15 to 64 Years Old	Age Dependency Ratio
Jurisdiction	Total	Number	Percent	Number	Percent		
Oregon	4,207,177	722,001	17%	743,125	18%	2,742,051	53.4
Clackamas County	418,577	73,699	18%	75,900	18%	268,978	55.6
Beavercreek	4,026	511	13%	859	21%	2,656	51.6
Boring	1,999	340	17%	496	25%	1,163	71.9
Damascus	10,878	1,634	15%	2,022	19%	7,222	50.6
Government Camp	84	0	0%	60	71%	24	250.0
Jennings Lodge	7,953	1,169	15%	1,692	21%	5,092	56.2
Mount Hood Village	4,408	507	12%	1,088	25%	2,813	56.7
Mulino	2,251	256	11%	562	25%	1,433	57.1
Oak Grove	17,382	2,455	14%	3,940	23%	10,987	58.2
Oatfield	12,993	2,090	16%	2,959	23%	7,944	63.6
Rhododendrum	173	0	0%	108	62%	65	166.2
Stafford	1,999	546	27%	420	21%	1,033	93.5
2044							
Clackamas County	493,768	65,567	13%	116,222	24%	311,979	58.3

Source: Social Explorer, Table 17, U.S. Census Bureau, 2017-2021 American Community Survey Estimates, Office of Economic Analysis. Portland State University, Population Research Center, "Population Forecasts", 2021.

The Clackamas County age dependency ratio is 55.6. The age dependency ratio indicates a higher percentage of dependent aged people to that of working age. The age dependency ratio for Clackamas County is expected to rise to 58.3 in 2045. With a higher age-dependency ratio there will be fewer

people of working age who can support mitigation and recovery from a natural disaster. In addition, as the population ages, the County may need to consider different mitigation and preparedness actions to address the specific needs of this group.

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 implemented and carried out. For example, school age children rarely make decisions about emergency management. Therefore, a larger youth population in an area will increase the importance of outreach and engagement 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. For example, 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.[32]

Families and Living Arrangements

There are two ways that the census defines households: 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. Table 24 shows that Clackamas County is predominately comprised of family households (69%). Of all households, 23% are one- person non-family households (householder living alone). Countywide about 11% of householders live alone and are age 65 or older.

Table 24 Household by Type, Including Living Alone

Jurisdiction	Total	Family Households		Householder Living Alone		Householder Living Alone (age 65+)	
		Estimate	Percent	Estimate	Percent	Estimate	Percent
Oregon	1,658,091	1,037,580	63%	458,841	28%	195,002	12%
Clackamas County	159,553	110,016	69%	37,224	23%	18,168	11%
Beavercreek	1,589	1,223	77%	256	16%	127	8%
Boring	687	564	82%	68	10%	47	7%
Damascus	3,569	2,943	82%	505	14%	174	5%
Government Camp	52	28	54%	24	46%	0	0%
Jennings Lodge	3,579	2,252	63%	1,077	30%	590	16%
Mount Hood Village	1,956	1,202	61%	588	30%	217	11%
Mulino	722	640	89%	58	8%	43	6%
Oak Grove	7,272	4,087	56%	2,455	34%	1,470	20%
Oatfield	4,879	3,549	73%	1,081	22%	732	15%
Rhododendrum	111	60	54%	51	46%	41	37%
Stafford	758	506	67%	252	33%	168	22%

Source: Social Explorer, Table 17, U.S. Census Bureau, 2017-2021 American Community Survey Estimates.

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

Table 25 shows household structures for families with children. About 34% of all households within the county are married family households that have children and 11% are single-parent households. These populations will likely require additional support and capacity during a disaster and in the recovery period following a disaster, and will inflict strain on the system if inseficiently supported and managed.

Table 25 Married-Couple and Single Parent Families with Children

Jurisdiction	Total Households	Married-Couple with Children		Single Parent with Children	
	Estimate	Estimate	Percent	Estimate	Percent
Oregon	1,037,580	312,802	30%	146,166	14%
Clackamas County	110,016	36,981	34%	12,563	11%
Beavercreek	1,223	277	23%	52	4%
Boring	564	197	35%	8	1%
Damascus	2,943	944	32%	172	6%
Government Camp	28	0	0%	0	0%
Jennings Lodge	2,252	587	26%	376	17%
Mount Hood Village	1,202	272	23%	48	4%
Mulino	640	138	22%	48	8%
Oak Grove	4,087	1,144	28%	601	15%
Oatfield	3,549	1,244	35%	138	4%
Rhododendrum	60	0	0%	0	0%
Stafford	506	218	43%	15	3%

Source: U.S. Census Bureau, 2017-2021 American Community Survey Estimates, Table DP02.

Income

Household income and poverty status are indicators of socio demographic capacity and the stability of the local economy. Household income can be used to compare economic areas as a whole but does not reflect how the income is divided among the area residents. Table 26 shows the distribution of household income for 2016 and 2021.

Countywide, between 2016 and 2021, all households making an income below $75,000 decreased, while the number of households making $75,000 and above increased in share. Also, the share of households making more than $100,000 increased more than other income cohorts. For the same period the share of total households remained relatively stable for all income cohorts, with the greatest growth seen in the $100,000-$199,999 and $200,000 or more income categories.

Table 26 Household Income

Household Income	2016^		2021		Change in Share	
	Estimate	Percent	Estimate	Percent	Estimate	Percent
Less than $15,000	9,510	6%	9,871	6%	-484	-0.7%
$15,000-$29,999	15,341	10%	13,013	8%	-1,471	-1.5%
$30,000-$44,999	16,110	11%	15,017	9%	-1,130	-1.3%
$45,000-$59,999	16,265	11%	14,756	9%	-1,179	-1.3%
$60,000-$74,999	15,358	10%	14,574	9%	452	-0.3%
$75,000-$99,999	21,232	14%	22,115	14%	1,385	0.1%
$100,000-$199,99	41,669	28%	49,184	31%	6,131	2.5%
$200,000 or more	15,666	10%	21,023	13%	4,577	2.4%

Source: Social Explorer, Table 56, U.S. Census Bureau, 2017-2021 American Community Survey Estimates and 2012-2016 American Community Survey Estimates Note: ^ 2016 dollars adjusted for 2021 via Social Explorer's Inflation Calculator

The 2020 median household income across Clackamas County is $88,517, representing a 14% increase in real incomes from 2016 (Table 27). Stafford has the highest median household income (and had the second greatest gain), Jennings Lodge has the lowest median household income (and had the smallest gain).

Table 27 Median Household Income

Jurisdiction	Median Household Income		Percent Change
	2016^	2021	
Oregon	$60,144	$70,084	17%
Clackamas County	$77,807	$88,517	14%
Beavercreek	$94,331	$108,165	15%
Boring	-	$87,202	-
Damascus	$93,518	$101,574	9%
Government Camp	-	-	-
Jennings Lodge	$59,953	$61,986	3%
Mount Hood Village	$68,388	$79,850	17%
Mulino	$82,208	$91,333	11%
Oak Grove	$67,228	$68,344	2%
Oatfield	$84,297	$92,221	9%
Rhododendrum	-	-	-
Stafford	$141,757	$161,489	14%

Source: Social Explorer, Table A14006, U.S. Census Bureau, 2017-2021 American Community Survey Estimates and 2012-2016 American Community Survey Estimates
Note: ^ 2016 dollars adjusted for 2020 via Social Explorer's Inflation Calculator

Table 28 identifies the percentage of individuals and cohort groups that are below the poverty level in 2021. It is estimated that about 7% of individuals, 20% of children under 18, and 18% of seniors live below the poverty level across the county. Rhododendum, Jennings Lodge, Mulino, and Oak Grove have the highest poverty rates.

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.

Table 28 Poverty Rates

	Total Population in Poverty		Children Under 18 in Poverty		18 to 64 in Poverty		65 or over in Poverty	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Oregon	498,517	12%	119,774	24%	316,755	64%	61,988	12%
Clackamas County	31,168	7%	6,235	20%	19,225	62%	5,708	18%
Beavercreek	155	4%	16	10%	99	64%	40	26%
Boring	113	6%	27	24%	64	57%	22	19%
Damascus	379	4%	62	16%	250	66%	67	18%
Government Camp	5	6%	0	0%	0	0%	5	100%
Jennings Lodge	992	13%	190	19%	668	67%	134	14%
Mount Hood Village	383	9%	114	30%	205	54%	64	17%
Mulino	274	12%	59	22%	89	32%	126	46%
Oak Grove	1,904	11%	383	20%	1,234	65%	287	15%
Oatfield	1,042	8%	140	13%	439	42%	463	44%
Rhododendrum	51	29%	0	0%	0	0%	51	100%
Stafford	80	4%	28	35%	52	65%	0	0%

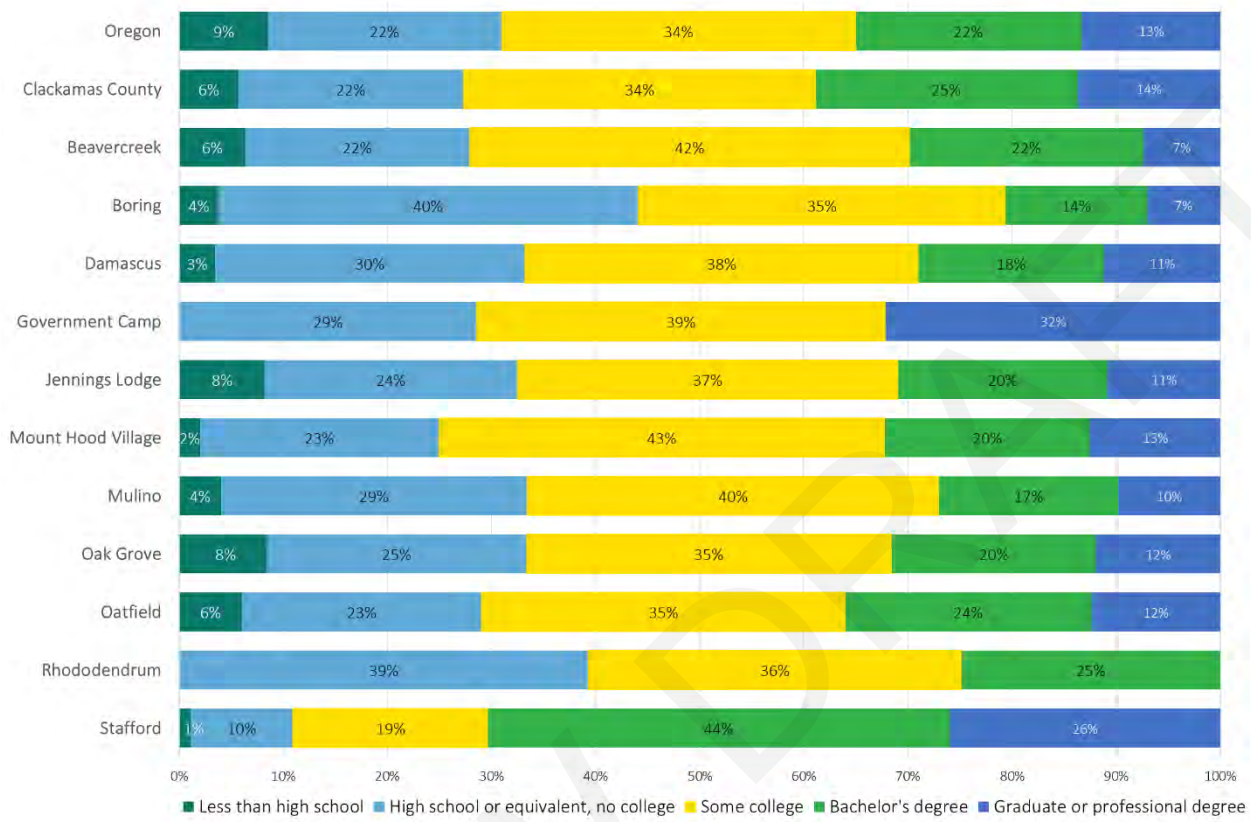
Source: Social Explorer, Tables 114, 115, 116, U.S. Census Bureau, 2017-2021 American Community Survey Estimates and 2012-2016 American Community Survey Estimates

Education

Educational attainment of community residents is also identified as an influencing factor in socio demographic capacity. Educational attainment often reflects higher income and therefore higher self-reliance. Widespread educational attainment is also beneficial for the regional economy and employment sectors as there are potential employees for professional, service and manual labor workforces. An oversaturation of either highly educated residents or low educational attainment can have negative effects on the resiliency of the community.

Approximately 6% of the Clackamas County population over 25 years does not have a high school degree or equivalent, while 22% have a high school degree or equivalent but do not have college experience. An additional 34% have some college or an Associate degree and 38% have earned a Bachelor's degree or higher (Figure 3). Jennings Lodge, Oak Grove, Oatfield, and Beaver Creek have the lowest percentages of high school graduates. Stafford has the highest percentage of people with a Bachelor's degree or higher.

Figure 3 Educational Attainment



Source: Social Explorer, Table 25, U.S. Census Bureau, 2017-2021 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 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 th 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. Clackamas County has 6% of its population without health insurance; Government Camp (29%) has the highest percentage of uninsured. The rate of uninsured changes with age,as the highest rates of uninsured are within the 18 to 64-year cohort. The ability to provide services to the uninsured populations may burden local providers following a natural disaster.

Table 29 Health Insurance Coverage

Jurisdiction	Total Population	Without Health Insurance							
		Total		Under 18 years		18 to 64 years		65+ years	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Oregon	4,167,351	278,280	7%	32,569	4%	241,771	10%	3,940	1%
Clackamas County	416,908	23,136	6%	3,463	4%	19,312	8%	361	< 1%
Beavercreek	4,026	159	4%	6	1%	145	6%	8	1%
Boring	1,999	86	4%	10	2%	76	7%	0	0%
Damascus	10,845	599	6%	40	2%	559	8%	0	0%
Government Camp	84	24	29%	0	-	24	100%	0	0%
Jennings Lodge	7,953	379	5%	71	5%	306	6%	2	< 1%
Mount Hood Village	4,401	267	6%	20	3%	247	9%	0	0%
Mulino	2,251	151	7%	0	0%	151	12%	0	0%
Oak Grove	17,328	1,387	8%	208	6%	1,176	12%	3	< 1%
Oatfield	12,955	433	3%	51	2%	351	5%	31	1%
Rhododendrum	173	0	0%	0	-	0	0%	0	0%
Stafford	1,999	89	4%	0	0%	48	5%	41	10%

Source: Social Explorer, Table 146, U.S. Census Bureau, 2017-2021 American Community Survey Estimates

The table below describes disability status of the population. Approximately 12% of the Clackamas County community non-institutionalized population identifies with one or more disabilities. Rhododendrum has the highest percentage of its total population with a disability (30%). The rate of disability increases with age for all jurisdictions.

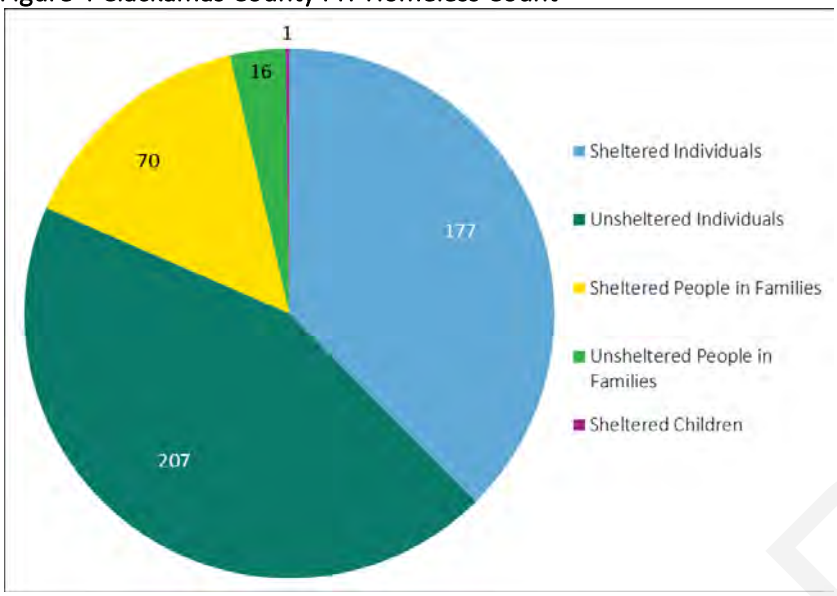
Table 30 Disability Status by Age Group

Jurisdiction	Population	With a disability		Under 18 years with a disability		18 to 64 years with a disability		65 years and over with a disability	
	Estimate^	Estimate	Percent	Estimate	Percent*	Estimate	Percent*	Estimate	Percent*
Oregon	4,167,351	599,964	14%	43,241	5%	306,591	12%	250,132	34%
Clackamas County	416,908	49,265	12%	3,027	3%	23,391	9%	22,847	30%
Beavercreek	4,026	568	14%	14	2%	299	12%	255	30%
Boring	1,999	258	13%	0	0%	44	4%	214	43%
Damascus	10,845	1,140	11%	30	1%	769	11%	341	17%
Government Camp	84	0	0%	0	-	0	0%	0	0%
Jennings Lodge	7,953	1,346	17%	135	9%	677	14%	534	32%
Mount Hood Village	4,401	596	14%	25	4%	231	9%	340	31%
Mulino	2,251	326	14%	7	2%	145	11%	174	31%
Oak Grove	17,328	2,427	14%	70	2%	1,232	12%	1,125	29%
Oatfield	12,955	1,958	15%	15	1%	723	10%	1,220	42%
Rhododendrum	173	52	30%	0	-	13	20%	39	36%
Stafford	1,999	95	5%	0	0%	23	2%	72	17%

Source: Social Explorer, U.S. Census Bureau, 2017-2021 American Community Survey Estimates, Table B18101.
Notes: ^ Non-institutionalized civilian population, * Percent of age group

In 2020, 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 471 individuals and persons in families in Clackamas County identify as homeless; 53%, 248 people were sheltered (177 individuals, 70 persons in families, and 1 sheltered child), and 47%, 223 people, were unsheltered (207 individuals and 16 persons in families).

Figure 4 Clackamas County PIT Homeless Count



Source: Oregon Housing and Community Service, 2021 Point-in-Time Homeless Count

The homeless have little resources to rely on, especially during an emergency. It will likely be the responsibility of the county, cities, 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.

Household Characteristics – Vehicles Available

Countywide two percent (2%) of all owner occupied households, and 12% of renter-occupied households, have no vehicle available (Table 31). The percentage of owner occupied households without a vehicle available is greatest in Rhododendrum (9%) and for renter occupied households it is greatest in Government camp (100%), Oatfield (24%). Jennings Lodge (17%), Oak Grove (14%) and Stafford (13%). Household access to a vehicle is key to evacuating quickly and safely. Households that have no access to a vehicle or limited vehicles available may face delays, or need assistance, to evacuate.

Table 31 Vehicles Available – Owner and Renter Occupied Housing

Jurisdiction	Owner Occupied Housing			Renter Occupied Housing		
	Housing Units	No Vehicle (Percent)	Two (or more) Vehicles (Percent)	Housing Units	No Vehicle (Percent)	Two (or more) Vehicles (Percent)
Oregon	1,047,165	2%	74%	610,926	15%	41%
Clackamas County	113,948	2%	80%	45,605	12%	44%
Beavercreek	1,477	1%	88%	112	< 1%	79%
Boring	557	< 1%	89%	130	< 1%	100%
Damascus	3,393	1%	82%	176	5%	80%
Government Camp	28	< 1%	100%	24	100%	< 1%
Jennings Lodge	1,967	2%	67%	1,612	17%	35%
Mount Hood Village	1,682	1%	73%	274	< 1%	57%
Mulino	607	< 1%	96%	115	< 1%	63%
Oak Grove	4,850	2%	70%	2,422	14%	39%
Oatfield	4,114	2%	82%	765	24%	36%
Rhododendrum	111	9%	63%	0	-	-
Stafford	646	< 1%	86%	112	13%	64%

Source: Social Explorer, U.S. Census Bureau, 2017-2021 American Community Survey Estimates, Table A10030 and A10054B.

Synthesis

As Clackamas County is the third largest county in the state of Oregon, in terms of population, resiliency and hazard mitigation efforts can be a lot harder to manage. The socio demographic characteristics and qualities of the community population such as age, race, gender, education, ability, income, and health and safety are significant factors that can influence the county's ability to cope, adapt to, and recover from natural disasters. The current status of socio demographic capacity indicators can have long term impacts on the economy and stability, and can ultimately affect future resiliency of Clackamas County.

One such significant socio-demographic characteristics to consider is the language(s) spoken by community members, specifically residents who are not proficient in English, with around four percent of Clackamas County residents idetnifed as having limited proficiency in English. Such language barriers will often make it difficult to reach populations of residents who don't speak English. Resiliency efforts need to focus on targeting these populations as they will be most vulnerable and may have trouble knowing what to do in the event of a disaster.

Clackamas County socio-economic factors to consider include:

- With around 14% growth from 2016 to 2021, the median household income across the county has increased to $88,517.
- 7% of the population is considered in poverty; the rates are highest in Rhododendrum, Jennings Lodge, Mulino, and Oak Grove.
- Children in poverty is greatest in Stafford, Mount Hood Village, Boring, and Mulino. Those 65 or over in poverty is greatest in Rhododendrum and Government Camp.
- 12% of the total population, and 30% of this population 65 years or older, has a disability.

Highlighting the above socio-economic factors and looking at the Socio Demographic Capacity of the county is important as it affects the resiliency of the county and helps determine target areas and potential vulnerable populations for increased notification on mitigation and resiliency efforts.

Table 32 indicates the vulnerabilities of physical infrastructure that are utlized by and provide services to the population that exist in relation to each of the natural hazards profiled in Volume I, Section 2. Impacts of the natural hazards is identified as either a direct impact (impacts occuring as a direct result of a hazard) or an indirect impact (impacts occur at a later time as a result of a hazard), or both.

Table 32 Clackamas County Population Related Infrastructure Vulnerabilities

Direct / Indirect / Both — Clackamas County Asset	Identified Hazard Exposure								
	Drought	Earthquake	Extreme Heat	Flooding	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Schools (particularly those identified in the 2007 Rapid Visual Survey)		D	B	D		I	B	I	I
Childcare Facilities		D	B	D		I	B	I	I
Adult Care Homes/ Assisted Living Facilities		D	B	D		I	B	I	I
Homeonwers in the Wildfire Urban Interface	I	I	D		I	I	B	I	I
Hospitals/Health Clinics		B	I	D	D	I	B	I	I
Mass Transit		B	B	D	D	I	B	I	B
Clackamas County Jail		B	I				I		

Source: Clackamas County HMAC

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 act to increase the resilience of the local economy.

Regional Affordability

indicators, i.e. median income, and is a critical analysis tool to understanding the economic status and resiliency of a community. This information can capture the likelihood of individuals' and community's ability to prepare for hazards, through such actions as retrofitting homes or purchasing hazard 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 with no to little Federal, State or local assistance.

Income Equality

Income equality is a measure of the distribution of economic resources, as measured by income, across a population. It is a statistic defining the degree to which all persons have a similar income. The table below illustrates the county and cities level of income inequality. The Gini index is a measure of income inequality. The index varies from zero to one. A value of one indicates perfect inequality (only one household has any income). A value of zero indicates perfect equality (all households have the same income).[33]

Table 33 shows that the countywide income inequality coefficient is 0.44. The areas of greatest income inequality are Stafford (0.48), Jennings Lodge (0.44), and Boring (0.43). The area of greatest income equality is Government Camp (0.22). The county as a whole has greater income inequality (0.45) than do any of the unincorporated communities (except Stafford). 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.[34]

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

[34] 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 33 Regional Income Inequality

Jurisdiction	Income Inequality Coefficient
Oregon	0.46
Clackamas County	0.45
Beavercreek	0.38
Boring	0.43
Damascus	0.39
Government Camp	0.22
Jennings Lodge	0.44
Mount Hood Village	0.41
Mulino	0.39
Oak Grove	0.40
Oatfield	0.42
Rhododendrum	0.39
Stafford	0.48

Source: Social Explorer, Table A14028, U.S. Census Bureau, 2017-2021 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.[35] Households spending more than 30% are considered housing cost burdened. Table 34 displays the percentage of homeowners and renters reflecting housing cost burden across the region.

Countywide roughly 39% of homeowners with a mortgage have a housing cost burden, compared to over 50% of renters. The communities of Rhododendrum, Damascus, Mulino, and Mount Hood Village have more than 50% of owners (with a mortgage) with a housing cost burden. Amongst renters, Stafford, Oak Grove, Oatfield, and Beaver Creek have more than 50% with a housing cost burden. In general, the population that spends more of their income on housing has proportionally fewer resources and less flexibility for alternative investments in times of crisis, for example, to implement mitigation actions.[36] This disparity imposes challenges for a community recovering from a disaster as housing costs may exceed the ability of local residents to repair or update their homes, or move to a new location. These populations may live paycheck to paycheck and are extremely dependent on their employer, and in the event their employer is also impacted, it will further detriment the recovery experience of by individuals and families.

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

[36] Ibid

Table 34 Households Spending >30% of Income on Housing

Jurisdiction	Owners		Renters
	With Mortgage	Without Mortgage	
Oregon	41%	21%	48%
Clackamas County	39%	24%	50%
Beavercreek	44%	10%	54%
Boring	48%	28%	21%
Damascus	53%	14%	40%
Government Camp	-	0%	0%
Jennings Lodge	34%	48%	47%
Mount Hood Village	50%	25%	18%
Mulino	52%	7%	16%
Oak Grove	40%	38%	59%
Oatfield	43%	35%	57%
Rhododendrum	89%	105%	-
Stafford	46%	16%	70%

Source: Social Explorer, Table A18002 and A10040, U.S. Census Bureau, 2017-2021 American Community Survey Estimates

Economic Diversity

Economic diversity is a general indicator of an area's fitness for weathering difficult financial times, and in the Willamette Valley region, business activity is fairly consists largely of small businesses.

One method for measuring economic diversity is through use of the Herfindahl Index, a formula that compares the composition of county and regional economies with those of states or the nation as a whole. Using the Herfindahl Index, a diversity ranking of 1 indicates the county with the most diverse economic activity compared to the state as a whole, while a ranking of 36 corresponds with the least diverse county economy. The table below describes the Herfindahl Index Scores for counties in the region.

Table 35 shows that Clackamas County has an economic diversity rank of 2 as of 2021, this is on a scale between all 36 counties in the state where 1 is the most diverse economic county in Oregon and 36 is the least diverse. The county's ranking has changed since 2016, where the county was ranked as 1.

Table 35 Regional Herfindahl Index Scores

County	2016			2021		
	Employment	Number of Industries	State Rank	Employment	Number of Industries	State Rank
Clackamas	127,242	267	1	147,742	268	2
Multnomah	381,347	281	2	408,911	287	1
Washington	235,258	261	16	270,125	268	12

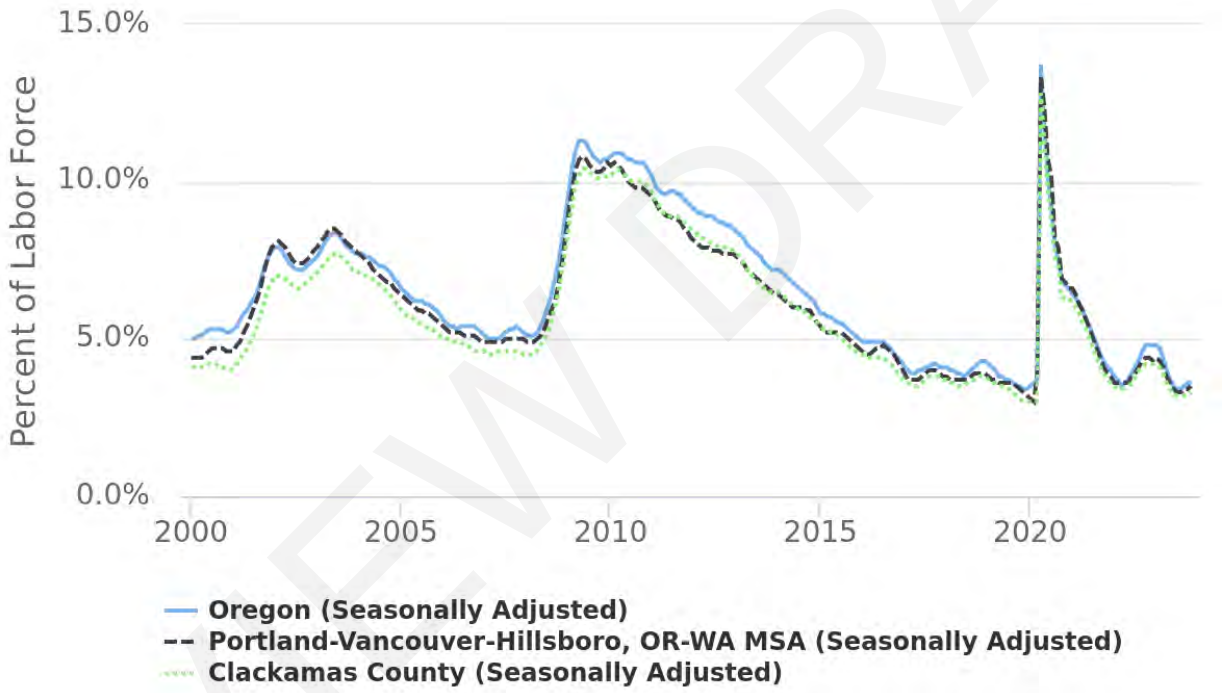
Source: Oregon Employment Department

While illustrative, economic diversity is not a guarantor of economic vitality or resilience. As of April 2023, Clackamas County is not listed as an economically distressed community as prescribed by Oregon Law. The economic distress measure is based on indicators of decreasing new jobs, average wages and income, and is associated with an increase of unemployment.[37]

Employment and Wages

According to the Oregon Employment Department (Figure 5), unemployment in Clackamas County has declined since 2009 (10.4%), though it spiked to around 12.8% during the Covid-19 Pandemic in 2020. In the following years, the unemployment rate has decreased to pre-pandemic rates (3.3%), which is slightly lower than the State of Oregon (3.6%) and other Counties in the region (3.5%).

Figure 5 Unemployment Rate



Source: Oregon Employment Department, "Local Area Employment Statistics", Qualityinfo.org. Accessed January 7, 2024.

Labor and Commute Shed

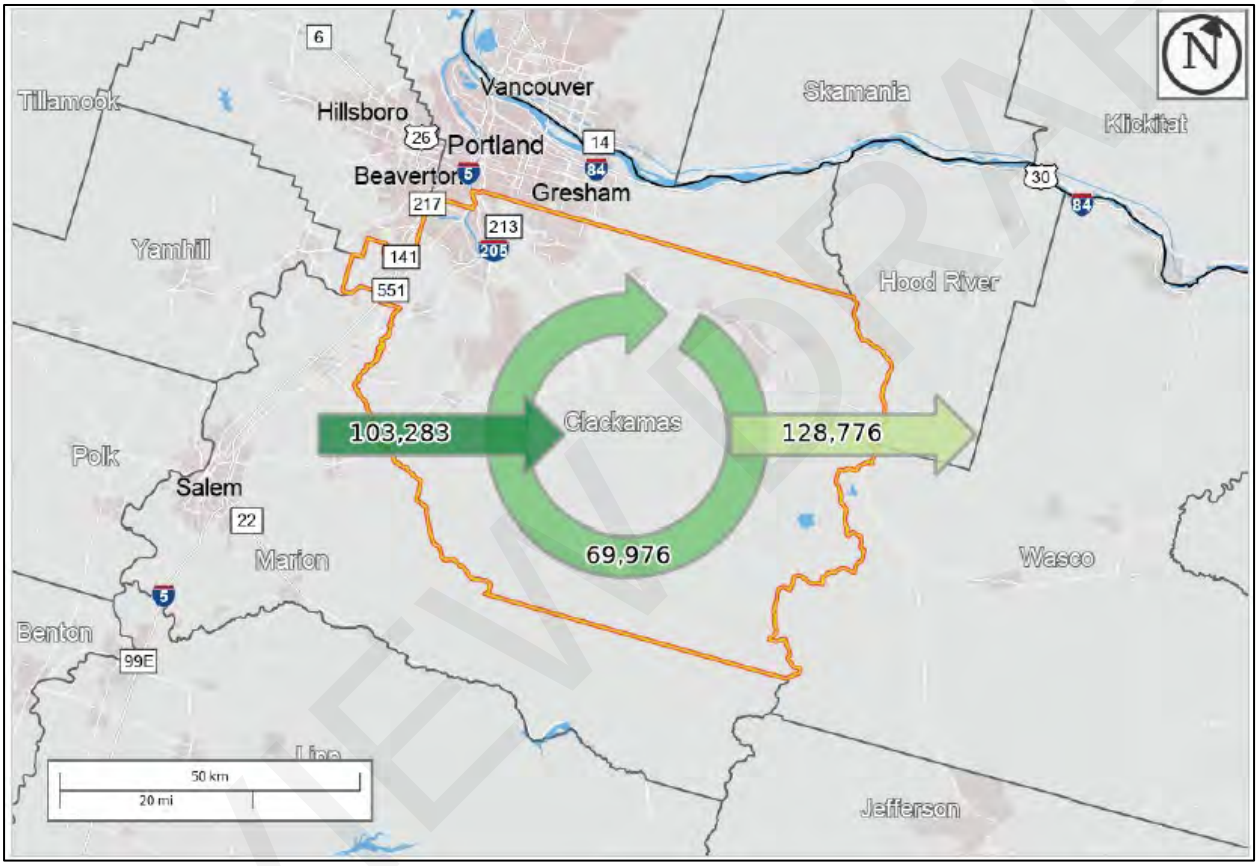
Most hazards can happen at any time during the day or night. It may be possible to give advance warning to residents and first responders who can take immediate preparedness and protection measures, but the variability of hazards is one part of why they can have such varied impact. A snow storm during the work day will have different impacts than one that comes during the night. During the day, a hazard has the potential to segregate the population by age or type of employment (e.g., school children at school, office workers in downtown areas). This may complicate some aspects of initial response such as transportation or the identification of wounded or missing. Conversely, a hazard at

[37] Business Oregon – Oregon Economic Data "Distressed Communities List". https://www.oregon.gov/biz/reports/pages/distressedareas.aspx

midnight may occur when most people are asleep and unable to receive an advance warning through typical communication channels. The following labor shed and commute shed analysis is intended to document where county residents work and where people who work in Clackamas County reside.

The Clackamas County economy is a cornerstone of regional economic vitality. Figure 6 _bookmark62shows the county's laborshed; the map shows that about 23% of workers live and work in the county (69,976), 34% of workers come from outside the county (103,283), and about 43% of residents work outside of the county (128,776).

Figure 6 Clackamas County Laborshed



Source: U.S. Bureau of the Census, On the Map

Table 36 shows the commute shed for those who live in Clackamas County. Approximately 65% of Clackamas County employed residents work outside of the County; 36% work in Multnomah County. About 89% of commuters work in the Portland Metro Area (including 1% who commute over the Columbia River to Clark County, WA) and another 4% work in neighboring Marion County.

Table 37 shows the labor shed for those who work in Clackamas County. Approximately 60% of Clackamas County workers live outside of the County; 23% live in Multnomah County. About 82% of the laborshed lives in the Portland Metro Area (including 4% who commute over the Columbia River to Clackamas County) and another 6% live in neighboring Marion County.

Table 36 Commute Shed - Where Workers Are Employed Who Live In Clackamas County - 2019

Jurisdiction	Number of Jobs	Share
All Jurisdictions	198,752	100%
Metro Area	177,129	89%
Multnomah County	71,539	36%
Clackamas County	69,976	35%
Washington County	32,846	17%
Clark County (WA)	2,768	1%
Marion County	8,570	4%
Yamhill County	1,636	1%
Lane County	1,604	1%
King County (WA)	868	< 1%
Deschutes County	957	< 1%
Linn County	761	< 1%
All other Locations	7,227	4%

Source: U.S. Bureau of the Census, On the Map

Table 37 Labor Shed – Where Workers Live Who Are Employed In Clackamas County

Jurisdiction	Number of Jobs	Share
All Jurisdictions	173,259	100%
Metro Area	141,801	82%
Clackamas County	69,976	40%
Multnomah County	40,056	23%
Washington County	24,730	14%
Clark County (WA)	7,039	4%
Marion County	10,404	6%
Yamhill County	2,947	2%
Lane County	2,158	1%
Deschutes County	1,682	1%
Linn County	1460	1%
Polk County	1,465	1%
All other Locations	11,342	7%

Source: U.S. Bureau of the Census, On the Map

Workers can be impacted during a disaster to varying levels based upon their means of transportation to work. Commuters who use motorized vehicles and public transportation that rely upon maintained roads, bridges, and other infrastructure may be delayed or unable to travel if infrastructure is impacted during an event (for example, earthquakes or heavy winter storms impacting the usability and integrity of roads and bridges). Table 38 shows that 80% of Clackamas County commuters utilized motorized

vehicles (cars, trucks, vans, or motorcycles) and an additional 3% use public transportation. Less than 1% of commuters either bike or walk to work, and 13% work from home. Stafford (25%) has the highest percentage of workers who work from home.

Table 38 Means of Transportation to Work

Jurisdiction	Workers (16 and older)	Drove Alone	Carpooled	Public Transportation (Percent)	Bike/Walked (Percent)	Worked at Home (Percent)
Oregon	1,988,071	69%	9%	4%	2%	13%
Clackamas County	202,378	72%	8%	3%	< 1%	13%
Beavercreek	1,953	83%	4%	1%	0%	10%
Boring	886	57%	27%	0%	0%	15%
Damascus	5,428	76%	9%	1%	0%	12%
Government Camp	24	100%	0%	0%	0%	0%
Jennings Lodge	3,743	71%	7%	10%	1%	8%
Mount Hood Village	2,268	67%	12%	0%	0%	11%
Mulino	908	76%	6%	0%	0%	14%
Oak Grove	8,387	68%	8%	6%	2%	14%
Oatfield	6,091	70%	8%	2%	< 1%	17%
Rhododendrum	51	41%	0%	0%	0%	0%
Stafford	724	67%	8%	0%	0%	25%

Source: Social Explorer, Table A18002 and A10040, U.S. Census Bureau, 2017-2021 American Community Survey Estimates

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 Clackamas County residents and businesses. Furthermore, since the Covid-19 pandemic, there has been a rise in the number of employees who work remotely or work a hybrid schedule between working in the office and working from home. As of 2022, it is estimated that upwards of 8 in 10 people are working either entirely remotely or a hybrid.[38] Understanding not just who but also how and where community members are working, and whether they are working inside or outside the home can help in assessing community vulnerability and risk, and the appropriate mitigation actions.

Industry

Key industries are those that represent major employers and are significant revenue generators. Different industries face distinct vulnerabilities to natural hazards, as illustrated by the industry specific discussions below. Identifying key industries in the region enables communities to target mitigation activities towards those industries' specific sensitivities. It is important to recognize that the impact that a natural hazard event has on one industry can reverberate throughout the regional economy.

This is of specific concern when the businesses belong to the basic sector industry. Basic sector industries are those that are dependent on sales outside of the local community; they bring money into a local community via employment. The farm and ranch, information, and wholesale trade industries

[38] Gallup, :Returning to the Office: The Current, Preferred and Future State of Remote Work", Accessed March 2023.

are all examples of basic industries. Non-basic sector industries are those that are dependent on local sales for their business, such as retail trade, construction, and health services.

Employment by Industry

Economic resilience to natural disasters is particularly important for the major employment industries in the region. If these industries are negatively impacted by a natural hazard, such that employment is affected, the impact will be felt throughout the regional economy. Thus, understanding and addressing the sensitivities of these industries is a strategic way to increase the resiliency of the entire regional economy.

Table 39 identifies Employment by industry. The industry sectors in Clackamas County with the highest percentage of the workforce are Education and Health Services (14.3%), Professional and Business Services (14.2%), Retail Trade (10.6%), Manufacturing (10.4%), Government (9.6%; including 8.0% local government), and Leisure and Hospitality (9.7%).

Table 39 Total Non-Farm Employment by Industry

Employment Sector	2022				Percent Change in Employment (2016-2022)	Employment Forecast* (2021-2031)
	Firms	Employees	Percent Workforce	Average Wage		
Total Payroll Employment	17,946	171,447	100%	$66,268	9%	15%
Total Private	17,633	154,964	90.4%	$66,177	10.1%	16%
Natural Resources and Mining	390	4,664	2.7%	$43,357	11.8%	7%
Construction	2,060	15,178	8.9%	$72,899	36.7%	17%
Manufacturing	729	17,820	10.4%	$74,681	2.3%	8%
Trade, Transportation & Utilities	2,582	33,915	19.8%	$74,681	0.3%	12%
Wholesale Trade	1,099	10,916	6.4%	$61,291	-0.4%	12%
Retail Trade	1,121	18,232	10.6%	$92,334	-2.9%	8%
Information	482	2,606	1.5%	$42,598	26.0%	22%
Financial Activities	1,610	7,912	4.6%	$111,640	6.6%	3%
Professional and Business Services	3,170	24,422	14.2%	$97,401	24.2%	16%
Education and Health Services	2,670	24,501	14.3%	$85,546	11.2%	19%
Leisure and Hospitality	1,207	16,675	9.7%	$64,945	5.5%	41%
Other Services	1,618	6,713	3.9%	$28,179	-7.1%	15%
Private Non-Classified	1,114	558	0.3%	$41,671	1261.0%	5%
Government	313	16,483	9.6%	$81,084	-2.8%	8%
Federal	1,114	558	0.3%	$67,123	-48.3%	1%
State	31	1,642	1.0%	$63,820	-37.8%	0%
Local	232	13,701	8.0%	$66,431	3.4%	10%

Source: Oregon Employment Department, "2016 and 2020 Covered Employment and Wages Summary Reports" and "Regional Employment Projections by Industry & Occupation 2021-2031". http://www.qualityinfo.org

Basic industries encourage growth in non-basic industries and bring wealth into communities from outside markets. However, a high dependence on basic industries can lead to severe difficulties when recovering from a natural disaster if vital infrastructure or primary resource concentrations have been greatly damaged. While Clackamas County has some basic industries, such as Manufacturing, five out of the six 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.

Synthesis

Community resiliency is related to regional economic capacity, which includes a region's available financial resources and locally generated income, and is measured by such economic capital as income equality, housing and living affordability, employment, and primary industries. 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 county to absorb disaster impacts for a quick recovery.

As Local Government, Education and Health Services, and Manufacturing are key to post-disaster recovery efforts, the region is bolstered by its diverse and strong employment sectors and growing industries. As such, it is important to consider what might happen to the county economy if the largest revenue generators and employers are impacted by a disaster. Strategies and actions to reduce vulnerability and risk from an economic focus are imperative and should focus on risk management for the county's dominant and most influential industries.

With an above average income equality, Clackamas County has a greater median household income than the state and Nation, as well as an unemployment rate that is slightly less than that of the state. And although the county is ranked number 2 as having the most diverse economy throughout all of Oregon, more Clackamas County residents are paying greater than 30% of their income on housing, than the State as a whole.

Table 40 indicates where economy related physical infrastructure vulnerabilities exist in relation to each of the natural hazards profiled in Volume I, Section 2. Impacts of the natural hazards is identified as either a direct impact (impacts occuring as a direct result of a hazard) or an indirect impact (impacts occur at a later time as a result of a hazard), or both.

Table 40 Clackamas County Economy Related Infrastructure Vulnerabilities

Direct / Indirect / Both — Clackamas County Asset	Identified Hazard Exposure								
	Drought	Earthquake	Extreme Heat	Flooding	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Clackamas Town Center		D	I	I			I	I	I
Precision Cast Parts		B	I	B			I		
Fred Meyer Distribution Center		B	I				I		
Agriculture (feed procurement, seasonal worker procurement, harvest delivery, refrigeration, etc.)	B	B	B	B	I	I	B	I	B
Forestry	B	I	D		D	I	B	D	D
Tourism (Hotels and Restaurants)	I	B	B	B	I	B	B	I	B
County/City water supplies	B	B	I	B	I	I	B	I	I
Transportation Corridors/Bridges		B	I	B	D	B	B	I	I
High Risk Dams	I	B		D	B	B	I		I

Source: Clackamas County HMAC

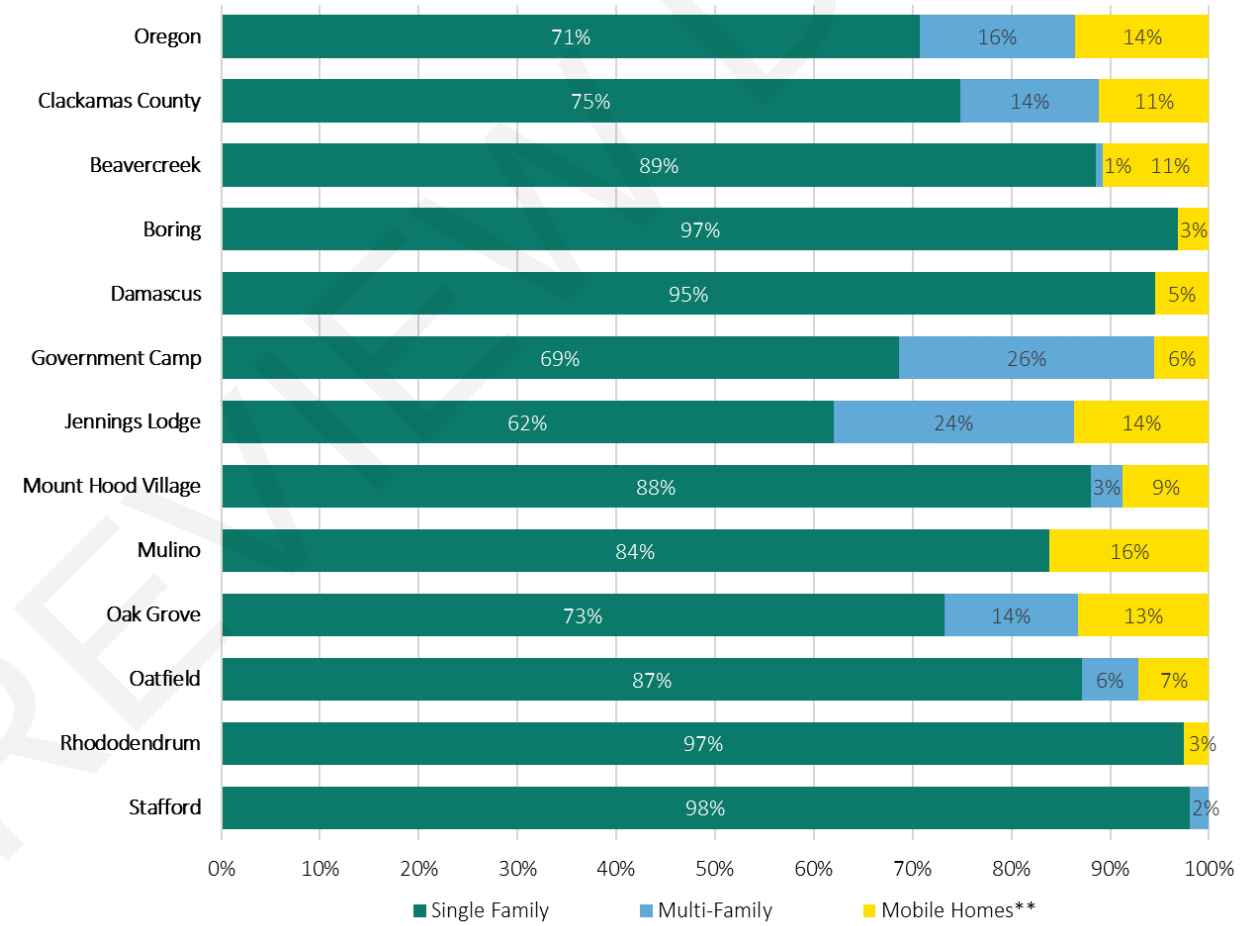
Physical Infrastructure Capacity

Physical infrastructure capacity refers to the built environment and infrastructure that supports the community. The various forms, quantity, and quality of built capital 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. Poorly maintained infrastructure can negatively affect a community's resiliency, including its ability to cope, respond, and recover from a natural disaster.

Housing

Figure 7 identifies the types of housing most common throughout the county. Of particular interest are mobile homes, which account for about 11% of the housing in countywide and 16% in Mulino. 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.

Figure 7 Housing Profile



Source: Social Explorer, Table A10032, U.S. Census Bureau, 2017-2021 American Community Survey Estimates

Aside from location and type of housing, the year structures were built has implications. In the 1970's, FEMA began assisting communities with floodplain mapping as a response to administer the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Upon receipt of floodplain maps, communities started to develop floodplain management ordinances to protect people and property from flood loss and damage. Housing within the floodplain is generally less vulnerable to flood if it was built after the implementation of floodplain development ordinances.

The National Flood Insurance Program's (NFIP's) Flood Insurance Rate Maps (FIRMs) delineate flood-prone areas. They are used to assess flood insurance premiums and to regulate construction so that in the event of a flood, damage minimized. The initial FIRMs for the county were created as early as 1977 while the current FIRMs effective date for Clackamas County and cities is June 17, 2008 (preliminary maps were released for areas within the Lower Columbia-Sandy Watershed in March 2016, effective maps are expected January 18, 2019). For more information about the flood hazard, NFIP, and FIRMs, please refer to Flood Hazard section of the Risk Assessment.

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.[39] Therefore, homes built before 1993 are more vulnerable to seismic events. DOGAMI's interpretation of state building code histories and evolution as described by Judson (2012), Oregon Building Codes Division (2002, 2010) and Business Oregon (2015) is shown in Table 41.

Table 41 Oregon's Seismic Design Level Benchmark Years

Building Type	Year Built	Design Level	Basis
Single Family Dwelling (including Duplexes)	Prior to 1976	Pre Code	Interpretation of Judson (2012)
	1976-1991	Low Code	
	1992-2003	Moderate Code	
	2004-present	High Code	
Manufactured Housing	Prior to 2003	Pre Code	Interpretation of Oregon Manufactured Dwelling Special Codes (Oregon Building Codes Division, 2002)
	2003-2010	Low Code	
	2011-present	Moderate Code	Interpretation of Oregon Manufactured Dwelling Special Codes Update (Oregon Building Codes Division, 2010)
All other buildings	Prior to 1976	Pre Code	Business Oregon 2022 Oregon Benefit-Cost Analysis Tool, p. 24 (Business Oregon, 2022)
	1976-1990	Low Code	
	1991-present	Moderate Code	

Source: DOGAMI, Lower Columbia-Sandy Watershed Natural Hazard Risk Report (2020), Table C.1

The Oregon Department of Geology and Mineral Industries (DOGAMI) conducted a multi-hazard risk assessment for Clackamas County in 2024 (O-XX-24). The Risk Report provides a quantitative risk assessment that informs communities of their risks related to the following natural hazards: channel migration, earthquake, flood, lahar (volcanic event), landslide, and wildfire.

[39] State of Oregon Building Codes Division. Earthquake Design History: A summary of Requirements in the State of Oregon, February 7, 2012. https://www.oregon.gov/bcd/codes-stand/Documents/inform-2012-oregon-sesmic-codes-history.pdf

Within the Risk Report DOGAMI assigned a seismic design level to each building within the County, summarized the number of buildings and building value as shown in Table 42.

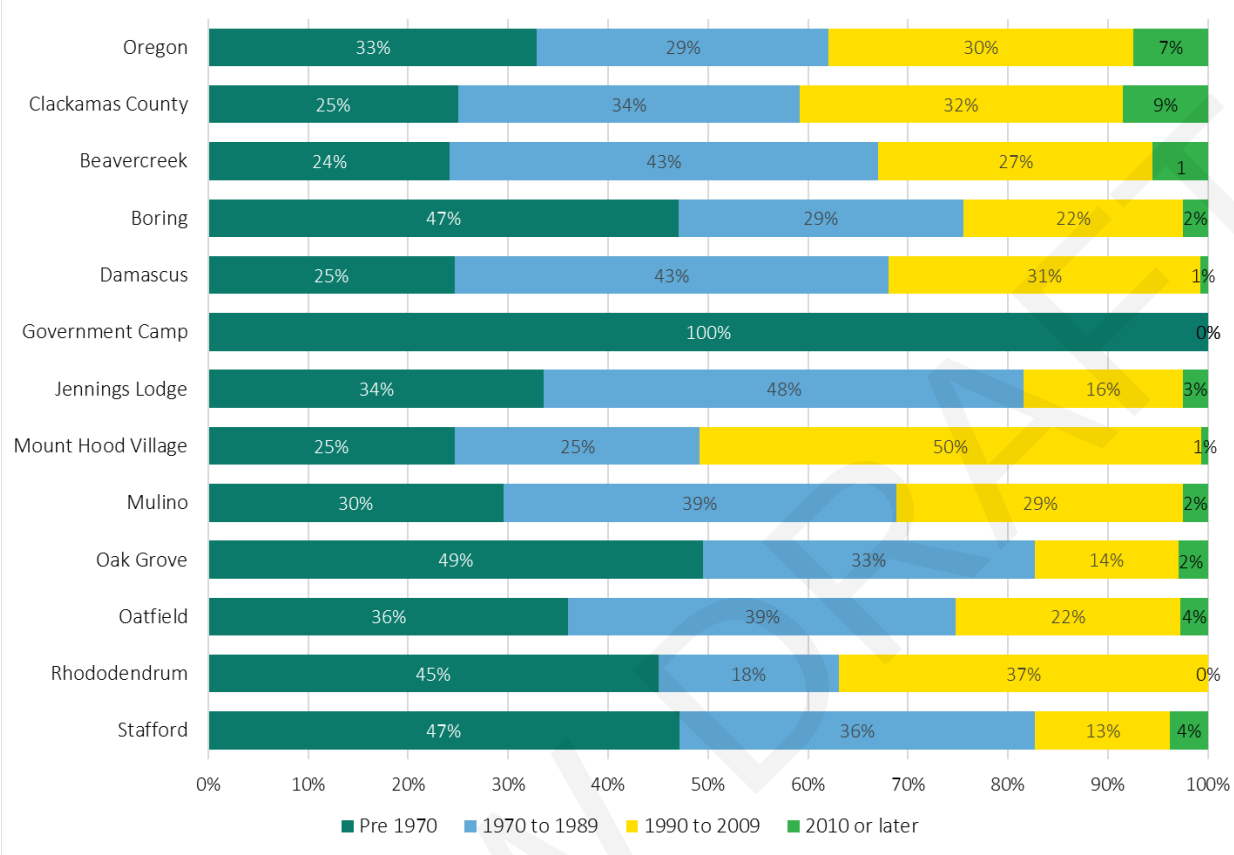
Table 42 Seismic Design Level in Clackamas County

		Pre Code		Low Code		Moderate Code		High Code	
Community	Total Number of Buildings	Number of Buildings	Percentage of Buildings	Number of Buildings	Percentage of Buildings	Number of Buildings	Percentage of Buildings	Number of Buildings	Percentage of Buildings
Unincorp. Clackamas Co (rural)	95,698	55,854	58%	19,959	21%	12,763	13%	7,122	7.4%
Government Camp	832	604	73%	95	11%	79	9.5%	54	6.5%
Molalla Prairie	4,123	2,752	67%	734	18%	365	8.9%	272	6.6%
Mulino Hamlet	2,021	1,154	57%	437	22%	225	11%	205	10%
Stafford Hamlet	1,206	691	57%	281	23%	141	12%	93	7.7%
The Villages-Mt Hood	3,796	2,156	57%	711	19%	698	18%	231	6.1%
Total Unincorp. County	106,844	62,607	59%	22,122	21%	14,192	13%	7,923	7.4%
Barlow	60	55	92%	1	1.7%	3	5.0%	1	1.7%
Canby	5,987	2,633	44%	1,005	17%	1,400	23%	949	16%
Estacada	1,771	778	44%	141	8.0%	143	8.1%	709	40%
Gladstone	4,046	2,950	73%	671	17%	328	8.1%	97	2.4%
Happy Valley	7,480	1,404	19%	410	5.5%	2,086	28%	3,580	48%
Johnson City	275	275	100%	0	0.0%	0	0.0%	0	0%
Lake Oswego	13,854	6,455	47%	4,164	30%	1,621	12%	1,614	12%
Milwaukie	7,936	6,040	76%	1,127	14%	645	8.1%	124	1.6%
Molalla	3,385	1,509	45%	293	8.7%	925	27%	658	19%
Oregon City	13,204	5,999	45%	1,199	9.1%	3,894	29%	2,112	16%
Rivergrove	197	90	46%	16	8.1%	26	13%	65	33%
Sandy	4,115	1,127	27%	625	15%	1,194	29%	1,169	28%
West Linn	9,181	3,130	34%	3,049	33%	2,336	25%	666	7.3%
Wilsonville	6,579	909	14%	2,113	32%	1,594	24%	1,963	30%
Total Study Area	184,914	95,961	52%	36,936	20%	30,387	16%	21,630	12%

Source: DOGAMI, Clackamas County Natural Hazard Risk Report (2024-PRELIMINARY), Table C-2

Figure 8 shows that, countywide, 25% of the housing stock was built prior to 1970, before the implementation of floodplain management ordinances. All of Government Camp, and close to half of Boring, Rhododendrum, Stafford, and Oak Grove housing units were built prior to 1970. Countywide, 59% of the housing stock was built before 1990 and the codification of stricter seismic building standards.

Figure 8 Year Structure Built



Source:, U.S. Census Bureau, 2017-2021 American Community Survey Estimates, Table B25034

Community Lifelines and Critical Infrastructure Profile

Clackamas County communities and economies are largely supported by the physical infrastructure present in the community, such as dams, roads, bridges, railways, and airports. These are considered examples of critical infrastructure, which are defined as facilities that are vital in government response and recovery strategies and are important to consider as there can be serious indirect impacts to such facilities when disrupted.

Critical facilities and physical infrastructure exists within and support all aspect of society, including socially, environmentally, economically, and physically .Such facilities include emergency services, communication services, transportation systems, government facilities, healthcare and public health facilities, information technology, water services, and energy generation and transmission.

Much of the critical infrastructure and critical facilities that supports communities can be categorized as Community Lifelines. A community lifeline is defined as a system them enables the continuous operation of critical government, social, economic, and business functions and is essential to human health and safety or economic security. Lifelines are characterized by structures and systems responsible for the provision of energy, water, communications, and transport, among others. Lifelines include local and regional networks serving residents and businesses throughout Clackamas County as well as the surrounding region.

The information provided in this section will outline important community lifelines and critical infrastructures throughout the county and will help provide a basis for better-informed decisions about how to reduce the county's infrastructural vulnerabilities to natural hazards and increase community resilience.

Dams

Dams are manmade structures built to impound water. Dams are built for many purposes including water storage for potable water supply, livestock water supply, irrigation, or fire suppression. Other dams are built for flood control, recreation, navigation, hydroelectric power or to contain mine tailings. Dams may also be multifunction, serving two or more of these purposes.

These critical infrastructures are mandmade structures and are often multifuncational. They can serve as water storage for potable water supply, livestock water supply, irrigation, or fire suppression. Other dams are built for flood control, recreation, navigation, hydroelectric power or to contain mine tailings.

The National Inventory of Dams, NID, which is maintained by the United States Army Corps of Engineers, is a database of approximately 92,000 dams in the United States. The NID does not include all dams in the United States. Rather, the NID includes dams that are deemed to have a high or significant hazard potential and dams deemed to pose a low hazard if they meet inclusion criteria based on dam height and storage volume.

This NID potential hazard classification is solely a measure of the probable impacts if a dam fails. Thus, a dam classified as High Potential Hazard (HPH) does not mean that the dam is unsafe or likely to fail. The level of risk (probability of failure) of a given dam is not considered in this classification scheme. Rather, the HPH classification simply means that there are people at risk downstream from the dam in the inundation area, if the dam were to fail.

Dams idetnified as significant hazard potential classification are those where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, or disruption of lifeline facilities. Significant hazard potential dams are often located in predominantly rural or agricultural areas.

Dams assigned to the high hazard potential classification are those where failure or mis- operation will probably cause loss of human life. Failure of dams in the high classification will generally also result in economic, environmental or lifeline losses, but the classification is based solely on probable loss of life.

Dams assigned the low hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the dam owner's property.

The National Inventory of Dams includes a total of 46 dams located in Clackamas County. Nine of the dams are categorized as high hazard, including Buche, Development No. 2, Faraday Forebay, Mompano, North Fork, River Mill, Spillway, Timothy Lake, and Willamette Falls Locks. There are also 20 dams categorized as significant hazard and 17 low hazard dams. According to the Oregon Water Resources Department (OWRD) none of the high hazard potential dams are eligible for the Rehabilitation of High Hazard Potential Dam Grant Program as of 8/25/2023.

Dam failures can occur at any time in a dam's life; however, failures are most common when water storage for the dam is at or near design capacity. At high water levels, the water force on the dam is higher and several of the most common failure modes are more likely to occur. Correspondingly, for any

dam, the probability of failure is much lower when water levels are substantially below the design capacity for the reservoir.

Dam failures can occur rapidly and with little warning. Fortunately, most failures result in minor damage and pose little or no risk to life safety. However, the potential for severe damage still exists.

More information on Dams can be found in the 2020 State of Oregon Natural Hazard Mitigation Plan Risk Assessment for Region 2.

Roads

The county's major expressway is Interstate 205. It runs North/South through Clackamas County and is one of the main passages for automobiles, buses, and trucks traveling through the state up to Clackamas vis I-5 or along the Columbia via I-84. Other highways that services Clackamas County includes:

- Interstate 5: Runs North to South along the western portion of the county through Wilsonville eventually branching out to create Interstate 205.
- US Route 26: Connects major Clackamas County cities, such as Sandy, to Portland via the Mount Hood Scenic Byway
- Oregon Route 211: Runs South to West from Portland out to Sandy when it connects with US Route 26. It also runs concurrently for part of the way with OR 224 in Estacada and Eagle Creek, and intersects with OR 213 in Molalla.
- Oregon Route 212: Runs East to West running from Clackamas and connecting the cities of Boring and Damascus.
- Oregon Route 213: Connects with cities and other highways in different parts of the county including Molalla and Estacada with the OR 211, Oregon City with Interstate 205, Clackamas, Estacada, Mount Hood, and Johnson City with Oregon Route 212/Oregon Route 224, and Milwaukie and Clackamas with OR 224.
- Oregon Route 224: Runs North to South throughout the county through the cities of Milwaukie, Clackamas, Eagle Creek, and Estacada.

Daily transportation infrastructure capacity throughout Clackamas County is stressed by maintenance, congestion, and oversized loads. Natural hazards can further disrupt automobile traffic by creating gridlock and/or cutting off access through a route, all of which severly impact emergency evacuations, an already difficult task.

Railroads

Railroads are major providers of regional and national cargo and trade flows. Railroads run through the Northern Willamette region provide vital transportation links from the pacific to the rest of the country. The Portland & Western (PNWR), the Union Pacific Railroad (UP), and the Oregon Pacific (OPR) are the three major railroads that run through Clackamas County. All three travel through the western portion of the county moving along north to south.

Rails are sensitive to icing from the winter storms that can occur in the Northern Willamette region. For industries in the region that utilize rail transport, these disruptions in service can result in economic losses. The potential for rail accidents caused by natural hazards can also have serious implications for the local communities if hazardous materials are involved.

Airports

Clackamas County has no commercial service airports, however Portland International Airport (PDX) which is the busiest airport in the state is located in neighboring Multnomah County. Clackamas County has 23 private airports and 4 heliports. Two heliports service hospitals, Providence Willamette Falls Medical Center and Meridian Park Hospital. Flights face potential for closure from a number of natural hazards that are common in Clackamas County, including windstorms and winter storms.

Bridges

Because of earthquake risk, the seismic vulnerability of the county's bridges is an important issue. Non-functional bridges can disrupt emergency operations, sever lifelines, and disrupt local and freight traffic. These disruptions may exacerbate local economic losses if industries are unable to transport goods. The county's bridges are part of the state and interstate highway system that is maintained by the Oregon Department of Transportation (ODOT) or that are part of regional and local systems that are maintained by the region's counties and cities.

The bridges in Clackamas County require ongoing management and maintenance due to the age and types of bridges. Modern bridges, which require minimum maintenance and are designed to withstand earthquakes, consist of pre-stressed reinforced concrete structures set on deep steel piling foundations.

Table 43 shows the structural condition of bridges in the region. A distressed bridge is a condition rating used by the Oregon Department of Transportation (ODOT) indicating that a bridge has been identified as having a structural or other deficiency, while a deficient bridge is a federal performance measure used for non-ODOT bridges; the ratings do not imply that a bridge is unsafe.[40] The table shows that overall 4% of the county owned bridges are distressed, compared to 5% of the city owned bridges and 3% of State Owned (ODOT) bridges. There are 16 historic bridges in the County; 9 state-owned and 7 county-owned.

Table 43 Bridge Inventory

Bridge Owner	Number	Distressed	Percent Distressed	Historic
State	118	3	3%	9
County	158	7	4%	7
City	19	1	5%	N/A
Total	295	11	4%	16

Source: The State of Oregon Natural Hazard Mitigation Plan, 2020;
Oregon Department of Transportation (2013) Oregon's Historic Field Guide

Utility Lifelines

Utility lifelines are the resources that the public relies on daily, such as electricity, fuel and communication lines. If these lifelines fail or are disrupted, the essential functions of the community can become severely impaired. Utility lifelines are closely related to physical infrastructures, like dams and power plants, as they transmit the power generated from these facilities.

[40] Oregon. Bridge Engineering Section (2012). 2012 Bridge Condition Report. Salem, Oregon: Bridge Section, Oregon Department of Transportation.

The network of electricity transmission lines running throughout Clackamas County is operated by Portland General Electric (PGE).[41] With the Williams Gas Pipeline in the Northwest operating approximately 3,900 miles of pipe beginning in northern Washington, making its way down through Portland, Oregon and then ending in the Rogue Valley, most residents in Clackamas County have their natural gas operated by Northwest Natural Gas.[42] These lines may be vulnerable agaist infrequently occuring natural hazards, such as earthquakes, as it could disrupt service for natural gas consumers across the region.

Seismic Lifelines

Seismic lifeline routes help maintain transportation facilities for public safety and resilience in the case of natural disasters. Following a major earthquake, it is important for response and recovery agencies to know which roadways are most prepared for a major seismic event. The Oregon Department of Transportation has identified lifeline routes to provide a secure lifeline network of streets, highways, and bridges to facilitate emergency services response after a disaster.[43]

System connectivity and key geographical features were used to identify a three-tiered seismic lifeline system. Routes identified as Tier 1 are considered the most significant and necessary to ensure a functioning statewide transportation network. The Tier 2 system provides additional connectivity to the Tier 1 system, it allows for direct access to more locations and increased traffic volume capacity. The Tier 3 lifeline routes provide additional connectivity to the systems provided by Tiers 1 and 2.

The Lifeline Routes in the Portland Metro Geographic Zone (which includes Clackamas County) consist of the following:

- Tier I: I-5 (except those identified in Tier II), I-205, OR 99W (from I-5 to OR217)
- Tier II: I-84, I-5 (between the northern and southern I-405 interchanges)
- Tier III: OR 217, US 26 (from I-5 to I-205), OR 43

Critical Facilities

Critical facilities are those facilities that are essential to government response and recovery activities (e.g., polices and fire stations, public hospitals, public schools). It is important that these facilities are the most resilient to natural hazards as interruption or destruction of these facilities could restrict response efforts and time needed to assist those in danger. DOGAMI included identified facilities within the Multi-Hazard Risk Report for Clackamas County (O-XX-24). Table 48 through Table 59 identify the critical facilities and their exposure to channel migration, flood, Cascadia Subduction Zone earthquake, crustal earthquake, landslide, volano, and wildfire hazards.

Fire safety for Clackamas County is primarily served by Clackamas County Fire District, which serves over 220,000 residents and covers nearly 228 square miles of urban, suburban, and rural communities, making it one of the largest fire protection districts in Oregon. There are 13 structural fire agencies and two (2) wildland fire agencies for a total of 15. Aside from just extinguishing fires, each fire district and department provides essential public services in the communities they serve, including emergency medical services, search and rescue, and fire prevention education.

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[41] Allan, Stuart et. al., Atlas of Oregon. Pg. 102.

[42] Williams, Gas Pipeline, Natural Gas Storage and Operations. Accessed April 25 2023. https://www.williams.com/pipeline/northwest-pipeline/

[43] CH2MHILL, Prepared for Oregon Department of Transportation. Oregon Seismic Lifeline Routes Identification Project, Lifeline Selection Summary Report, May 15 2012.

The county Courthouse is located in Oregon City and primarily houses state and court- related offices, the rest of the county departments are also located in Oregon City in either the Public Services Building or Development Services Building located in what is known as the Red Soils Campus. The Clackamas County Department of Communications (C-COM) provides 9-1-1 emergency and non-emergency call taking service for all residents throughout the county except for residents within the city limits of Lake Oswego, West Linn and Milwaukie whose 9-1-1 calls are answered by Lake Oswego 9-1-1 (LOCOM).

Dependent Facilities

In addition to the critical facilities mentioned in Table C-31, there are other facilities vital to the continued delivery of health services and may significantly impact the public's ability to recover from emergencies. Facilities which have patients that are dependent on continued support and care include assisted living centers, nursing homes, residential mental health facilities, and psychiatric hospitals. In the event of a disaster, these facilities may also act as secondary medical facilities as they are equipped with nurses, medical supplies, and beds. Distributed across the county, Clackamas has 15 adult day care facilities, 30 assisted living facilities, 15 registered nursing homes, 30 residential care facilities, 19 supportive living facilities, and 1 mental health residential program that will assist those in need.[44]

Correctional Facilities

Correctional facilities are incorporated into physical infrastructure as they play an important role in everyday society by maintaining safe separation from the public. There are two correctional facilities located in Clackamas County. The Clackamas County Jail and the Clackamas County Juvenile Department are both located in Oregon City. While correctional facilities are built to code to resist structural failure, they typically have backup power to sustain regulation of inmates following the immediate event of an emergency. It is when the impacts of the event continue over a long duration, that logistical planning of these facilities becomes a challenge.

Synthesis

Built capacity refers to the built environment and infrastructure that support a community. The various forms of built capital mentioned above will play significant roles in the event of a disaster. Physical infrastructures, along with utility and transportation lifelines are critical during a disaster and are essential for proper functioning and response. Community resilience is directly affected by the quality and quantity of built capital and lack of, or poor condition of, infrastructure can negatively affect a community's ability to cope, respond, and recover from a natural disaster. Initially following a disaster, communities may experience isolation from surrounding cities and counties due to infrastructure failure. These conditions will force communities to rely on local and immediate resources, so it is important to identify critical infrastructures throughout the county as they may play crucial roles in the mitigation and recovery stages of a disaster.

- 75% of the housing stock in Clackamas County is single-family units, Mobile Homes (11%), and Multi-Family units (14%), which are particularly prone to the effects of natural hazards and disasters.
- 80% of the total housing units in the unincorporated county were built before building codes enforced a stricter policy for seismic building standards (pre-code – 59% or low code – 21%).
- 27% of the housing stock is renter-occupied.

[44] Clackamas County Website. Clackamas County Social Services Resource Guide. https://www.clackamas.us/socialservices/housingresources.html

It is important for the county to consider these numbers when producing mitigation and educational outreach materials as it is important to reach all populations, especially the ones who face a higher risk of damage. There are nine (9) dams in the county classified with a high threat potential, two (2) of which are state regulated High Hazard Dams (Buche and Mompano). There are a variety of critical facilities located throughout county limits that in the event of a disaster can make communication efforts challenging. Several major highways run throughout the county, giving residents a number of alternative routes that may provide service access, or serve as evacuation routes, yet if these roads are destroyed it can isolate communities and make rescue efforts more challenging.

Table 44 and Table 45 indicate where built and critical infrastructure related vulnerabilities exist in relation to each of the natural hazards profiled in Volume I, Section 2. Impacts of the natural hazards is identified as either a direct impact (impacts occuring as a direct result of a hazard) or an indirect impact (impacts occur at a later time as a result of a hazard), or both.

Table 44 Clackamas County Built Infrastructure Related Vulnerabilities

Direct / Indirect / Both — Clackamas County Asset	Identified Hazard Exposure								
	Drought	Earthquake	Extreme Heat	Flooding	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Homeowners in Forest Edge Apartments	I	B	I		B		B	I	B
Carver Mobile Home Ranch		B	I	B	I		B	I	I
Development on established floodplains, historic and pre-historic debris flow plains	I	B	I	B	I	D	B		I
Decentralized water and sewage systems	B	I	I	B	D	I	B	D	D
Increased development in the wildland-urban interface	I	B	B	I	D	I	B	D	I

Source: Clackamas County HMAC

Table 45 Clackamas County Critical Infrastructure and Services Related Vulnerabilities

Direct / Indirect / Both — Clackamas County Asset	Identified Hazard Exposure								
	Drought	Earthquake	Extreme Heat	Flooding	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Electric grid		B	D	I	D	D	B	D	D
All highways and bridges		B	I	B	D	I	I	I	B
County and City buildings		B	I	I			I		I
Cellular communications infrastructure		B	D	I	D	D	B	D	D
Fiber optic lines		B	D	I	D	D	B	D	D
Water intake facilities	I	B		B	I	I	I		
Emergency Services (fire departments, police departments, hospitals, EOCs)		B	I	B	I	I	B	I	B
Water treatment plants/sewer	I	B		B	I	I	I		

Source: Clackamas County HMAC

Community Connectivity Capacity

Community connectivity capacity places strong emphasis on social structure, trust, norms, and cultural resources within a community. In terms of community resilience, these emerging elements of social and cultural capital will be drawn upon to stabilize the recovery of the community. Social and cultural capitals are present in all communities; however, it may be dramatically different from one city to the next as these capitals reflect the specific needs and composition of the community residents.

Social Systems and Service Providers

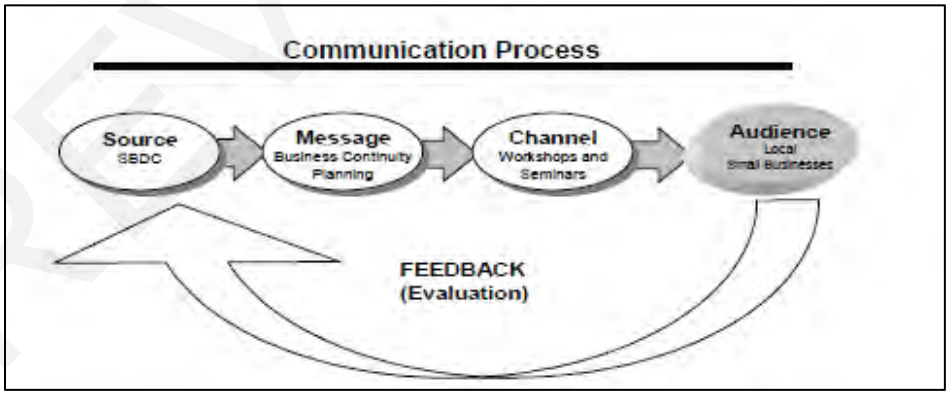
Social systems include community organizations and programs that provide social and community-based services, such as employment, health, senior and disabled services, professional associations and veterans' affairs for the public. In planning for natural hazard mitigation, it is important to know what social systems exist within the community because of their existing connections to the public. Often, actions identified by the plan involve communicating with the public or specific subgroups within the population (e.g. elderly, children, low income, etc.). The county can use existing social systems as resources for implementing such communication-related activities because these service providers already work directly with the public on a number of issues, one of which could be natural hazard preparedness and mitigation. The presence of these services is more predominantly located in urbanized areas of the county, this is synonymous with the general urbanizing trend of local residents.

The following is a brief explanation of how the communication process works and how the community's existing social service providers could be used to provide natural hazard related messages to their clients.

There are several essential elements for communicating effectively to a target audience, including:

- 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 9 Communication Process



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

The following table provides a list of existing social systems within Clackamas County. The table provides information on each organization or program's service area, types of services offered, populations served, and how the organization or program could be involved in natural hazard mitigation. The three involvement methods identified in the table are defined below:

- Education and Outreach – Organizations can partner with a community to educate the public and/or provide outreach assistance on natural hazard preparedness and mitigation.
- Information Dissemination – Organizations can partner with a community to provide hazard related information to target audiences.
- Plan/Project Implementation – Organizations may have plans and/or policies that can be used to implement mitigation activities or the organizations can serve as the coordinating or partner organization to implement mitigation actions.

The information provided in the table can also be used to complete action item worksheets by identifying potential coordinating agencies and internal and external partners.

Civic Engagement

Civic engagement and involvement in local, state and national politics are important indicators of community connectivity. Those who are more invested in their community may have a higher tendency to vote in political elections. The 2020 Presidential General Election resulted in 85% voter turnout in the county.[45] These results are a bit more than, but relatively equal to voter participation reported across the State (79%).[46]Other indicators such as volunteerism, participation in formal community networks and community charitable contributions are examples of other civic engagement that may increase community connectivity.

Cultural Resources and Historic Places

The cultural and historic heritage of a community is more than just tourist charm. For families that have lived in the county for generations and new resident alike, it is the unique places, stories, and annual events that make Clackamas County an appealing place to live.

The cultural and historic assets in the county are both intangible benefits and obvious quality-of-life-enhancing amenities. Mitigation actions to protect these assets span many of the other systems already discussed. Some examples of that overlap could be seismic retrofit (preserving historic buildings and ensuring safety) or expanding protection of wetlands (protect water resources and beautify the county).

The National Register of Historic Places lists all types of facilities and infrastructure that help define a community. Whether it is first schoolhouse in town or even just the home of a resident who played a vital role in the success of the community, the Register lists all types of historic features that characterize the area. Table 46 categorizes the 91 different National Historic Sites located throughout Clackamas County by their distinction and function.

These places provide current residents, youth, and visitors with a sense of community. Because of the history behind these sites, and their role in defining a community, it is important to protect these historic sites from the impacts natural disasters might have on them.

[45] Clackamas County, "Election Results". https://www.clackamas.us/elections/results.html#2020

[46] State of Oregon, "Election Statistics". https://sos.oregon.gov/elections/Pages/electionsstatistics.aspx

Table 46 List of National Register of Historic Sites in Clackamas County

Type of Structure	Number of Structures
Bridges and Locks	2
Cabins, Estates, Farms, Houses, Huts, Lodges, Log Cabins	60
Mills	2
Ranger and Guard Stations	3
Roads	4
Churches	4
Schools	1
Historic Districts	3
Miscellaneous Buildings	12
Total	**91**

Source: National Register of Historic Places

Libraries and Museums

Libraries and Museums are other facilities which a community will use to stay connected. Clackamas County has a Library District in which all but one city, Johnson City, is a participant.[47] The purpose of The District is to provide residents with one single library computer system which make it easy for residents to borrow materials from any or all of the libraries throughout the county. Residents can even request to have materials delivered via library courier to their neighborhood library for easy pick-up. There are 2 county libraries, 11 city run libraries, and 3 college/university libraries.[48]

Because all but one city within the county operates a public library, these facilities should be considered a common place for the community to gather during a disaster, as well as and serve a critical function in maintaining a sense of community.

Museums can also function in maintaining a sense of community as they provide residents and visitors with the opportunity to explore the past and develop cultural capacity. Throughout Clackamas County there are a number of museums that provide information on topics that range from historical, technology, science, and art. As a preservation of history, it is important to also consider museums in the mitigation process for community resilience, as these structures should be protected in critical times, especially disasters.

Community Stability

Community stability is a measure of rootedness in place. It is hypothesized that resilience to a disaster stems in part from familiarity with place, not only for navigating the community during a crisis, but also accessing services and other supports for economic or social challenges.[49]

[47] Clackamas County Website, Library District. Accessed 25 April 2023. http://www.clackamas.us/librarydistrict/.

[48] Libraries in Clackamas County. Accessed 25 April 2023. https://www.clackamas.us/lib

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

Residential Geographic Stability

Table 47 estimates residential stability across the region. It is calculated by the number of people who have lived in the same house and those who have moved within the same county a year ago, compared to the percentage of people who have migrated into the region. Clackamas County overall has a geographic stability rating of about 93% (i.e., 93% of the population lived in the same house or moved within the county). Government Camp has the highest geographic stability (100%) while Rhododendrum has the lowest (75%).

Table 47 Regional Residential Stability

Jurisdiction	Population	Geographic Stability	Same House	Moved Within Same County
Oregon	4,167,009	93%	84%	8%
Clackamas County	414,232	93%	87%	6%
Beavercreek	3,998	98%	90%	8%
Boring	1,999	97%	97%	0%
Damascus	10,837	93%	92%	1%
Government Camp	84	100%	100%	0%
Jennings Lodge	7,805	92%	84%	7%
Mount Hood Village	4,343	97%	92%	5%
Mulino	2,218	98%	95%	2%
Oak Grove	17,222	94%	87%	8%
Oatfield	12,764	96%	89%	6%
Rhododendrum	173	75%	68%	8%
Stafford	1,966	96%	93%	3%

Source: Social Explorer, Table 130, U.S. Census Bureau, 2017-2021 American Community Survey Estimates

Homeownership

Housing tenure describes whether residents rent or own the housing units they occupy. Homeowners are typically more financially stable but are at risk of greater property loss in a post-disaster situation. People may rent because they choose not to own, they do not have the financial resources for home ownership, or they are transient.

Collectively, about 67% of the occupied housing units in Clackamas County are owner- occupied; about 27% are renter occupied. Damascus (94%), Beavercreek (88%), and Stafford (85%) have the highest rate of owner- occupied units. Jennings Lodge (45%), and Oak Grove (31%) have the highest rate of renter-occupied households. Government Camp (16%), Mulino (11%), and Rhododendrum (11%) have the highest vacancy rates within the county. In addition, seasonal or recreational housing accounts for

approximately 78%, 74%, and 33% of the housing stock in Rhododendrum, Government Camp, and Mount Hood Village respectively.[50]

Table C-36 Housing Tenure and Vacancy

Jurisdiction	Housing Units	Owner-occupied		Renter-occupied		Seasonal^		Vacant^^	
		Estimate	Percent	Estimate	Percent	Estimate	Percent	Estimate	Percent
Oregon	1,798,864	1,047,165	58%	610,926	34%	58,181	3%	82,592	5%
Clackamas County	169,113	113,948	67%	45,605	27%	3,332	2%	6,228	4%
Beavercreek	1,687	1,477	88%	112	7%	6	0%	92	5%
Boring	707	557	79%	130	18%	0	0%	20	3%
Damascus	3,618	3,393	94%	176	5%	0	0%	49	1%
Government Camp	506	28	6%	24	5%	374	74%	80	16%
Jennings Lodge	3,614	1,967	54%	1,612	45%	0	0%	35	1%
Mount Hood Village	3,078	1,682	55%	274	9%	1,003	33%	119	4%
Mulino	812	607	75%	115	14%	0	0%	90	11%
Oak Grove	7,755	4,850	63%	2,422	31%	0	0%	483	6%
Oatfield	5,143	4,114	80%	765	15%	0	0%	264	5%
Rhododendrum	999	111	11%	0	0%	775	78%	113	11%
Stafford	758	646	85%	112	15%	0	0%	0	0%

Source: Social Explorer, Table A10060 and A10044, U.S. Census Bureau, 2017-2021 American Community Survey Estimates, Table B25004

^ = Seasonal, recreational, or occasional housing units.

^^ = Functional vacant units, computed after removing seasonal, recreational, or occasional housing units from vacant housing units.

According to studies, wealth increases resiliency and recovery from disasters[51]. 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. In the most extreme cases, renters lack sufficient shelter options when lodging becomes uninhabitable or unaffordable post-disaster

Synthesis

Clackamas County has distinct social and cultural resources that work in favor to increase community connectivity and resilience. Sustaining social and cultural resources, such as social services and cultural events, may be essential to preserving community cohesion and a sense of place. The presence of larger communities makes additional resources and services available for the public. However, it is important to consider that these amenities may not be equally distributed to the rural portions of the county and may produce implications for recovery in the event of a disaster.

In the long-term, it may be of specific interest to the county to evaluate community stability. A community experiencing instability and low homeownership may hinder the effectiveness of social and cultural resources, distressing community coping and response mechanisms.

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

[51] Ibid

Appendix D: Community Risk Profiles

A risk analysis summary for each community is provided in this section to encourage ideas for natural hazard risk reduction. Increasing disaster preparedness, public hazards communication, and education, ensuring functionality of emergency services, and ensuring access to evacuation routes are actions that every community can take to reduce their risk. This appendix contains community specific data to provide an overview of the community and the level of risk from each natural hazard analyzed. In addition, for each community a list of critical facilities and assumed impact from individual hazards is provided.

This section to be added once the Risk Report is finalized

Table 48 Unincorporated Clackamas County (Rural) Hazard Profile
To be provided when Risk Report is finalized

Table 49 Unincorporated Clackamas County (Rural) Critical Facilities
To be provided when Risk Report is finalized

Table 50 Unincorporated Community of Government Camp Hazard Profile
To be provided when Risk Report is finalized

Table 51 Unincorporated Community of Government Camp Critical Facilities
To be provided when Risk Report is finalized

Table 52 Unincorporated Community of Molalla Prairie Hazard Profile
To be provided when Risk Report is finalized

Table 53 Unincorporated Community of Molalla Prairie Critical Facilities
To be provided when Risk Report is finalized

Table 54 Unincorporated Community of Mulino Hamlet Hazard Profile
To be provided when Risk Report is finalized

Table 55 Unincorporated Community of Mulino Hamlet Critical Facilities
To be provided when Risk Report is finalized

Table 56 Unincorporated Community of Stafford Hamlet Hazard Profile
To be provided when Risk Report is finalized

Table 57 Unincorporated Community of Stafford Hamlet Critical Facilities
To be provided when Risk Report is finalized

Table 58 Unincorporated Community of the Villages at Mount Hood Hazard Profile
To be provided when Risk Report is finalized

Table 59 Unincorporated Community of the Villages at Mount Hood Critical Facilities
To be provided when Risk Report is finalized

Appendix E: Natural Hazard & Base Maps

The following maps were developed for the 2012 version of the NHMP. Additional maps are provided in the Hazard Profiles in Volume I, Section 2. For additional map resources visit:

Oregon HazVu: Statewide Geohazards Viewer:
https://www.oregon.gov/dogami/hazvu/Pages/index.aspx

SLIDO: Statewide Landslide Information Database for Oregon:
https://www.oregon.gov/dogami/slido/Pages/index.aspx

Oregon Explorer:
https://tools.oregonexplorer.info/OE_HtmlViewer/Index.html?viewer=oe

Oregon Explorer: Community Wildfire Protection Plan Planning Tool:
https://tools.oregonexplorer.info/OE_HtmlViewer/Index.html?viewer=wildfireplanning

Map 1: Base Map

Map 2: Average Precipitation

Map 3: FEMA FIRM 100 Year Flood Plain

Map 4: River SubBasins

Map 5: Slope Stability

Map 6: Historic Landslides

Map 7: Debris Flows

Map 8: Soil Liquefaction

Map 9: Soil Amplification

Map 10: Earthquake Hazard

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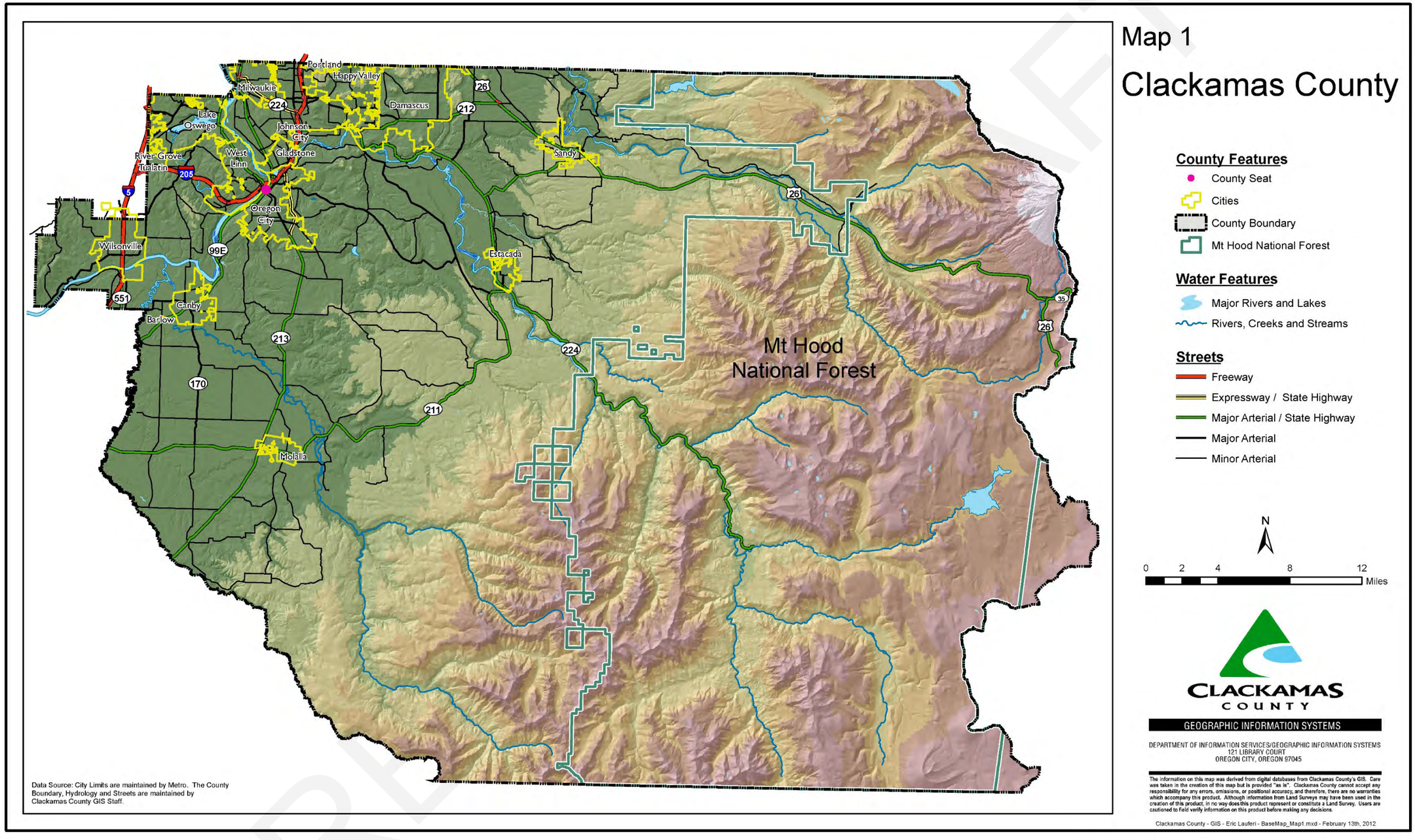
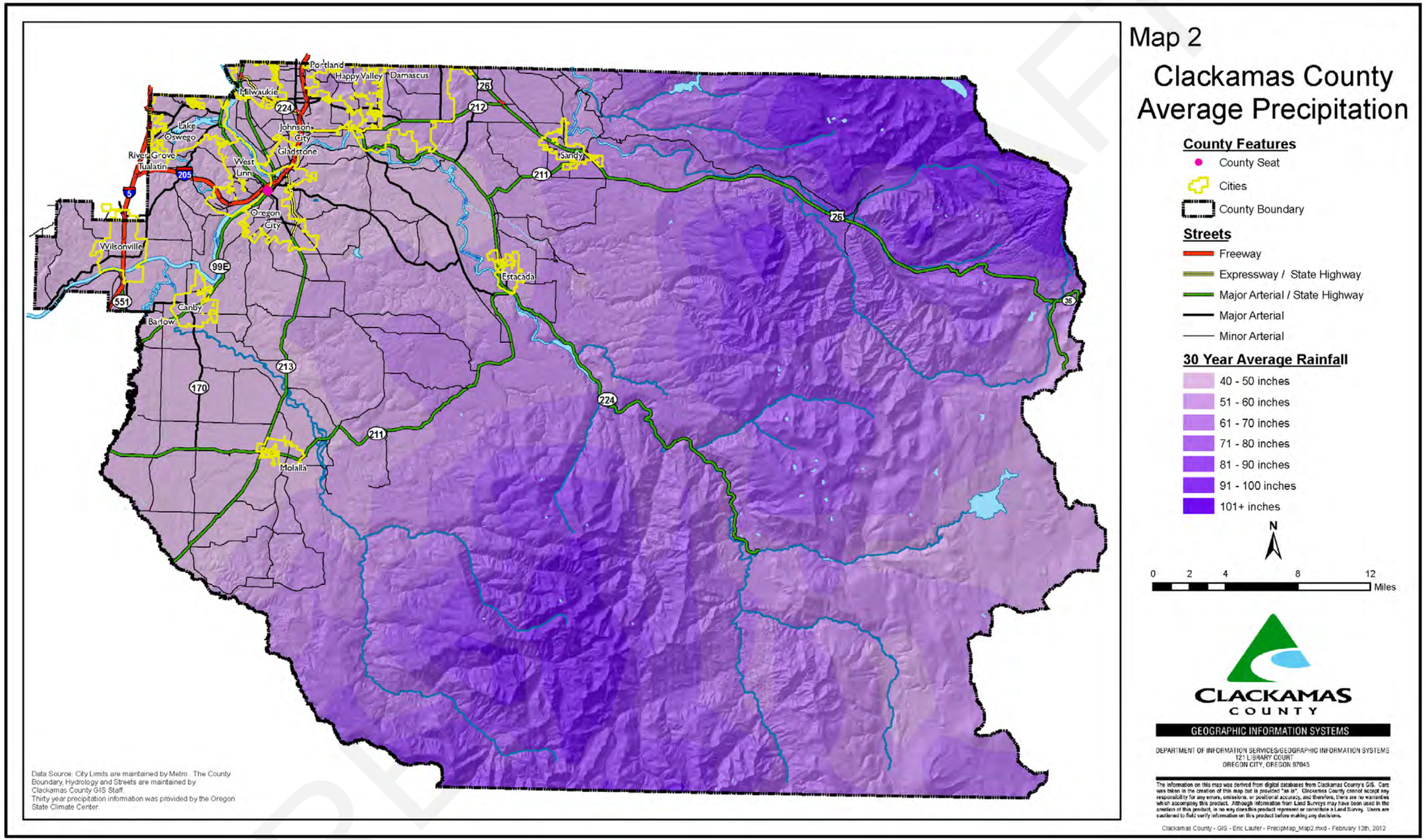
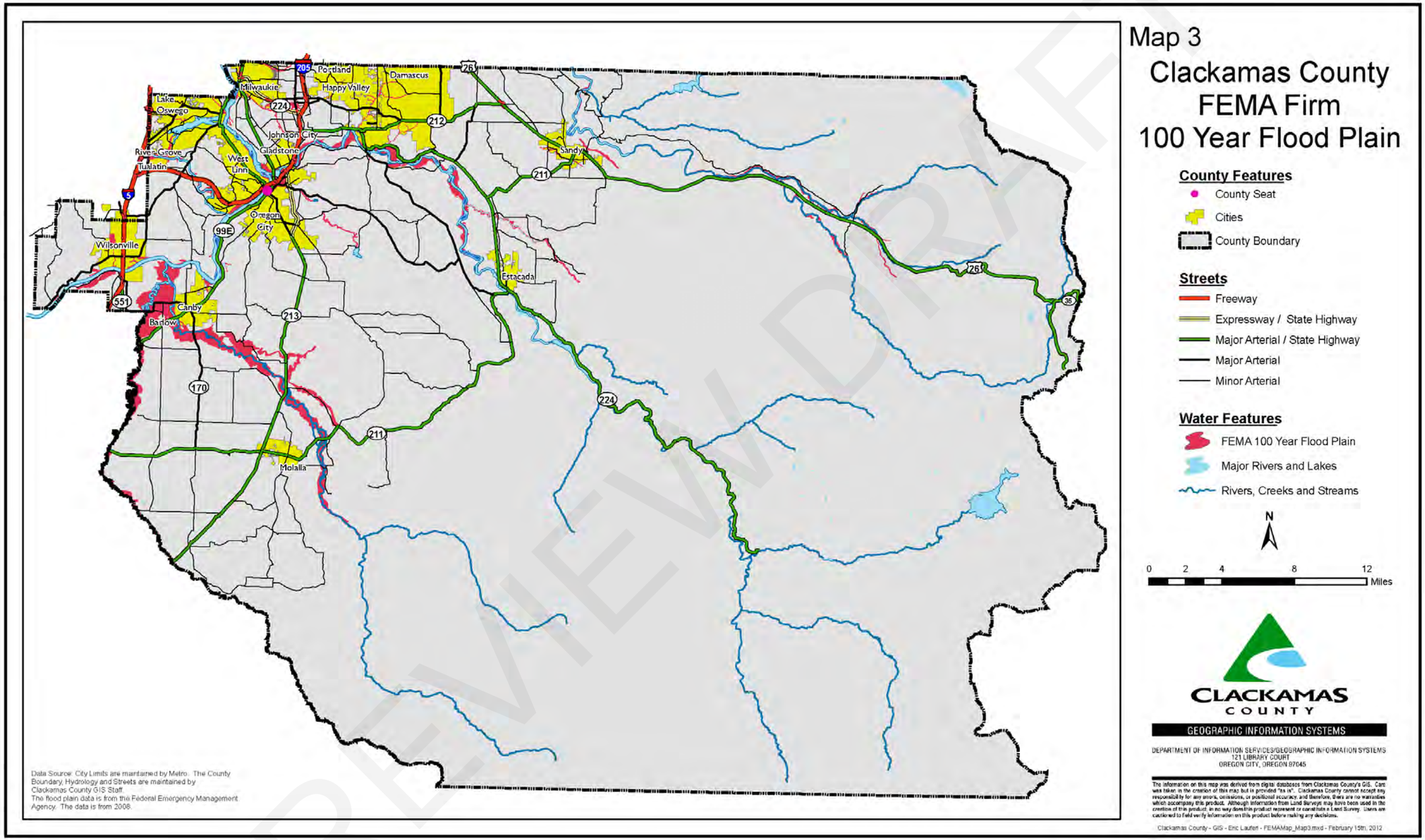
Map 1: Base Map



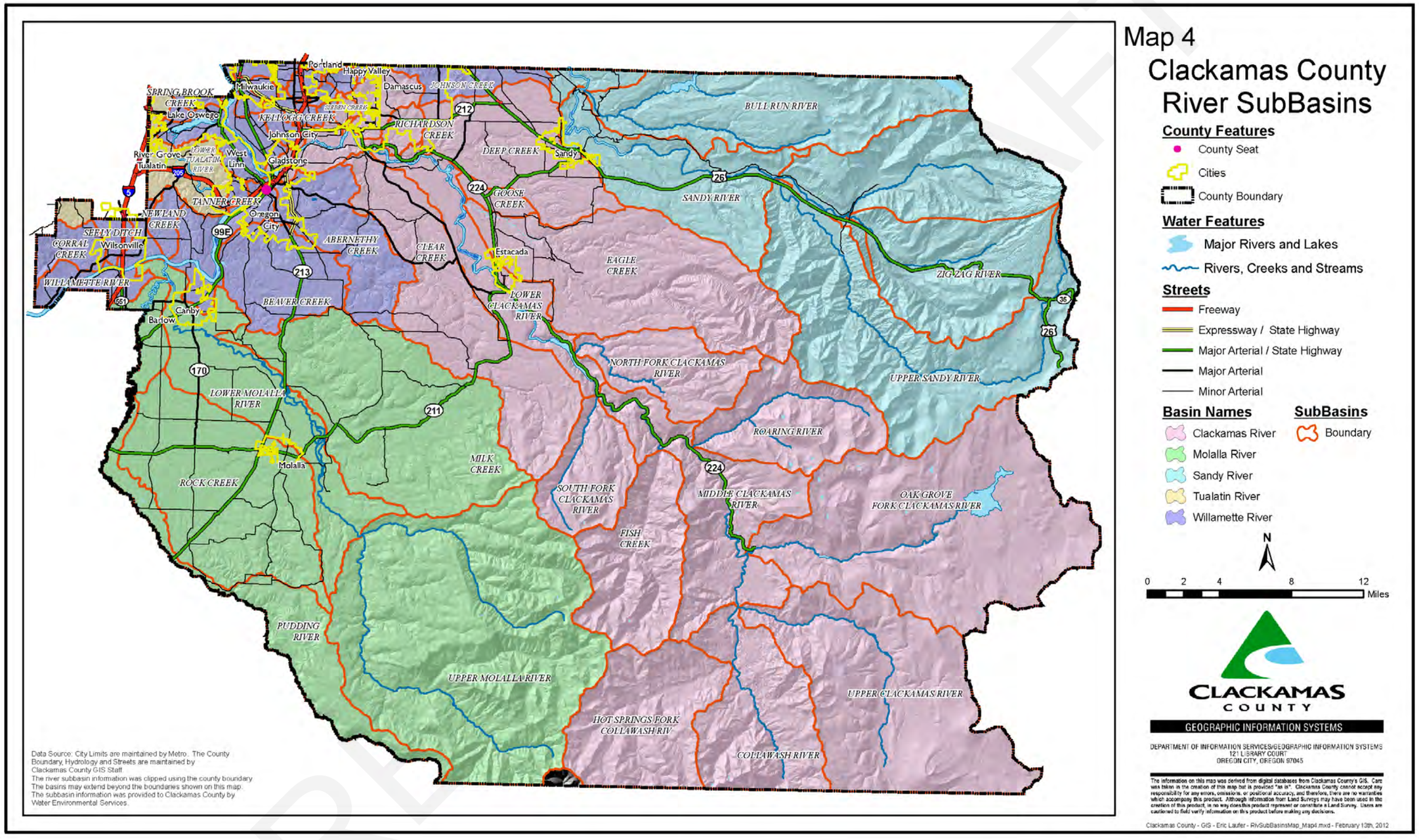
Map 2 Average Precipitation



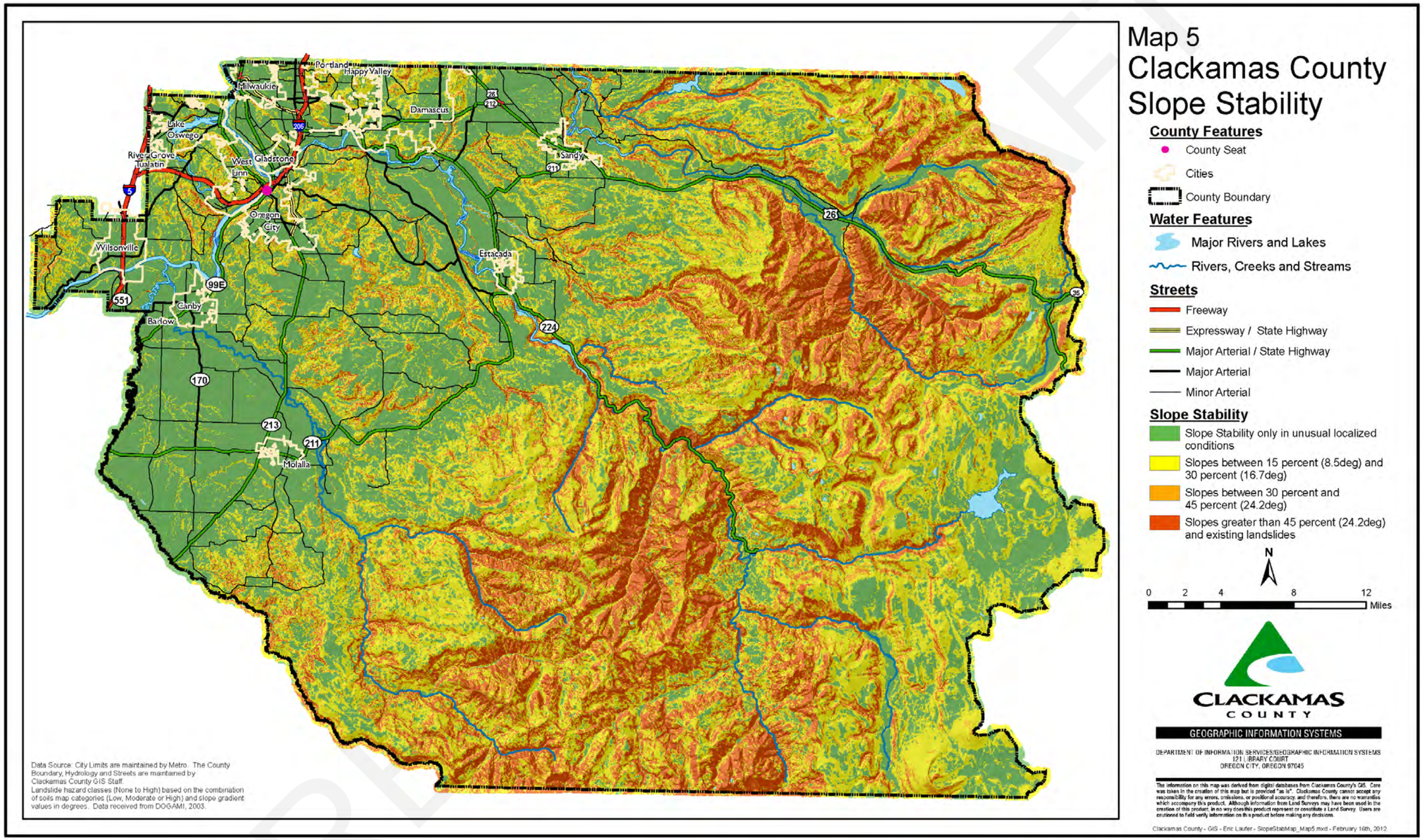
Map 3 FEMA FIRM 100 Year Flood Plain



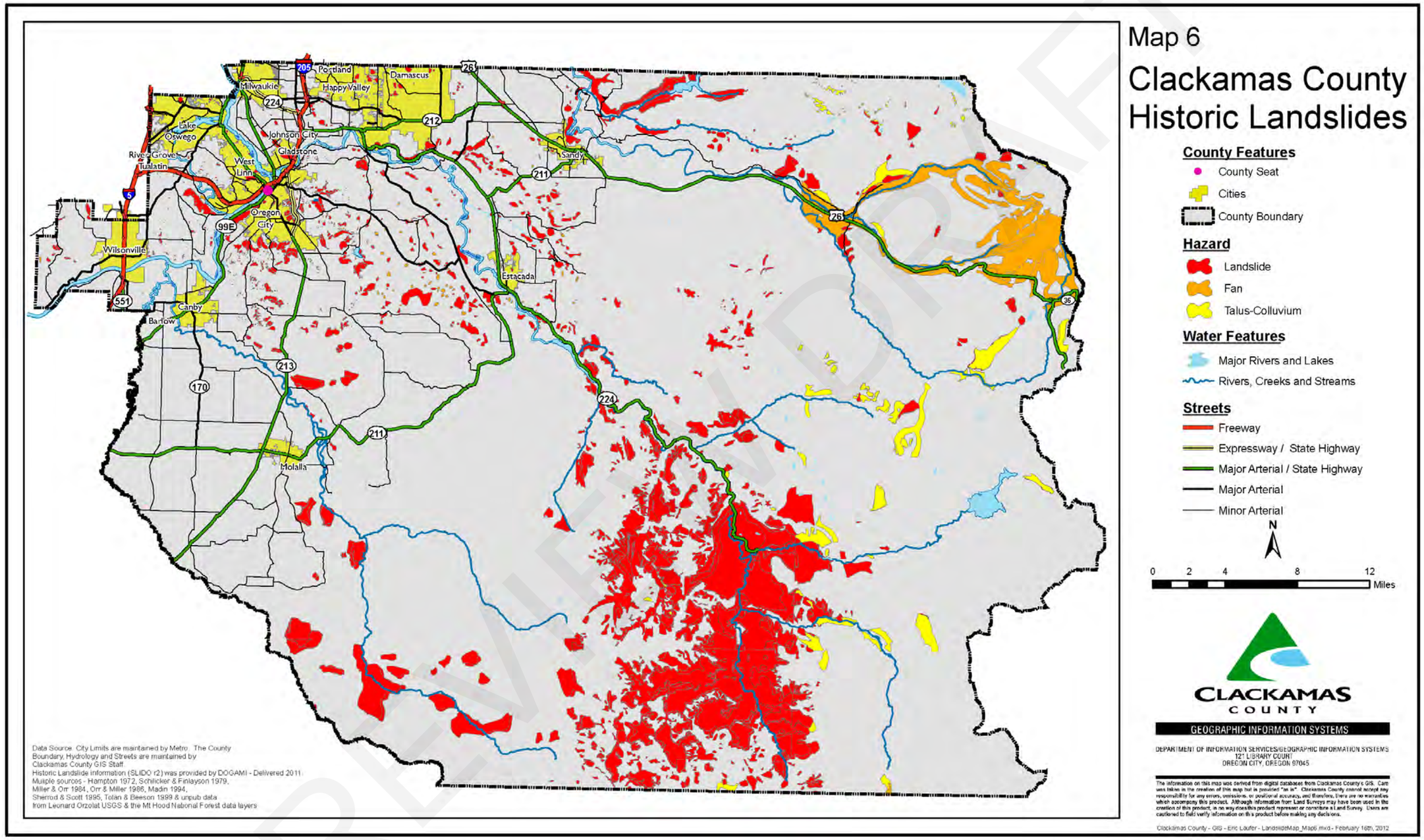
Map 4 River SubBasins



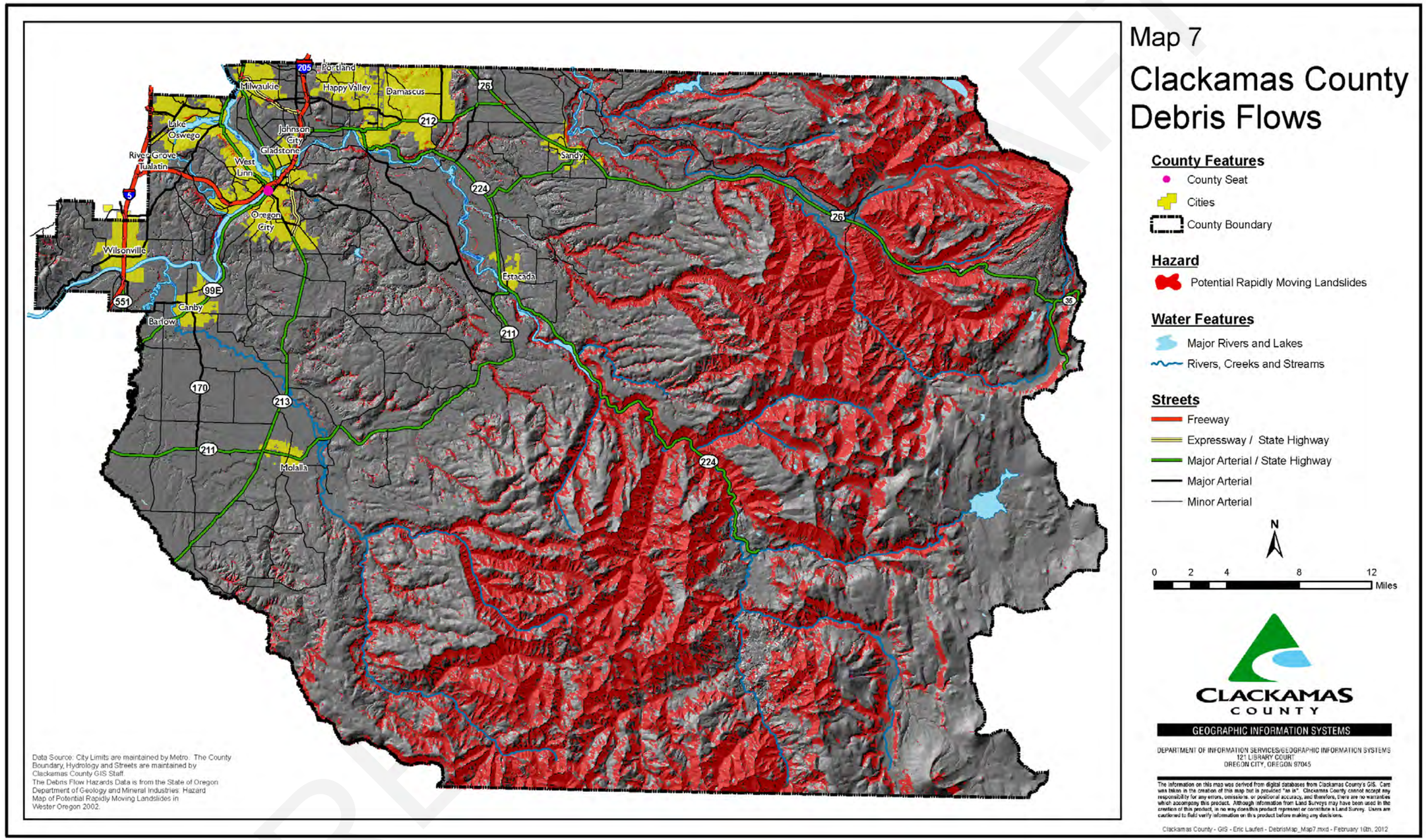
Map 5 Slope Stability



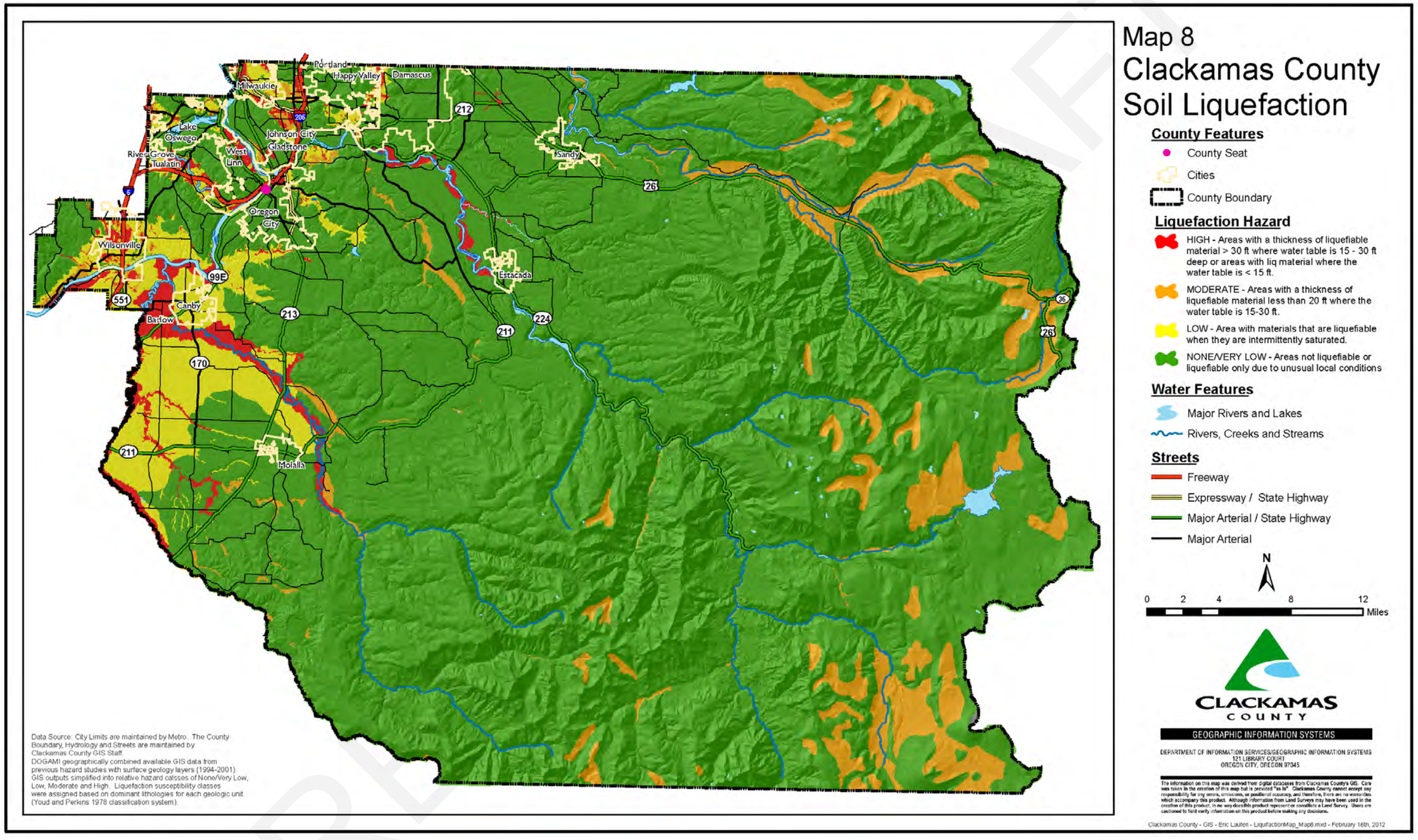
Map 6 Historic Landslides



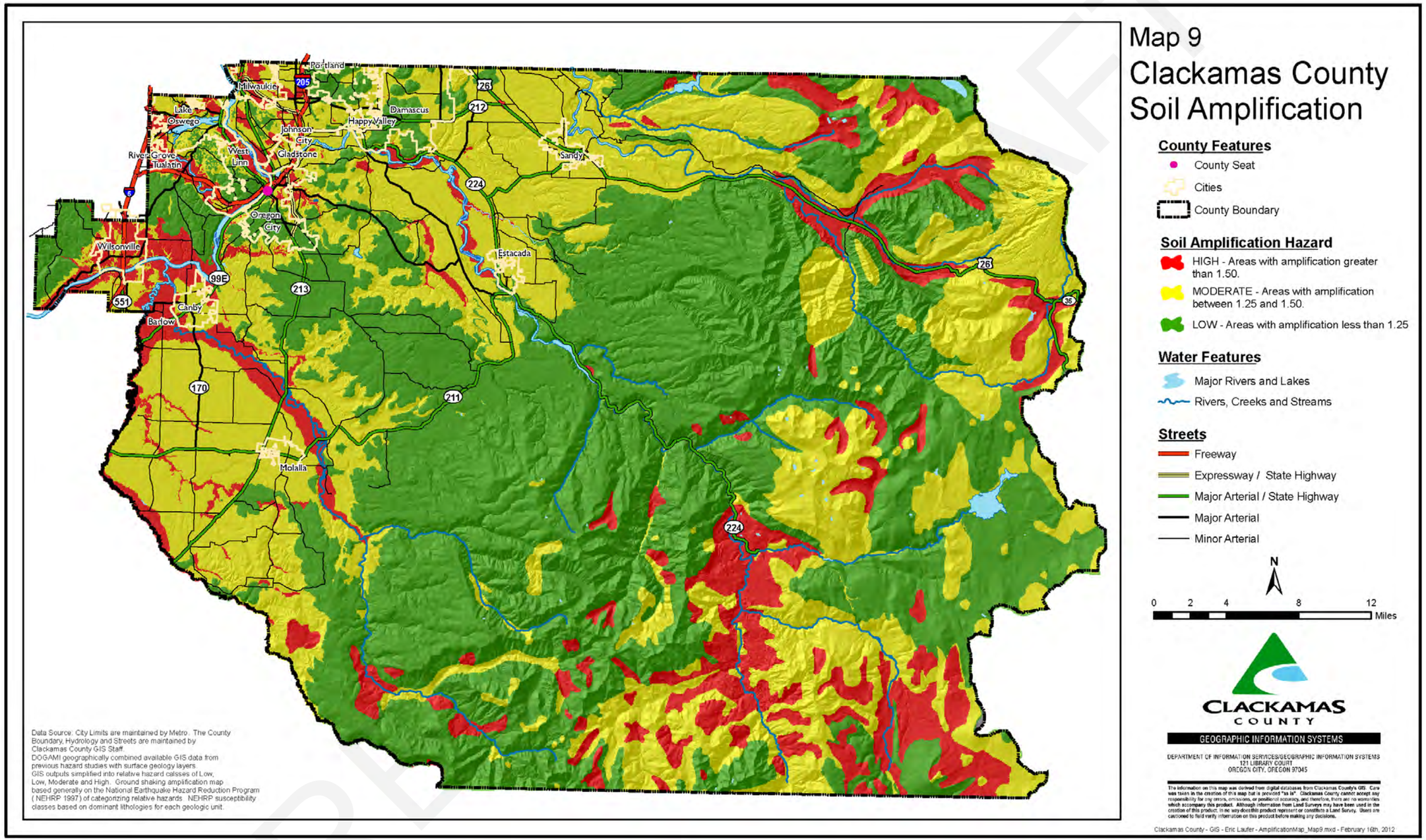
Map 7 Debris Flows



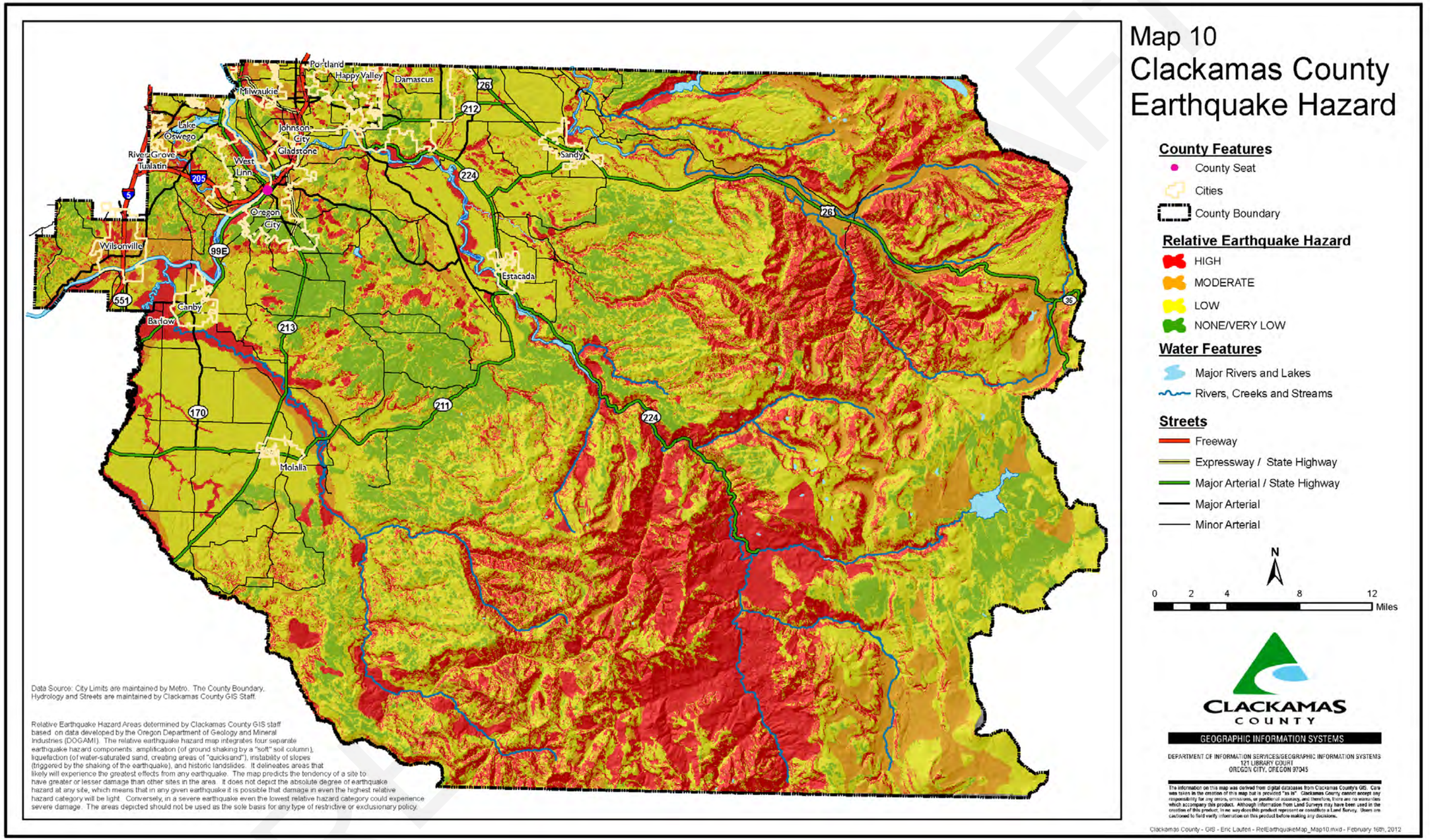
Map 8 Soil Liquefaction



Map 9 Soil Amplification



Map 10 Earthquake Hazard



Appendix F: Economic Analysis of Natural Hazard Mitigation Projects

This appendix was developed by the Oregon Partnership for Disaster Resilience at the University of Oregon's Institute for Policy Research and Engagement (IPRE). 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 – Department 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 Department of Emergency Management (OEM), the Federal Emergency Management Agency (FEMA), 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, and its implementation and maintenance. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, so as to avoid disaster-related damages and related financial burders later on, post-disaster. Benefit/cost analysis is based on calculating the frequency and severity of a hazard, avoiding future damages, and overall 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. Unless an alternate approach is approved by FEMA, jurisdictions must use the latest available approved FEMA benefit/cost analysis (BCA) toolkit. Alternate approaches should be used with consultation from the State Hazard Mitigation Officer. See https://www.fema.gov/benefit-cost-analysis for more information.

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 based on 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 Steering 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 considering 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.

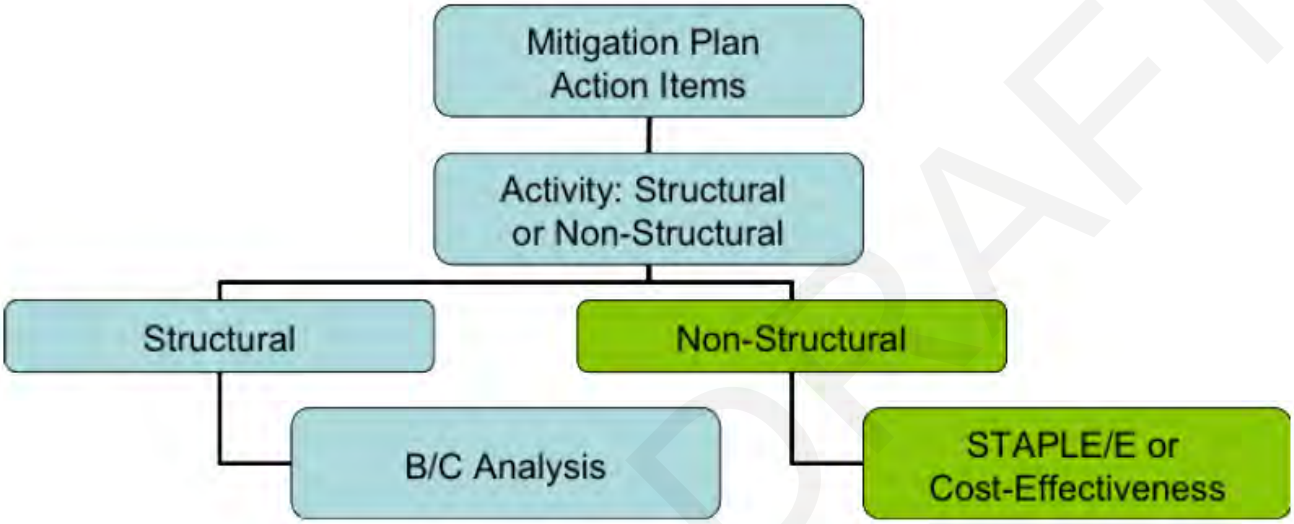
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

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 10 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 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.

Step 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.

Step 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.

Step 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 based on 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 because 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 time.

Additional Costs from Natural Hazards

Property owners should also assess changes in a broader set of factors that can change because 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 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, small

business development, critical infrastructure, and transportation projects among others. Incorporating natural hazard mitigation with other community projects can increase the viability of project implementation.

Resources

CUREe Kajima Project, *Methodologies for Evaluating the Socio-Economic Consequences of Large Earthquakes*, Task 7.2 Economic Impact Analysis, Prepared by University of California, Berkeley Team, Robert A. Olson, VSP Associates, Team Leader; John M. Eidinger, G&E Engineering Systems; Kenneth A. Goettel, Goettel and Associates, Inc.; and Gerald L. Horner, Hazard Mitigation Economics Inc., 1997

Federal Emergency Management Agency, *Benefit/Cost Analysis of Hazard Mitigation Projects*, Riverine Flood, Version 1.05, Hazard Mitigation Economics, Inc., 1996 Federal Emergency Management Agency, *Report on the Costs and Benefits of Natural Hazard Mitigation*. Publication 331, 1996.

Goettel & Horner Inc., Earthquake Risk Analysis Volume III: The Economic Feasibility of Seismic Rehabilitation of Buildings in the City of Portland, Submitted to the Bureau of Buildings, City of Portland, August 30, 1995.

Goettel & Horner Inc., *Benefit/Cost Analysis of Hazard Mitigation Projects,* Volume V, Earthquakes, Prepared for FEMA's Hazard Mitigation Branch, October 25, 1995.

Horner, Gerald, *Benefit/Cost Methodologies for Use in Evaluating the Cost Effectiveness of Proposed Hazard Mitigation Measures*, Robert Olsen Associates, Prepared for Oregon Military Department – Department of Emergency Management, July 1999.

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

Risk Management Solutions, Inc., *Development of a Standardized Earthquake Loss Estimation Methodology*, National Institute of Building Sciences, Volume I and II, 1994.

VSP Associates, Inc., *A Benefit/Cost Model for the Seismic Rehabilitation of Buildings*, Volumes 1 & 2, Federal Emergency management Agency, FEMA Publication Numbers 227 and 228, 1991.

VSP Associates, Inc., Benefit/Cost Analysis of Hazard Mitigation Projects: Section 404 Hazard Mitigation Program and Section 406 Public Assistance Program, Volume 3: Seismic Hazard Mitigation Projects, 1993.

VSP Associates, Inc., *Seismic Rehabilitation of Federal Buildings: A Benefit/Cost Model*, Volume 1, Federal Emergency Management Agency, FEMA Publication Number 255, 1994.

Appendix G: Grant Programs and Resources

Introduction

There are numerous local, state and federal funding sources available to support natural hazard mitigation projects and planning. The following section includes an abbreviated list of the most common funding sources utilized by local jurisdictions in Oregon. Because grant programs often change, these sources are periodically reviewed and updated to maintain a current list of active resources.

Post-Disaster Federal Programs

Hazard Mitigation Grant Programs

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. The HMGP involves a paper application which is first offered to the counties with declared disasters within the past year, then becomes available statewide if funding is still available. http://www.fema.gov/hazard-mitigation-grant-program.

Physical Disaster Loan 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. The HMGP involves a paper application which is first offered to the counties with declared disasters within the past year, then becomes available statewide if funding is still available.
http://www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/disaster-loans

Non-Disaster Federal Program

Building Resilient Infrastructure and Communities Grant Program

The Building Resilient Infrastructure and Communities (BRIC) 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. BRIC grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds. The BRIC grant program is offered annually; applications are submitted online. Applicants need a user profile approved by the State Hazard Mitigation Officer, which should be garnered well before the application period opens. https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities

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/103279. 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:
https://www.oregon.gov/OEM/emresources/Grants/Pages/HMA.aspx

Contact: State Hazard Mitigation Officer, email: shmo@mil.state.or.us

State Programs

Special Public Works Fund

The Special Public Works Fund (SPWF) provides funds for publicly owned facilities that support economic and community development in Oregon. Funds are available to public entities for: planning, designing, purchasing, improving and constructing publicly owned facilities, replacing publicly owned essential community facilities, and emergency projects as a result of a disaster. Public agencies that are eligible to apply include: cities, counties, county service districts, (organized under ORS Chapter 451), tribal councils, ports, districts as defined in ORS 198.010, and airport districts (ORS 838). Facilities and infrastructure projects that are eligible for funding are: airport facilities, buildings and associated equipment, levee accreditation, certification, and repair, restoration of environmental conditions on publicly-owned industrial lands, port facilities, wharves, and docks, the purchase of land, rights of way and easements necessary for a public facility, telecommunications facilities, railroads, roadways and

bridges, solid waste disposal sites, storm drainage systems, wastewater systems, and water systems. https://www.orinfrastructure.org/Infrastructure-Programs/SPWF/

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.
https://nationalmap.gov/ortho.html

Mapping Standards Support, DOI-USGS

Expertise in mapping and digital data standards to support the National Flood Insurance Program.
http://ncgmp.usgs.gov/standards.html

Soil Survey, USDA-NRCS

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

Project Support

Coastal Zone Management Program, NOAA.

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

Community Development Block Grant Entitlement Communities Program, US Department of Housing and Urban Development

Provides grants to entitled cities and urban counties to develop viable communities (e.g., decent housing, a suitable living environment, expanded economic opportunities), principally for low- and moderate- income persons.
http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs/entitlement

National Fire Plan (DOI – USDA)

The NFP provides technical, financial, and resource guidance and support for wildland fire management across the United States. This plan addresses five key points: firefighting, rehabilitation, hazardous fuels reduction, community assistance, and accountability. http://www.forestsandrangelands.gov/

Assistance to Firefighters Grant Program, FEMA

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

Emergency Watershed Protection Program, USDA-NRCS

Provides technical and financial assistance for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas damaged by severe natural hazard events. http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp

Rural Development Assistance – Utilities, USDA

Direct and guaranteed rural economic loans and business enterprise grants to address utility issues and development needs. http://www.rurdev.usda.gov/Utilities_Programs_Grants.html

Rural Development Assistance – Housing, USDA.

The RDA program provides grants, loans, and technical assistance in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster necessary. http://www.rurdev.usda.gov/HAD-HCFPGrants.html

Public Assistance Grant Program, FEMA.

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

National Flood Insurance Program, FEMA

The NFIP makes available flood insurance to residents of communities that adopt and enforce minimum floodplain management requirements. http://www.fema.gov/national-flood-insurance-program

HOME Investments Partnerships Program, HUD

The HOME IPP provides grants to states, local government and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons. http://www.hud.gov/offices/cpd/affordablehousing/programs/home/

Disaster Recovery Initiative, HUD

The DRI provides grants to fund gaps in available recovery assistance after disasters (including mitigation).

http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs/dri

Emergency Management Performance Grants, FEMA

EMPG grants help state and local governments to sustain and enhance their all-hazards emergency management programs. http://www.fema.gov/fy-2012-emergency-management-performance-grants-program

Partners for Fish and Wildlife, DOI – FWS

The PFW program provides financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats. http://www.fws.gov/partners/

North American Wetland Conservation Fund, DOI-FWS

NAWC fund provides cost-share grants to stimulate public/private partnerships for the protection, restoration, and management of wetland habitats.
http://www.fws.gov/birdhabitat/Grants/index.shtm

Federal Land Transfer / Federal Land to Parks Program, DOI-NPS

Identifies, assesses, and transfers available federal real property for acquisition for State and local parks and recreation, such as open space. http://www.nps.gov/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 FY2012, it was originally enacted in 2000 to provide five years of transitional assistance to rural counties affected by the decline in revenue from timber harvests on federal lands. Funds have been used for improvements to public schools, roads, and stewardship projects. Money is also available for maintaining infrastructure, improving the health of watersheds and ecosystems, protecting communities, and strengthening local economies. http://www.fs.usda.gov/pts/

Community Wildfire Defense Grant Program

The Community Wildfire Defense Grant Program provides to communities at risk of wildfire to plan for and reduce the risk of wildfire. The program provides funding to at-risk communities for the purposes of developing/revising their Community Wildfire Protection Plans (CWPP) and/or implementing mitigation activities identified within their CWPPs. The Program also helps communities in the wildland urban interface (WUI) implement activities related to restoring and maintaining the landscape, creating fire adapted communities, and improving wildfire responses. https://www.fs.usda.gov/managing-land/fire/grants

Appendix H: Community Survey

Purpose

The purpose of the NHMP Community Survey was to gather information on how community members living in Clackamas County perceive and react to the natural hazards that impact the county, as well as mitigation measures taken to reduce the risks associated with these hazards. In this survey, community members were encouraged to provide input on their concerns, potential mitigation actions for the county, and comment on how the plan can be improved to best represent the county as a whole.

Media Releases for Survey

Media releases were distributed across the county to inform Clackamas County residents to participate in the survey. Releases were made by the Clackamas County Public and Government Affairs Department, the participating jurisdictions, and social and cultural organizations throughout the county. Additionally, planning team members delivered presentations at community meetings, such as Connect Meetings, to raise awareness about the survey and encourage organizations present at the meetings to share the survey with their communities.

NHMP Clackamas County Survey Data Analysis

The planning team released a survey for community members who live in Clackamas County. The survey remained open for five (5) weeks from May 22 through June 23, 2023. Clackamas County Disaster Management coordinated with county staff, city, and special district participants to distribute the survey. This was done by promoting it online on websites, social media, and newsletters, as well as during public events. In total, 2,544 survey responses were received.

Survey respondents were largely from the Northwest region of the county (34%), including areas such as Lake Oswego, Stafford, and West Linn. The other survey respondents were more evenly balanced across the other regions, with the least responses coming from the West region of the county (5%), including areas such as Canby and Wilsonville. Furthermore, survey respondents were overwhelmingly white (90%), primarily female (50%), and were ages 30-49 (36%). The annual household income of respondents was more evenly balanced, with the greatest number of respondents earning between $30,000-$44,999 (19%).

Community members' concerns regarding natural hazards is an especially pertinent question, as it aids the county in more accurately assessing community priorities when it comes to hazard mitigation actions and goals. Respondents were asked about which hazards they were most concerned about (rated a 5 on the score), with respondents reporting that they were most concerned about Wildfire (35%) and Extreme Heat (29%). Approximately one-third of respondents indicated they were highly concerned (rated a 4 on the scale) about Winter Storms (32%), Windstorms (31%), and Earthquakes (29%). The hazards that were most often indicated as not being a concern (rated a 1 on the scale) to most respondents were Volcanoes (17%), Floods (15%), and Landslides (14%). These levels of concern align well with the 2024 Hazard Vulnerability Analysis (HVA), which ranked Wildfire as the county's number 1 hazard concern, as well as Earthquakes as number 2 and 3 (Cascadia and Crustal), Winter

Storms as number 4, and Extreme Heat as number 5. Therefore, the most up-to-date science and climate projections, county priorities, and community concerns are in alignment, which has been one of the principal objectives of the NHMP update.

Next, survey respondents were also asked to rate how important each of the listed mitigation actions and goals was to the community, with the list of actions and goals corresponding to the Action Items described in this 2024 NHMP update. Overall, roughly one-third of respondents rated each of these goals and actions as very important (rated a 5 on the scale), with the goals and actions with the greatest indication of importance being strengthening infrastructures against natural hazards (38%), strengthening critical facilities (35%), and enhancing back-up energy sources and fuel supply in the event of a natural disaster (35%). Once again, the Action Items that have been identified as high priority by the county are in alignment with the mitigation actions and goals community members have identified as very important for community safety and well-being.

For natural hazard mitigation planning, it is vital to understand where in the community potential risk exists and what parts of the community need mitigation action to reduce such risk. Survey respondents were asked to identify any safety concerns related to potential future natural hazards around their homes and neighborhoods. Many respondents noted areas where there were instances of nuisance flooding, local parks with vegetation overgrowth, or the location of trees that pose as potential threats to structures during storms. Through the documentation of these potential disaster sites, an inventory was developed that enables the county to document community members' concerns relating to potential hazards near their homes and neighboring areas. In addition, it enables the county to identify locations that are high-risk for certain hazards, as well as locations for prospective mitigation project sites.

It is crucial to understand how and where community members remain engaged in their communities to assess community resilience and determine how much community connectivity exists within a community. Survey respondents indicated that they are quite engaged and active in their community. Almost two-fifths of respondents (41%) stated that they make donations that benefit their community, including donating to food drives, blood donations, and more. Respondents also are very sociable within their neighborhood, with 41% of respondents indicating they socialize with their neighbors. Almost one-third of respondents (31%) noted that they engage in local politics in some way, either through voting, supporting local campaigns, running for office, and more. Beyond the provided option, respondents also are involved in their community's CERT program, are members of their community/neighborhood organizations, follow community social media pages, and read local newspapers and newsletters. In light of the fact that there is quite a bit of community interconnectivity throughout Clackamas County, information and knowledge can be more readily shared within and across different community groups.

Q1. Do you live in Clackamas County?

- YES, I live in Clackamas County.
- NO, I do not live in Clackamas County.

	Do you live in Clackamas County
Yes	2,544
No	0

Q2. What area of Clackamas County do you live in, or are closest to?

- East county area (Damascus, Sandy, Estacada, Mount Hood area)
- East county area (Damascus, Sandy, Estacada, Mount Hood area)
- North county area (Clackamas area, Gladstone, Happy Valley, Milwaukie)
- Northwest county area (Lake Oswego, Stafford area, Tualatin, West Linn)
- Oregon City area (Oregon City, Beavercreek, Redland)
- South county area (Molalla, Mulino, Colton)
- West county area (Canby, Wilsonville)

Answer Choices	Percentage	Number
East county area	15%	368
North county area	21%	528
Northwest county area	34%	848
Oregon City area	13%	331
South county area	11%	273
West county area	5%	128
Total	100%	2,476
Skipped	0%	68

Q3. How concerned are you about the following natural disasters affecting you, your cohabitating family, or your residence in the future? Please assign a number to your concern, with "1" meaning "Not at all concerned," and "5" meaning "Very concerned."

	Not at all Concerned 1	2	3	4	Very Concerned 5
Drought	7%	17%	30%	25%	22%
Earthquake	4%	12%	28%	29%	27%
Extreme Heat	4%	13%	26%	29%	29%
Flood	15%	20%	27%	22%	17%
Landslide	14%	18%	29%	23%	16%
Volcano	17%	19%	26%	21%	17%
Wildfire	3%	8%	25%	30%	35%
Winstorm	4%	13%	29%	31%	22%
Winter Storm	4%	13%	28%	32%	23%

Q4. Are there any safety concerns related to potential future natural hazards around your home/neighborhood that you would like Clackamas County Disaster Management to be aware of? This can include such issues as stormwater runoff leading to nuisance flooding/ponding at a certain intersection, steep slopes with minimal vegetation at risk of runoffs/landslides, or other pertinent issues

relating to natural hazard safety concerns. For any identified concern, please provide details in the box corresponding to the identified hazard.

Q5. Planning for natural hazards can lessen event impacts on communities. Prioritizing before and after hazard events can help keep the entire county functioning as close to normal as possible.
Of the following listed goals for reducing the risk from hazards, please assign a number to its level of importance, with "1" meaning "Not at all important," and "5" meaning "Very important."

	Not at all Important 1	2	3	4	Very Important 5
Enhance the function of ecological features and natural resources (e.g. improving floodwater absorption in wetlands)	3%	11%	30%	30%	26%
Improve disclosures about natural hazard risks during real estate transactions	3%	11%	27%	29%	29%
Promote improved cooperation and collaboration among public agencies, community members, nonprofit organizations, and businesses	2%	8%	27%	32%	30%
Strengthen critical facilities such as hospitals, fire stations, government buildings (e.g. seismic retrofitting, flood elevations)	3%	8%	24%	31%	35%
Limit development in known hazardous areas, such as floodplains	3%	9%	24%	30%	34%
Strengthen infrastructure (transportation/energy/water) against earthquakes or flooding (e.g., retrofit bridges, place power lines underground)	2%	8%	23%	30%	38%
Improve community engagement and outreach programs on hazards and risk reduction actions and strategies	3%	10%	30%	32%	26%
Enhance back-up energy sources and fuel supply in the event of a natural disaster impacting public and private energy and fuel sources and locations	2%	7%	24%	32%	35%
Improve and enhance emergency and response services (e.g., police, fire, ambulance)	2%	8%	25%	32%	34%

Q6. Staying engaged and active in your community is an important way to build community resilience and connectivity. From the following, select how you stay involved and engaged with your community:

- Local faith-based organizations
- Attending local government meetings
- Local politics (e.g., running for office, supporting campaigns, voting, etc.)
- Community Center programs (e.g., art classes, community band, etc.)
- Socialize with neighbors
- School programs (e.g., PTA, school board meeting, etc.)

- Making donations that benefit your community (e.g., food drives, blood donation, etc.)
- Local cultural and/or social organizations (e.g. Rotary, nonprofits serving communities)
- Participating and/or running local sport teams/events
- Community safety programs (e.g., CERT)
- Other (please specify)

	Percentage	Number
School programs (e.g., PTA, school board meeting, etc.)	18%	378
Local politics (e.g., running for office, supporting campaigns, voting, etc.)	31%	654
Attending local government meetings	20%	428
Community Center programs (e.g., art classes, community band, etc.)	27%	568
Community safety programs (e.g., CERT)	22%	463
Local cultural and/or social organizations (e.g. Rotary, nonprofits serving communities)	25%	541
Local faith-based organizations	20%	424
Participating and/or running local sport teams/events	16%	339
Making donations that benefit your community (e.g., food drives, blood donation, etc.)	41%	870
Socialize with neighbors	42%	892
Other	7%	146

Q7. Please provide any additional comments or suggestions regarding your risk of future natural hazard events below.

Q8. What is your age

- Under 18
- 18-29
- 30-49
- 50-64
- 65+

Answer Choices	Percentage	Number
Under 18	0%	4
18-29	26%	565
30-49	36%	774
50-64	19%	410
65+	18%	391

Q9. How do you identify your gender?

- Cisgender Female
- Cisgender Male
- Female
- Genderfluid
- Genderqueer
- Male
- Non-binary
- Questioning
- Transgender Male
- Transgender Female
- Two-spirit
- Identity not listed above.

Answer Choices	Percentage	Number
Agender	0%	6
Cisgender Female	6%	127
Cisgender Male	3%	66
Female	49%	1,042
Genderfluid	1%	14
Genderqueer	1%	21
Male	42%	886
Non-binary	1%	20
Questioning	0%	10
Transgender Male	0%	8
Transgender Female	0%	4
Two-spirit	0%	4
An identity not listed above	2%	34

Q10. Please indicate your total annual income?

- Under $15,000
- $15,000 and $29,999
- $30,000 and $44,999
- $45,000 and $59,999
- $60,000 and $74,999
- $75,000 and $99,999
- $100,000 and $199,999
- Over $200,000

Answer Choices	Percentage	Number
Under $15,000	2%	37
Between $15,000 and $29,999	13%	265
Between $30,000 and $44,999	19%	381
Between $45,000 and $59,999	18%	367
Between $60,000 and $74,999	15%	299
Between $75,000 and $99,999	12%	255
Between $100,000 and $199,999	15%	301
Over $200,000	7%	146

Q11. Which description(s) do identify with? Please select all that apply (Grouped together in graph)

Answer Choices	Responses	Number
Black and African American	7%	147
Asian	7%	141
Hispanic and Latino/a/x	3%	74
Middle Eastern/North African	1%	14
Native American and Pacific Islander	3%	70
White	91%	1,941
Biracial/Multiracial/Mixed Heritage	1%	17
An identity not listed	2%	42