Volume III: Appendices

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APPENDIX A:
ACTION ITEM FORMS

Action Item Forms

** - Priority Action Item*

Table A-1 Internal and External Partners and Acronyms

HMAC – Hazard Mitigation Advisory Committee Lead and Supporting Agencies

Internal to Clackamas County	
CA - County Administration	**PGA** - Public and Government Affairs
BCS – Business and Community Services	**TS** – Technology Services
DM – Disaster Management	**TCA** - Tourism and Cultural Affairs
Finance	**DTD** - Transportation and Development
H3S – Health, Housing, and Human Services	**WES** - Water Environment Services
External to County	
Local and Regional	
Chambers of Commerce	**RDPO** – Regional Disaster Preparedness
CFDB - Clackamas Fire Defense Board	Organization
CWEC - Clackamas Wildfire Executive	School Districts
Committee	**SWCD** - Soil and Water Conservation Districts
Community Planning Organizations	**TVF&R** – Tualatin Valley Fire and Rescue
Metro	Universities and Colleges
Mutual Aid Partners	**UASI** – Urban Area Security Initiative
Neighborhood Associations	Utility Providers
Property Owners	Water districts
	WC - Watershed Councils
State	
DLCD – Department of Land Conservation and	**ODF** - Oregon Department of Forestry
Development	**OSSPAC** – Oregon Seismic Safety Policy
DOGAMI – Oregon Department of Geology and	Advisory Commission
Mineral Industries	**OWEB** – Oregon Watershed Enhancement
IFA – Infrastructure Finance Authority	Board
OEM – Oregon Office of Emergency	Oregon Solutions
Management	
Federal	
ASFPM - Association of State Floodplain	**USACE** – U.S. Army Corps of Engineers
Managers	**USFS** – U.S. Forest Service
BLM – Bureau of Land Management	**NRCS** – Natural Resources Conservation Service
CVO – David A Johnston Cascade Volcano	**NWS** – National Weather Service
Observatory, USGS Volcano Hazards Program	**USGS** – United States Geological Survey
FEMA – Federal Emergency Management	
Agency	
Private/Non-Profit	
Community Foundations	
Insurance Providers	
Realtors	
Funding	
HMA- Hazard Mitigation Assistance	
PDM – Pre-disaster Mitigation Grant Program	
HMGP – Hazard Mitigation Grant Program	
FMA – Flood Mitigation Assistance Grant	
Program	
SRGP – Seismic Rehabilitation Grant Program	

Action Item Forms

Each action item has a corresponding action item worksheet describing the activity, identifying the rationale for the project, identifying potential ideas for implementation, and assigning coordinating and partner organizations. The action item worksheets can assist the community in pre-packaging potential projects for grant funding. The worksheet components are described below.

ALIGNMENT WITH EXISTING PLANS/POLICIES

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

STATUS/RATIONALE FOR PROPOSED ACTION ITEM

Action items should be fact-based and tied directly to issues or needs identified throughout the planning process. Action items can be developed at any time during the planning process and can come from a number of sources, including participants in the planning process, noted deficiencies in local capability, or issues identified through the risk assessment. The rationale for proposed action items is based on the information documented in Section 2. The worksheet provides information on the activities that have occurred since the previous plan for each action item.

IDEAS FOR IMPLEMENTATION

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:

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.

INTERNAL AND EXTERNAL PARTNERS:

The internal and external partner organizations listed in the Action Item Worksheets are potential partners recommended by the project HMAC but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial

contact is also to gain a commitment of time and/or resources toward completion of the action items.

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

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

PLAN GOALS ADDRESSED:

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

TIMELINE:

All broad scale action items have been determined to be ongoing, as opposed to short-term (0 to 2 years) or long-term (3 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. For example, although Flood Action Item #3: "*Develop better flood warning systems*" has been addressed by working with the National Weather Service to install flood staff gauges around troublesome areas, the HMAC will continue this effort of mitigating flood loss.

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 or general funds. An action item may include several potential funding sources.

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

Multi-Hazard #1*

Proposed Action Item	Alignment with Plan Goals:
Integrate the goals and action items from the Clackamas County Natural Hazard Mitigation Plan into existing regulatory documents and programs, where appropriate.	Encourage Partnerships & Implementation

Alignment with Existing Plans/Policies:

Capital Improvement Plan; Comprehensive Plan

2018 Status/Rationale for Proposed Action Item:

- The HMAC continues to work with the county on integrating action items for the NHMP into regulatory documents and programs.
- The DTD Long-Range Planning Work Program may include a project to consolidate and streamline County regulations and plans that pertain to sensitive, hazardous, and environmental zones and overlays that would be contained in one all-encompassing Critical & Hazardous Overlay Zone (CHAOZ). The timeframe for initiating this project has not been precisely determined.
- No updates to the seismic building codes are expected at the moment. The state could, however, decide in the future to incorporate the updated DOGAMI earthquake information into the applicable codes, at which point the County would be required to adopt it, but nothing is currently expected or on the radar.

Ideas for Implementation:

- Use the mitigation plan to update the county's Comprehensive Land Use Plan State Land Use Planning Goal 7, designed to protect life and property from natural disasters and hazards through planning strategies that restrict development in areas of known hazards;
- Integrate the county's mitigation plan into current capital improvement plans; and
- Partner with other organizations and agencies with similar goals to promote building codes that are more disaster resistant at the state level.

Coordinating Organization:	Hazard Mitigation Advisory Committee

Internal Partners:	External Partners:
Disaster Management; Finance; Transportation and Development	U.S. Forest Service

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund	Low	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing action item
Priority:	High

** - High Priority Action Item*

Multi-Hazard #2*

Proposed Action Item	Alignment with Plan Goals:
Identify and pursue funding opportunities to develop and implement local and county mitigation activities.	Encourage Partnerships & Implementation

Alignment with Existing Plans/Policies:
Capital Improvement Plan

2018 Status/Rationale for Proposed Action Item:
The following are different funding opportunities used to develop and implement local and county mitigation activities during the last NHMP cycle: • 1 FMA FY16 grant award for mitigating a Repetitive Loss property • 1 HMGP 5% award for a flood warning system (DR-1956) • 1 HMGP awards for flood acquisitions (DR-1956) • 1 PDM FY16 award for NHMP update planning grant • 1 Title III award for updating the Clackamas County Community Wildfire Protection Plan • $2.36 million in wildfire mitigation grants for wildfire mitigation and fuels reduction activities by ODF and CCFD1

Ideas for Implementation:
• Develop incentives for local governments, citizens, and businesses to pursue hazard mitigation projects; • Allocate county resources and assistance to mitigation projects when possible; and • Partner with other organizations and agencies in Clackamas County to identify grant programs and foundations that may support mitigation activities.

Coordinating Organization:	Disaster Management

Internal Partners:	External Partners:
Transportation and Development	Oregon Emergency Management; Federal Emergency Management Agency; Oregon Department of Forestry; Community Foundations, etc.

Potential Funding Sources:	Estimated cost:	Timeline:
Capital Funds; FEMA PDM, HMGP and FMA Grants; Forest Service Grants; Other grant sources	Low to High: Calculated on a project by project basis	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing action item
Priority:	High

** - High Priority Action Item*

Multi-Hazard #3

Proposed Action Item:	Alignment with Plan Goals:
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.	Encourage Partnerships & Implementation

Alignment with Existing Plans/Policies:

N/A

2018 Status/Rationale for Proposed Action Item:

- The Hazard Mitigation Advisory Committee continues to meet annually. The following are the dates of past HMAC meetings prior to the 2018 NHMP update process:
  - June 11, 2013 and November 11, 2013
  - April 23, 2014 and June 25, 2014
  - April 2, 2015 and June 17, 2015
  - March 30, 2016 and June 23, 2016
  - May 25, 2017 and November 7, 2017 (began NHMP update)
  - February 28, 2018 NHMP update
- The Sandy Sustainable Flood Recovery Group, which includes many of the County members of the HMAC, has continued to meet twice a month since March 2011 to discuss long-term mitigation activities.

Ideas for Implementation:

- Establish clear roles for participants, meeting regularly to pursue and evaluate implementation of mitigation strategies;
- Oversee implementation of the mitigation plan;
- Establish measurable standards to evaluate mitigation policies and programs and provide a mechanism to update and revise the mitigation plan;
- Monitor hazard mitigation implementation by jurisdictions and participating organizations through surveys and other reporting methods;
- Develop updates for the Natural Hazards Mitigation Action Plan based on new information;
- Conduct a full review of the Natural Hazards Mitigation Action Plan every 5 years by evaluating mitigation successes, failures, and areas that were not addressed; and
- Provide training for Committee members to remain current on developing issues in the natural hazard loss reduction field.

Coordinating Organization:	Hazard Mitigation Advisory Committee

Internal Partners:	External Partners:
Disaster Management; Transportation and Development, Technology Services, County Administration	

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund	Low	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Multi-Hazard #4*

Proposed Action Item	Alignment with Plan Goals:
Identify, improve, and sustain collaborative programs focusing on the real estate and insurance industries, public and private sector organizations, and individuals to avoid activity that increases risk to natural hazards.	Encourage Partnerships & Implementation; Promote Public Awareness; Protect Life and Property

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• In October 2013, Clackamas County co-sponsored with the Portland Area Realtors Association a realtor workshop on flood insurance. • Clackamas County was selected in 2014 by the USACE for a Public Involvement Pilot Project for the upper Sandy Basin communities, which involved holding facilitated community meetings to discuss flood risk management, with participation by a local realtor. • A Sandy River area realtor participated as a local stakeholder at the Clackamas County Risk Map Resilience Meeting in Oct. 2017.

Ideas for Implementation:
• Distribute information about flood, fire, earthquake, and other forms of natural hazards insurance to property owners in areas identified to be at risk through hazard mapping; • Develop a one-page handout on types of insurance and deliver through county utility or service agencies; • Educate individuals and businesses on the benefit of engaging in mitigation activities such as developing impact analyses; • Pinpoint areas of high risk and transfer the cost of risk to property owners through insurance (rather than to the public); • Encourage the development of unifying organizations to ensure communication and dissemination of natural hazard mitigation information; • Identify activities for private sector and citizen involvement such as nonstructural seismic daycare retrofits; and •

Coordinating Organization:	Disaster Management

Internal Partners:	External Partners:
Public and Government Affairs; Business and Community Services	Realtors; Utility Providers; Property Owners

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund	Low to Medium	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing action item
Priority:	High

** - High Priority Action Item*

Multi-Hazard #5

Proposed Action Item:	Alignment with Plan Goals:
Develop public and private partnerships to foster natural hazard mitigation program coordination and collaboration in Clackamas County.	Encourage Partnerships & Implementation

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• Since 2013 there has been one county-wide, Presidential Disaster Declaration. As a result, there has been outreach to affected residents regarding SBA loans. • There has also been some outreach and partnering with the Oregon City Chamber of Commerce. (Cascadia Rising, 2015 Floods and the Vice President joined County DM staff to take the National Disaster Recovery Framework training at EMI in 2017.)

Ideas for Implementation:
• Work with city governments to develop local Natural Hazards Mitigation Plans that are consistent with the goals and framework of the County Plan; • Identify all organizations within Clackamas County that have programs or interests in natural hazards mitigation; • Involve private businesses throughout the county in mitigation planning; • Improve communication between ODOT and county road departments, and work together to prioritize and identify strategies to deal with road problems; and • Establish protocol for communication electric providers and the Department of Transportation and Development to assure rapid restoration of transportation capabilities.

Coordinating Organization:	Disaster Management

Internal Partners:	External Partners:
Transportation and Development; Business and Community Services; Public and Government Affairs	Chambers of Commerce

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund; Business Partnerships	Low	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing action item
Priority:	Medium

Multi-Hazard #6*

Proposed Action Item	Alignment with Plan Goals:
Update and Maintain inventories of at-risk buildings and infrastructure and prioritize mitigation projects.	Protect Life and Property; Encourage Partnerships & Implementation

Alignment with Existing Plans/Policies:
Comprehensive Plan

2018 Status/Rationale for Proposed Action Item:
• The County is implementing a Building Safety Evaluation Program (BSEP) as a process for identifying vulnerable buildings and conducting post-disaster safety inspections. • The Facilities Maintenance Department continues to work with Disaster Management to develop and maintain a list/inventory of the County's at-risk buildings and infrastructure. Disaster Management maintains the prioritized list. • The County also utilizes the, Statewide Seismic Needs Assessment Using Rapid Visual Screening (RVS), DOGAMI Open-File Report O-07-02.

Ideas for Implementation:
• Identify critical facilities at risk from natural hazards events; • Develop strategies to mitigate risk to these facilities, or to utilize alternative facilities should natural hazards events cause damages to the facilities in question; • Incorporate the building inventory developed by the Department of Geology and Mineral Industries (Dec. 2002) into the hazard assessment; and • Identify bridges at risk from flood or earthquake hazards, identify enhancements, and implement projects needed to reduce the risks.

Coordinating Organization:	Disaster Management

Internal Partners:	External Partners:
Technology Services; Finance; Transportation and Development	Department of Geology and Mineral Industries

Potential Funding Sources:	Estimated cost:	Timeline:
Capital Funds	Medium to High	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	High

** - High Priority Action Item*

Multi-Hazard #7*

Proposed Action Item	Alignment with Plan Goals:
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.	Augment Emergency Services

Alignment with Existing Plans/Policies:
Emergency Operations Plan

2018 Status/Rationale for Proposed Action Item:
• Clackamas County continues to participate in safety fairs throughout the county. • Each city sponsors workshops in conjunction with the Disaster Management Department. • The county's Resilience Coordinator continues to present at local and regional workshops, conferences, and fairs.

Ideas for Implementation:
• Develop a program to encourage private property owners to upgrade their bridges to support weight of fire trucks and emergency vehicles; • Encourage individual and family preparedness through public education projects such as safety fairs; • Identify opportunities for partnering with citizens, private contractors, and other jurisdictions to increase availability of equipment and manpower for efficiency of response efforts; • Work with Community Planning Organizations (CPO's) and other neighborhood groups to establish community response teams; and • Familiarize public officials of requirements regarding public assistance for disaster response.

Coordinating Organization:	Disaster Management

Internal Partners:	External Partners:
Transportation and Development; Public and Government Affairs; Technology Services; Health, Housing, and Human Services	Community Planning Organizations; Neighborhood Associations

Potential Funding Sources:	Estimated cost:	Timeline:
Disaster Management Grant Program; General Fund	Low to Medium	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	High

** - High Priority Action Item*

Multi-Hazard #8

Proposed Action Item:	Alignment with Plan Goals:
Use technical knowledge of natural ecosystems and events to link natural resources management and land use organizations to mitigation activities and technical assistance.	Enhance Natural Systems

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:

- Clackamas County Department of Transportation and Develop is working with Water Environment Services and the Sandy River Watershed Council to use the best available data to accurately redefine the erosion zone and not just the flood zone. WES is working with LiDAR studies, and is working to map the migration zones to include all public infrastructure.
- Mapping erosional hazards and channel migration is a component of WES's collection system and wastewater treatment facility for Hoodland master plans.
- WES partnered with the Wetlands Conservancy on projects to educate property owners in the upper Kellogg Creek basin about floodplain functions and flooding, to hold community workshops to discuss living next to the creek, and to identify project sites on private property for future flood mitigation projects. Additional engagement and coordination has occurred with watershed groups:
  - North Clackamas Urban Watershed Council (NCUWC)
  - Greater Oregon City Watershed Council (GOCWC)

Ideas for 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 the watershed; and
- Develop education and outreach programs that focus on protecting natural systems as a mitigation activity.

Coordinating Organization:	Water Environment Services

Internal Partners:	External Partners:
Transportation and Development	Watershed Councils; Soil and Water Conservation Districts; Oregon Watershed Enhancement Board

Potential Funding Sources:	Estimated cost:	Timeline:
Oregon Watershed Enhancement Board; General Fund	Low to Medium	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Multi-Hazard #9*

Proposed Action Item	Alignment with Plan Goals:
Enhance strategies for debris management.	Encourage Partnerships and Implementation; Augment Emergency Services; Enhance Natural Systems

Alignment with Existing Plans/Policies:
Emergency Operations Plan

2018 Status/Rationale for Proposed Action Item:
• The Clackamas County Sustainability & Solid Waste program has one member attending the regional workgroup, and several key staff have attended the FEMA Debris Management training at the NETC in Maryland in September 2016. • County staff have developed a Preliminary Debris Management Plan which is slated for submittal to FEMA for first review in 2018. • They have been training internally to address disaster-related debris management and have engaged city partners in the development of an action plan that will inform and allow the County to refine its Debris Management Plan with broader community needs in mind. • Dan Johnson, DTD Director; Scott Caufield, Building Codes Administrator; Eben Polk, Sustainability Manager et al, are creating the Disaster Debris Management Plan and are coordinating internally as needs arise.

Ideas for Implementation:
• Work with Metro to complete a regional debris management plan; and • Identify local resources available to implement debris management plan.

Coordinating Organization:	Transportation and Development

Internal Partners:	External Partners:
Disaster Management	Metro; Regional Disaster Preparedness Organization

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund	Low to Medium	X Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	High

** - High Priority Action Item*

Multi-Hazard #10

Proposed Action Item:	Alignment with Plan Goals:
Update County Comprehensive Plan to integrate most current natural hazard mapping data for Clackamas County and make available to county GIS to improve technical analysis of earthquake hazards.	Protect Life and Property; Encourage Partnerships & Implementation

Alignment with Existing Plans/Policies:
Clackamas County Comprehensive Plan; Statewide Planning Goal 7

2018 Status/Rationale for Proposed Action Item:
• The Clackamas County Comprehensive Plan and Zoning & Development Ordinance (ZDO) have not yet adopted earthquake hazard mapping or associated implementing ordinances. Again, the aforementioned development of CHAOZ and a countywide Surface Water Management Master Plan could lead to adoption and implementation of earthquake hazard mapping and associated development standards. • Under the Clackamas County Strategic Plan, Performance Clackamas, the County has developed a strategic goal to adopt a master plan for countywide surface water management. This plan conceivably might include the development of CHAOZ that could operate as a key component of the surface water management plan.

Ideas for Implementation:
• Utilize LIDAR technology to enhance earthquake mapping efforts.

Coordinating Organization:	Transportation and Development and Technology Services

Internal Partners:	External Partners:
Disaster Management	Metro; Department of Geology and Mineral Industries; U.S. Geological Survey

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund; Grants	Low to Medium	☐ Short Term (0-2 years) X Long Term (2-4+ years) ☐ Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Multi-Hazard #11*

Proposed Action Item	Alignment with Plan Goals:
Perform pre-disaster assessments on County owned and/or operated buildings and facilities, potential shelter sites, and essential facilities.	Protect Life and Property; Encourage Partnerships & Implementation

Alignment with Existing Plans/Policies:

Clackamas County Comprehensive Plan; Statewide Planning Goal 7

2018 Status/Rationale for Proposed Action Item:

- The Building Codes Division is developing a plan to perform pre-disaster assessments on County owned and/or operated buildings and facilities, potential shelter sites, and essential facilities.
- The plan will outline and prioritize these facilities to be evaluated pre-disaster to determine potential hazards that could be mitigated over time to ensure better performance should a disaster occur.
- The plan and pre-assessments will include evaluations for hazards such as unreinforced masonry construction (URM), year built and relative condition, type of construction, and suitability for the proposed use as component of the Division's Education & Outreach efforts. The anticipated time line for completion of the work in June 30, 2020.

Ideas for Implementation:

- Utilize the pre-assessments to inform prioritization and retrofitting of County owned and/or operated buildings and facilities, potential shelter sites, and essential facilities.

Coordinating Organization:	Transportation and Development		
Internal Partners:		External Partners:	
Disaster Management, Finance		Department of Geology and Mineral Industries; U.S. Geological Survey	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund; Grants		Medium to High	X Short Term (0-2 years) ☐ Long Term (2-4+ years) ☐ Ongoing
Form Submitted by:	New Action Item (2018)		
Priority:	High		

** - High Priority Action Item*

Earthquake #1

Proposed Action Item:	Alignment with Plan Goals:
Pursue funding opportunities for structural and nonstructural retrofitting of homes, schools, businesses, and government offices that are identified as seismically vulnerable.	Protect Life and Property; Augment Emergency Services; Encourage Partnerships & Implementation

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• Funding source of limited implementation is the Oregon Seismic Rehabilitation Grant Program (SRGP) that depends on the State Treasurer to obligate bond capacity and the ability of the Infrastructure Finance Authority to incur bond debt into their operating budget. • Projects that have been funded through the SRGP program are listed in Volume I, Section 2 and within the city addenda.

Ideas for Implementation:

• Provide information for property owners, small businesses, and organizations on sources of funds (loans, grants, etc.); and
• Work with owners of buildings included in the DOGAMI seismic survey to ensure that they are aware of potential grant opportunities. Current Needs:
  ○ Rivergrove Water has completed seismic analysis on reservoirs and needs funding for seismic bracing.
  ○ Milwaukie Community Center (owned by Milwaukie, maintained and operated by Clackamas County North Parks Recreation District) needs seismic upgrade. No engineering studies have been completed.
  ○ Colton Fire has an engineering report and needs seismic upgrades

Coordinating Organization:	Hazard Mitigation Advisory Committee

Internal Partners:	External Partners:
Disaster Management; County Administration	Office of Emergency Management; Federal Emergency Management Agency

Potential Funding Sources:	Estimated cost:	Timeline:
FEMA HMA; IFA Seismic Rehabilitation Grant Program; Capital Funds; Local bonds	High	□ Short Term (0-2 years) □ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Earthquake #2

Proposed Action Item:	Alignment with Plan Goals:
Encourage purchase of earthquake hazard insurance.	Protect Life and Property; Promote Public Awareness

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• CCDM continues to encourage the purchase of earthquake hazard insurance at annual preparedness fairs all over the county.

Ideas for Implementation:
• Provide earthquake insurance information to Clackamas County residents; and • Coordinate with insurance companies and organizations such as the Insurance Information Service of Oregon and Idaho to produce and distribute earthquake insurance information.

Coordinating Organization:	Hazard Mitigation Advisory Committee

Internal Partners:	External Partners:
Disaster Management	Insurance Providers, Office of Emergency Management; Oregon Seismic Safety Policy Advisory Commission

Potential Funding Sources:	Estimated cost:	Timeline:
General fund	Low	□ Short Term (0-2 years) □ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	Low

Earthquake #3*

Proposed Action Item	Alignment with Plan Goals:
Encourage seismic strength evaluations for existing critical facilities in the County to identify vulnerabilities for mitigation of schools and universities, public infrastructure, and critical facilities to meet current seismic standards.	Protect Life and Property; Augment Emergency Services

Alignment with Existing Plans/Policies:
Emergency Operations Plan

2018 Status/Rationale for Proposed Action Item:
• Currently, all new facilities must comply with and meet seismic standards. If someone moves into an old building, they must upgrade to current standards. • DOGAMI did a windshield survey of schools, fire stations, police, and city halls (2007 RVS). The focus was on action of existing buildings and information was shared with participants. • Seismic resiliency is a component of WES's collection system and wastewater treatment facility master plans. Upgrades are constructing as opportunity and funding allows.

Ideas for Implementation:
• Encourage owners of non-retrofitted reservoirs to upgrade them to meet seismic standards; • Encourage all water providers to replace all old cast iron pipes with more ductile iron, and identify partnership opportunities with other agencies for pipe replacement; and • Perform FEMA 154 seismic evaluations on all buildings not included in the recent DOGAMI inventory.

Coordinating Organization:	Disaster Management

Internal Partners:	External Partners:
Transportation and Development, Hazard Mitigation Advisory Committee	Infrastructure Finance Authority, School districts, universities and colleges, utilities, water districts

Potential Funding Sources:	Estimated cost:	Timeline:
SRGP, HMA (PDM, HMGP)	High	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	High

** - High Priority Action Item*

Earthquake #4

Proposed Action Item:	Alignment with Plan Goals:
Encourage reduction of nonstructural and structural earthquake hazards in homes, schools, businesses, and government offices through public education.	Protect Life and Property; Promote Public Awareness

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:

- Voluntary programs are ongoing.
- County building inspectors provide earthquake safety brochures.

Ideas for Implementation:

- Provide information to government building and school facility managers and teachers on nonstructural mitigation techniques including: securing bookcases, filing cabinets, light fixtures, and other objects that can cause injuries and block exits;
  - Encourage facility managers, business owners, and teachers to refer to FEMA's practical guidebook: Reducing the Risks of Nonstructural Earthquake Damage;
  - Encourage homeowners and renters to use Is Your Home Protected from Earthquake Disaster? A Homeowner's Guide to Earthquake Retrofit (IBHS) for economic and efficient mitigation techniques;
- Use the FEMA 154 seismic evaluations generated by DOGAMI to prioritize critical and essential buildings for upgrades;
- Explore partnerships to provide retrofitting classes for homeowners, renters, building professionals, and contractors; and
- Target development located in potential fault zones or in unstable soils for intensive education and retrofitting resources.

Coordinating Organization:	Hazard Mitigation Advisory Committee

Internal Partners:	External Partners:
Disaster Management	Federal Emergency Management Agency, Office of Emergency Management, Department of Land Conservation and Development

Potential Funding Sources:	Estimated cost:	Timeline:
General fund	Low	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Flood #I*

Proposed Action Item	Alignment with Plan Goals:
Identify opportunities to educate people within Clackamas County's public and private flood prone properties and identify feasible mitigation options.	Protect Life and Property; Encourage Partnerships & Implementation

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• The CRS is on hold at a Class 10 until the County has a dedicated agency and staff to fully implement and support the program. The requisite staff and resources necessary to reconstitute and implement the CRS could be acquired through the aforementioned development of CHAOZ and a countywide Surface Water Management Master Plan. • The Sandy Sustainable Flood Recovery Group continues education and outreach in the upper Sandy River Basin and in the Kellogg Creek Watershed. • WES partnered with the Wetlands Conservancy on projects to educate property owners in the upper Kellogg Creek basin about floodplain functions and flooding, to hold community workshops to discuss living next to the creek, and to identify project sites on private property for future flood mitigation projects. • Clackamas County adopted a strategic goal of having a CRS score of 6 by 2020 http://www.clackamas.us/performance/documents/performanceclackamas.pdf

Ideas for Implementation:
• Identify appropriate and feasible mitigation activities for identified repetitive flood properties. Funding may be available through FEMA's Hazard Mitigation Grant and Flood Mitigation Assistance Programs and the Pre-disaster Mitigation Program; • Contact repetitive loss property owners to discuss mitigation opportunities, and determine interest should future project opportunities arise; • Explore options for incentives to encourage property owners to engage in mitigation; and • Encourage and support the relocation of the Clackamas County Roads Department out of the floodplain.

Coordinating Organization:	Transportation and Development

Internal Partners:	External Partners:
Disaster Management; Hazard Mitigation Advisory Committee	Department of Land Conservation and Development; Office of Emergency Management

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund; HMA; FEMA Risk MAP	Medium	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	High

** - High Priority Action Item*

Flood #2

Proposed Action Item:	Alignment with Plan Goals:
Recommend revisions to requirements for development within the floodplain, where appropriate	Protect Life and Property

Alignment with Existing Plans/Policies:

Flood Ordinance; Zoning Code

2018 Status/Rationale for Proposed Action Item:

- Clackamas County Planning is working on trying to get residents more involved.
- The county dropped to a 10 in the CRS. At this point the cost of implementing the program is higher than the actual benefits to NFIP policy holders, so the county is working on ways to resolve this.
- WES is beginning a project to update its Regulations and Standards for new development, which pertain solely to storm systems, erosion control, water quality buffers, and wastewater systems. Water quality and flow control requirements for development may change.
- WES applies its Standards for new development to properties whether in the floodplain or not.
- Clackamas County is working with Oregon Solutions to examine the need for a state-scale channel migration zone policy for new and existing development.

Ideas for Implementation:

- Explore raising the base elevation requirement for new residential construction to three or more feet above base flood elevation, or greater. An increased elevation standard is one activity the county can engage in to receive credit from the NFIP Community Rating System Program; and
- Consider adopting regulations specific to migrating streams such as the Sandy and Molalla Rivers.

Coordinating Organization:	Transportation and Development

Internal Partners:	External Partners:
Disaster Management; Water Environment Services; Technology Services	Department of Land Conservation and Development; Association of State Floodplain Managers; Oregon Solutions

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund	Low	☐ Short Term (0-2 years) X Long Term (2-4+ years) ☐ Ongoing

Form Submitted by:	Existing Action Item
Priority:	Low

Flood #3

Proposed Action Item:	Alignment with Plan Goals:
Develop better flood warning systems.	Protect Life and Property; Augment Emergency Services

Alignment with Existing Plans/Policies:
Emergency Operations Plan

2018 Status/Rationale for Proposed Action Item:
• 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. The County is currently seeking technical and funding support to enhance the performance and reliability. • WES installed satellite communications at its lower Kellogg Creek flow monitoring station near Milwaukie, and partnered with NOAA to host the real-time data on its Advanced Hydrologic Prediction Service website https://water.weather.gov/ahps2/hydrograph.php?wfo=PQR&gage=kcmo3

Ideas for Implementation:
• Coordinate with appropriate organizations to evaluate the need for more stream gauges; and • Distribute information regarding flooding to the general public efficiently.

Coordinating Organization:	Disaster Management

Internal Partners:	External Partners:
Technology Services; Transportation and Development	Northwest Weather Service; Federal Emergency Management Agency; Oregon Emergency Management; US Army Corps of Engineers

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund; NWS; FEMA	Low to Medium	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Flood #4

Proposed Action Item:	Alignment with Plan Goals:
Maintain data and mapping for floodplain information within the county and identify and map flood-prone areas outside of designated floodplains.	Protect Life and Property; Promote Public Awareness

Alignment with Existing Plans/Policies:

Flood Ordinance

2018 Status/Rationale for Proposed Action Item:

- Updated FIRMS for the Sandy River Basin are completed in the County's adoption process. These maps do not address erosion hazards.
- The 2015 Channel Migration Zone (CMZ) Study for the upper Sandy River delineates 10 miles of erosion hazard and risk with an Erosion Protection Action Line to help plan for mitigation measures.
- The GIS department has also coordinated with CCDM to map CMZ property exposure and estimate losses.
- DOGAMI has released a 2017 report mapping CMZ sub-basins in Oregon.
- Silver Jackets CMZ project in progress to develop a flood risk management plan for the upper Sandy River Communities. movement of river channel.

Ideas for Implementation:

- Apply for FEMA's cooperative technical partnership using the 2-foot contour interval floodplain mapping data acquired by Clackamas County GIS;
- Use WES inventory and mapping data to update the flood-loss estimates for Clackamas County; and
- Identify opportunities to upgrade Federal Insurance Rate Maps, and arrange for Cooperative Technical Partnership mapping upgrades for select areas.

Coordinating Organization:	Technology Services

Internal Partners:	External Partners:
Transportation and Development; Disaster Management	Department of Geology and Mineral Industries; Federal Emergency Management Agency; Department of Land Conservation and Development

Potential Funding Sources:	Estimated cost:	Timeline:
RiskMap; General Fund; FEMA	Medium	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Flood #5

Proposed Action Item:	Alignment with Plan Goals:
Encourage development of acquisition and management strategies to preserve open space for flood mitigation, fish habitat, and water quality in the floodplain and reduce risk to flood prone properties as well as preserve space for open space property.	Protect Life and Property; Enhance Natural Systems

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• County used DR-1956 HMGP funds to acquire three damaged properties along the upper Sandy River following the 2011 flood and is currently using FMA16 funds to acquire a repetitive loss property along Mt. Scott Creek.

Ideas for Implementation:
• Develop a comprehensive strategy for acquiring and managing floodplain open space in Clackamas County; • Explore funding for property acquisition from federal (e.g., FEMA Hazard Mitigation Grant Program), state, regional, and local governments, as well as private and non-profit organizations, trails programs, fish programs; • Develop a regional partnership among flood mitigation, fish habitat, and water quality enhancement organizations/programs to improve educational programs; • Identify sites where environmental restoration work can benefit flood mitigation, fish habitat, and water quality; • Work with landowners to develop flood management practices that provide healthy fish habitat; and • Identify existing watershed education programs and determine which programs would support a flood education component.

Coordinating Organization:	Disaster Management

Internal Partners:	External Partners:
Water Environment Services; Transportation and Development	Metro; Federal Emergency Management Agency

Potential Funding Sources:	Estimated cost:	Timeline:
Capital Funds; General Fund; FEMA HMA; OWEB	Medium	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Flood #6

Proposed Action Item:	Alignment with Plan Goals:
Identify and address surface water drainage problematic sites for all parts of unincorporated Clackamas County.	Protect Life and Property; Enhance Natural Systems

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:

- DTD is replacing culverts throughout the county (ongoing project).
- In the urban area and portions of the Tualatin River watershed, WES identifies capacity-limited storm infrastructure for replacement or repair. Currently WES is evaluating 6 capacity-limited storm systems and is budgeting for repairs in FY 2018-19. Additional sites may follow in future FYs, pending available funding.

Ideas for Implementation:

- Map culverts in unincorporated areas of the county;
- Prepare an inventory of culverts that historically create flooding problems and target them for retrofitting; and
- Prepare an inventory (*in-progress*) of major urban drainage problems and identify causes and potential mitigation actions for urban drainage problem areas (e.g. reduce standing water on Telford Road along Johnson Creek by upgrading the 20-inch culvert on Spring Water Trail to drain more efficiently with the County 60-inch culvert in that area.).

Coordinating Organization:	Water Environment Services

Internal Partners:	External Partners:
Transportation and Development; Technology Services	Soil and Water Conservation Districts; Watershed Councils

Potential Funding Sources:	Estimated cost:	Timeline:
Capital Funds	Medium to High	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Flood #7

Proposed Action Item:	Alignment with Plan Goals:
Establish a framework to compile and coordinate surface water management plans and data throughout the county.	Protect Life and Property; Encourage Partnerships & Implementation

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• The development of CHAOZ and a countywide Surface Water Management Master Plan could lead to the establishment of a framework to compile and coordinate surface water management plans and data on a countywide basis. • Clackamas County adopted a strategic goal of by 2020 adopting a master plan for surface water management that will enhance the quality of surface water. WES is taking a lead role in this planning effort, along with DTD and Disaster Management input. The plan could include floodplain management as an action to improve surface water quality.

Ideas for Implementation:
• Develop surface water management plans for areas that are not currently within surface water management plan boundaries.

Coordinating Organization:	Water Environment Services

Internal Partners:	External Partners:
Transportation and Development; Technology Services	

Potential Funding Sources:	Estimated cost:	Timeline:
Unidentified	Medium	X Short Term (0-2 years) ☐ Long Term (2-4+ years) ☐ Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Flood #8*

Proposed Action Item	Alignment with Plan Goals:
Encourage purchase of flood insurance.	Protect Life and Property; Encourage Partnerships & Implementation; Promote Public Awareness

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:

- The Clackamas County Planning Division routinely encourages property owners and prospective buyers, at all levels of development review and provision of property information, to purchase flood insurance if they are within proximity to a perennial water body, especially anywhere within the Sandy River Basin, even if they are not located in a FEMA floodplain.
- The Division also informs prospective buyers about FEMA's mandatory purchase of flood insurance for structures in the floodplain that are financed through federally backed mortgages.

Ideas for Implementation:

- Develop an outreach program that addresses communities located in or near the 100 and 500-year floodplain and provides them with valuable information on the NFIP.

Coordinating Organization:	Transportation and Development		
Internal Partners:		External Partners:	
Disaster Management; Hazard Mitigation Advisory Committee		Department of Land Conservation and Development; Insurance Providers	
Potential Funding Sources:		Estimated cost:	Timeline:
Unknown		Unknown	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing
Form Submitted by:	Existing Action Item (HMAC, 2012)		
Priority:	High		

** - High Priority Action Item*

Flood #9

Proposed Action Item:	Alignment with Plan Goals:
Develop a floodplain management plan as a standalone for the CRS program.	Encourage Partnerships & Implementation

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• The CRS could be reconstituted and implemented through the development of CHAOZ and a countywide Surface Water Management Master Plan, in turn leading to the development of a standalone floodplain management plan that fully meets CRS criteria. • Nothing has occurred since 2012. Countywide surface water district under consideration in 2018. • Clackamas County adopted a strategic goal of by 2020 adopting a master plan for surface water management that will enhance the quality of surface water. WES is taking a lead role in this planning effort, along with DTD and Disaster Management input. The plan could include floodplain management as an action to improve surface water quality.

Ideas for Implementation:
• Create a floodplain management plan that can be used for the CRS program. This new plan will give the CRS program new weight and can help improve the county's current CRS rating score.

Coordinating Organization:	Transportation and Development

Internal Partners:	External Partners:
Disaster Management; Water Environment Services; County Administration	

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund	High	X Short Term (0-2 years) ☐ Long Term (2-4+ years) ☐ Ongoing

Form Submitted by:	Existing Action Item (HMAC, 2012)
Priority:	Medium

Landslide #1

Proposed Action Item:	Alignment with Plan Goals:
Continue to improve knowledge of landslide hazard areas and understanding of vulnerability and risk to life and property in hazard-prone areas.	Protect Life and Property; Promote Public Awareness

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• In late 2013 DOGAMI completed a landslide hazard and susceptibility analysis for most of the County, (9 quadrangles covering the northwestern and central communities with most of the County's populations). These maps have not yet been adopted or integrated into the County's planning process.

Ideas for Implementation:
• Adopt and integrate the 2013 DOGAMI landslide hazard and susceptibility maps into the county's planning process. • Develop public information to emphasize economic risk when building on potential or historical landslide areas; • Identify funding sources to enhance site-specific geohazard mapping the Urban Growth Boundary; • Partner with PSU to develop a descriptive landslide inventory along all Clackamas County roadways, including appropriate mitigation strategies; and • Identify existing mechanisms for public outreach (e.g., SWCD, NRCS, watershed councils, etc.).

Coordinating Organization:	Hazard Mitigation Advisory Committee

Internal Partners:	External Partners:
Transportation and Development; Technology Services	Department of Geology and Mineral Industries

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund	Medium to High	X Short Term (0-2 years) ☐ Long Term (2-4+ years) ☐ Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Landslide #2

Proposed Action Item:	Alignment with Plan Goals:
Identify public education tools and opportunities in high-risk debris flow and landslide areas.	Protect Life and Property; Augment Emergency Services; Promote Public Awareness

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• There is currently a USGS report in review that examines concentrations of residents, employees and visitors in the Hoodland area with seasonal variability to serve as a tool for evacuation planning. • DOGAMI MH study for Mt. Hood contains exposure analysis for landslide and debris flow hazards in the Sandy River Basin. http://www.oregongeology.org/pubs/ofr/p-O-11-16.htm

Ideas for Implementation:
• Identify potential debris removal resources; • Increase participation in regional committee planning for emergency transportation routes; • Identify and publicize information regarding emergency transportation routes; and • Work with County Evacuation Planning Committee to develop and exercise evacuation plans.

Coordinating Organization:	Disaster Management

Internal Partners:	External Partners:
Transportation and Development	Department of Geology and Mineral Industries

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund	Low to Medium	X Short Term (0-2 years) ☐ Long Term (2-4+ years) ☐ Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Landslide #3*

Proposed Action Item	Alignment with Plan Goals:
Continue to limit activities in identified potential and historical landslide areas through regulation and public outreach.	Protect Life and Property; Promote Public Awareness; Enhance Natural Systems

Alignment with Existing Plans/Policies:

Comprehensive Plan; Development Code

2018 Status/Rationale for Proposed Action Item:

- DOGAMI continues to map out landslide hazard areas and get the word out.
- There haven't been any changes in the Comprehensive Plan or land use ordinances, however land use mapping tools pick up new information automatically because the GIS Division updates new mapping data when received from DOGAMI.
- Steep slope land use maps continue to refer to hazardous areas.
- Changes in land use ordinances to routinely adopt the most current landslide hazard data from DOGAMI could be realized through the aforementioned development of CHAOZ and a countywide Surface Water Management Master Plan. In the meantime, the County obtains the most recent landslide hazard data from DOGAMI and coordinates among the Planning, Engineering, Building and Septic & Onsite Wastewater Systems (SOWS) divisions to utilize the data, steer development away from hazardous areas to the extent feasible, and apply requirements for geotechnical reports during the course of development review.
- Customers are also routinely notified when properties are located in a mass movement / landslide hazard area.

Ideas for Implementation:

- Analyze and recommend improvements to existing regulations regarding development in landslide prone areas. Consider using the City of Salem Landslide Ordinance as an example of effective regulation for development;
- Incorporate the data from the historic and potential debris flow and landslides hazard map (DOGAMI, 2003) into the County's Comprehensive Land Use Plan to assist in meeting State Land Use Planning Goal 7, designed to protect life and property from natural disasters and hazards through the implementation of planning strategies that restrict development in areas of known hazards;
- Examine logging regulations on private property to ensure accountability of cumulative downslope effects; and
- Identify existing mechanisms for public outreach (e.g., SWCD, NRCS, watershed councils, etc.).

Coordinating Organization:	Hazard Mitigation Advisory Committee

Internal Partners:	External Partners:
Transportation and Development, Technology Services	Department of Geology and Mineral Industries; Department of Land Conservation and Development

Potential Funding Sources:	Estimated cost:	Timeline:
DLCD Technical Assistance	Low to Medium	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	High

** - High Priority Action Item*

Landslide #4*

Proposed Action Item	Alignment with Plan Goals:
Recommend construction and subdivision design that can be applied to steep slopes to reduce the potential adverse impacts from development.	Protect Life and Property; Promote Public Awareness

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:

- Landslides and steep slopes are already considerations in the approval of land divisions and residential developments on legal lots of record) as required by Clackamas County Zoning and Development Ordinance Sections 1001, 1002, and 1003.
- Additionally, the state-wide adopted Building Codes in Oregon address foundation design and slope stability for both commercial and residential construction.
- Finally, the County's adopted Grading and Excavation Ordinance (CC Title 9.03) also establishes requirements for earthwork in hazardous areas.

Ideas for Implementation:

- Analyze and recommend improvements to existing regulations regarding development in landslide prone areas. Consider using the City of Salem Landslide Ordinance as an example of effective regulation for development;
- Incorporate the data from the historic and potential debris flow and landslides hazard map (DOGAMI, 2003) into the County's Comprehensive Land Use Plan to assist in meeting State Land Use Planning Goal 7, designed to protect life and property from natural disasters and hazards through the implementation of planning strategies that restrict development in areas of known hazards;
- Examine logging regulations on private property to ensure accountability of cumulative downslope effects; and
- Identify existing mechanisms for public outreach (e.g., SWCD, NRCS, watershed councils, etc.).

Coordinating Organization:	Hazard Mitigation Advisory Committee

Internal Partners:	External Partners:
Transportation and Development	Department of Geology and Mineral Industries Department of Land Conservation and Development; Soil and Water Conservation Districts, Natural Resources Conservation Services, Watershed Councils

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund	Low	X Short Term (0-2 years) ☐ Long Term (2-4+ years) ☐ Ongoing

Form Submitted by:	Existing Action Item (HMAC, 2012)
Priority:	High

** - High Priority Action Item*

Severe Weather #1

Proposed Action Item:	Alignment with Plan Goals:
Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe weather.	Augment Emergency Services; Encourage Partnerships & Implementation

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:

- WES and DTD, along with Happy Valley and Rivergrove, will partner to implement a joint stormwater management plan that includes routine inspection and maintenance of storm system inlets, conveyances, and treatment BMPs, to ensure proper condition and function, thereby improving operational resiliency in severe weather events like intense rainfall.

Ideas for Implementation:

- Partner with responsible agencies and organizations to design and implement programs that reduce risk to life, property, and utility systems;
- Develop partnerships between utility providers and county and local public works agencies to document known hazard areas;
- Reduce icy conditions or other hazards at public access public service buildings and ensure public safety by prioritizing critical facilities' parking lots to be cleared before other roads.
  - Improve traffic management
  - Track progress of road crews.
  - Provide public/staff with info. regarding road closures, sanding and plowing routes, time the roads were plowed, and a safety rating via cable access and website; and
- Enhance County plowing capability
  - Purchase a residential snow plow and a deicer machine

Coordinating Organization:	Hazard Mitigation Advisory Committee

Internal Partners:	External Partners:
Transportation and Development	Mutual Aid Partners

Potential Funding Sources:	Estimated cost:	Timeline:
Capital Funds	Low to High	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Severe Weather #2

Proposed Action Item:	Alignment with Plan Goals:
Continue to educate the public on severe weather mitigation activities.	Protect Life and Property; Promote Public Awareness

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• Ongoing effort of County Disaster Management (see below of implementation measures).

Ideas for Implementation:
• Distribute educational materials to Clackamas residents and public and private sector organizations regarding evacuation routes during road closures; • Target the vulnerable populace for disseminating preparedness information; and • Reduce freezing pipes and resultant damage by encouraging water providers to put a flyer in November water bills to advise of preventions measures available. • Calendar discontinued

Coordinating Organization:	Hazard Mitigation Advisory Committee

Internal Partners:	External Partners:
Public and Government Affairs	

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund	Low	□ Short Term (0-2 years) □ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Severe Weather #3*

Proposed Action Item	Alignment with Plan Goals:
Monitor and implement programs to keep trees from threatening lives, property, and public infrastructure during windstorm events.	Augment Emergency Services; Encourage Partnerships & Implementation

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• Efforts to monitor and implement programs to keep trees from threatening lives, property, and public infrastructure during windstorm events is ongoing.

Ideas for Implementation:
• Partner with responsible agencies and organizations to design and disseminate education information to property owners to reduce risk from tree failure to life, property, and utility systems; • Develop partnerships between utility providers and county and local public works agencies to document known hazard areas; and • Identify potentially hazardous trees in urban areas.

Coordinating Organization:	Transportation and Development

Internal Partners:	External Partners:
Business and Community Services	Utility Providers

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund	Medium	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	High

** - High Priority Action Item*

Severe Weather #4

Proposed Action Item:	Alignment with Plan Goals:
Support/encourage electrical utilities to use underground construction methods where possible to reduce power outages from windstorms.	Encourage Partnerships & Implementation; Enhance Natural Systems

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• All new county electrical utilities (non-transmission) are required to be constructed underground.

Ideas for Implementation:
• Increase the use of underground utilities where possible.

Coordinating Organization:	Transportation and Development

Internal Partners:	External Partners:
Disaster Management	Utility Providers

Potential Funding Sources:	Estimated cost:	Timeline:
Permit fees	Low	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Volcanic Event #1

Proposed Action Item:	Alignment with Plan Goals:
Work with the state and other impacted jurisdictions to update and exercise the Mount Hood Inter-Agency Volcano Coordination Plan.	Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• Clackamas County Disaster Management has initiated a multi-hazard evacuation planning process for the Hoodland area for volcano, wildfire and flood hazards. Many of the jurisdictions involved in the Mt. Hood Inter-Agency Volcano Coordination Plan are participating.

Ideas for Implementation:
• Coordinate with local and regional groups to conduct exercises, plan evaluation and revisions.

Coordinating Organization:	Disaster Management

Internal Partners:	External Partners:
Tourism and Cultural Affairs; Transportation and Development	Department of Geology and Mineral Industries; U.S. Geological Survey; Office of Emergency Management; Metro; Cascades Volcano Observatory; Tualatin Valley Fire and Rescue

Potential Funding Sources:	Estimated cost:	Timeline:
General Fund	Low	☐ Short Term (0-2 years) X Long Term (2-4+ years) ☐ Ongoing

Form Submitted by:	Existing Action Item
Priority:	Medium

Volcanic Event #2

Proposed Action Item:	Alignment with Plan Goals:
Utilize existing risk assessments and collaborate with USGS-CVO and related agencies to develop ash fall models that are specific to Clackamas County.	Protect Life and Property; Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness

Alignment with Existing Plans/Policies:
Emergency Operations Plan

2018 Status/Rationale for Proposed Action Item:
• USGS funded DOGAMI Multi-Hazard study of proximal and distal land-based exposure to volcano hazards for Sandy River and Hood River valleys. This may provide the basis for vulnerability assessments for near-field ash hazard assessments. http://www.oregongeology.org/pubs/ofr/p-O-11-16.htm • Clackamas County collaborated with the USGS on a population exposure analysis for the Hoodland area in the eastern County for volcano, wildfire and flood hazards. https://pubs.er.usgs.gov/publication/ofr20131073 • From the GIS standpoint, no one has done or has access to any ash fall models or maps at this time. GIS is a tool that could model some of this if the base data was available. Once the DOGAMI Mt Hood study becomes available, it may provide the county with initial debris flow and possibly ash fall models.

Ideas for Implementation:
• Determine critical activities that must be implemented for varying degrees of ash fall; and • Work with the National Early Volcano Warning System collaborative group to better assess ash fall modeling and warning systems in Clackamas County.

Coordinating Organization:	Technology Services

Internal Partners:	External Partners:
Disaster Management	Department of Geology and Mineral Industries; U.S. Geological Survey

Potential Funding Sources:	Estimated cost:	Timeline:
USGS	Low to Medium	☐ Short Term (0-2 years) X Long Term (2-4+ years) ☐ Ongoing

Form Submitted by:	Existing Action Item
Priority:	Low

Volcanic Event #3

Proposed Action Item:	Alignment with Plan Goals:
Strengthen response and recovery programs, and work with the USGS-CVO to enhance public education programs for volcanic eruption hazards.	Protect Life and Property; Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness

Alignment with Existing Plans/Policies:

2018 Status/Rationale for Proposed Action Item:
• CCDM participated in CVO and UW regional volcano risk workshop, May 2017. • Cooperated with USGS for the release of OFR 2013-1073 multi-hazard vulnerability study for the Hoodland area, with an emphasis on assessing volcanic risk. • DOGAMI Natural Hazard Risk Report (expected July 2018)

Ideas for Implementation:
• Develop basic public education materials that describe volcanic eruption hazards (pyroclastic surges, pyroclastic flows, lahars, mudflows, landslides, ash fall), potential impacts, and appropriate response and mitigation activities; • Coordinate with the media for volcanic hazard education programs to reduce conveyance of misinformation; • Participate with the USGS-CVO to develop a public education program for volcano hazards specific to Clackamas County; and • Work with active citizen groups to sustain volcanic hazards education programs.

Coordinating Organization:	Disaster Management

Internal Partners:	External Partners:
	U.S. Geological Survey

Potential Funding Sources:	Estimated cost:	Timeline:
USGS	Low	☐ Short Term (0-2 years) X Long Term (2-4+ years) ☐ Ongoing

Form Submitted by:	Existing Action Item
Priority:	Low

Wildfire #1*

Proposed Action Item:	Alignment with Plan Goals:
Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan.	Protect Life and Property; Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness; Enhance Natural Systems

Alignment with Existing Plans/Policies:
Clackamas County Community Wildfire Protection Plan (2018)
2018 Status/Rationale for Proposed Action Item:
The wildfire mitigation action items provide direction on specific activities that organizations and residents in Clackamas can take to reduce wildfire hazards.
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions

Wildfire Risk Assessment (Ch. 4):

1. Maintain and update the Fuels Reduction (FR) and Communities at Risk (CAR) maps and databases.
2. Continue to track structure vulnerability data throughout the County through structural triage assessments.
3. Update the Overall Wildfire Risk Assessment as new data becomes available.

Hazardous Fuels Reduction and Biomass Utilization (Ch. 5):

1. Develop and maintain an inventory of potential and successful FR projects by meeting with parks and natural lands managers quarterly.
2. Continue securing funding to implement projects/hire seasonal ODF staff.

Emergency Operations (Ch. 6):

1. Develop and FDB Communications Works Group.
2. Conduct a Conflagration Exercise.

Education and Community Outreach (Ch. 7):

1. Develop Firewise toolkit for CAR's.
2. Create incentives for fuels reduction.
3. Update and distribute the Burn Permitting and Fire Restrictions Brochure.
4. Continue to improve address signage throughout the County.

Structural Ignitability Policies and Programs (Ch. 8):

1. Identify a DTD representative for the WFEPC.
2. Improve coordination with Rural Fire Agencies.
3. Integrate WU into Plan Map and include a public outreach strategy.

Coordinating Organization:	Clackamas Wildfire Executive Committee

Internal Partners:	External Partners:
Clackamas Fire Defense Board, Disaster Management public land management agencies	Oregon Department of Forestry, U.S. Forest Service, U.S. Bureau of Land Management

Potential Funding Sources:	Estimated cost:	Timeline:
ODF, operating budgets	Low to High	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	New Action Item/ Wildfire Planning Executive Committee (2018)
Priority:	High (*CWPP identified priority actions listed above*)

** - High Priority Action Item*

Wildfire #2*

Proposed Action Item:	Alignment with Plan Goals:
Encourage private landowners to create and maintain defensible space around homes and other buildings.	Protect Life and Property; Encourage Partnerships & Implementation; Promote Public Awareness

Alignment with Existing Plans/Policies:
Clackamas County Community Wildfire Protection Plan (2018)
2018 Status/Rationale for Proposed Action Item:
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.
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions
• Develop basic public education materials that describe wildfire hazards and the benefits of creating defensible space around homes and other buildings. • Coordinate with the media for wildfire hazard education programs to reduce conveyance of misinformation; • Work with active citizen groups (Firewise Communities, etc.) to sustain volcanic hazards education programs. • Wildfire education and outreach materials may be found on the National Fire Protection Association's website: https://www.nfpa.org/Public-Education.

Coordinating Organization:	Disaster Management

Internal Partners:	External Partners:
	Oregon Department of Forestry, U.S. Forest Service, U.S. Bureau of Land Management, Clackamas Fire Defense Board, Clackamas Wildfire Executive Committee, public land management agencies

Potential Funding Sources:	Estimated cost:	Timeline:
ODF, operating budgets	Low to High	☐ Short Term (0-2 years) ☐ Long Term (2-4+ years) X Ongoing

Form Submitted by:	New Action Item
Priority:	High

** - High Priority Action Item*

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APPENDIX B:
PLANNING AND PUBLIC PROCESS

NHMP Update Changes

This memo describes the changes made to the 2013 Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP) during the 2018 NHMP update process.

Project Background

Clackamas County and the cities of Canby, Estacada, Gladstone, Happy Valley, Johnson City, Lake Oswego, Milwaukie, Molalla, Oregon City, Sandy, West Linn, and Wilsonville and Clackamas Fire District #1 partnered with the Oregon Partnership for Disaster Resilience (OPDR) to update the multi-jurisdictional 2013 Clackamas County NHMP. The Disaster Mitigation Act of 2000 requires communities to update their NHMPs every five years to remain eligible for Pre-Disaster Mitigation (PDM) program funding, Flood Mitigation Assistance (FMA) program funding, and Hazard Grant Mitigation Program (HMGP) funding. A Federal Disaster Management Pre-Disaster Mitigation grant funded the CSC work with non-federal match provided by Clackamas County.

OPDR and the committees made several changes to the previous NHMP to consolidate and streamline the NHMP. The Clackamas Fire District #1 and Clackamas River Water Providers had addenda added to this version of the NHMP. The community of Damascus disincorporated in 2016, as such their addendum was removed in this version of the NHMP.

Major changes are documented and summarized in this memo.

2018 NHMP Update Changes

The sections below only discuss *major* changes made to the NHMPs during the 2018 NHMP update process. Major changes include the replacement or deletion of large portions of text, changes to the NHMP's organization, new mitigation action items, the deletion of the Damascus addendum, and the addition of the Clackamas Fire District to the NHMP. If a section is not addressed in this memo, then it can be assumed that no significant changes occurred.

The NHMP's format and organization have been altered to fit within OPDR's NHMP templates. Table B-1 lists the 2013 Clackamas County NHMP section names and the corresponding 2018 section names, as updated (major Volumes are highlighted). This memo will use the 2018 NHMP update section names to reference any changes, additions, or deletions within the NHMP.

Table B-1 Changes to Organization

2013 Clackamas County MNHMP	2019 Clackamas County MNHMP
Acknowledgements	Acknowledgements
Table of Contents	Table of Contents
-	Approval Letters and Resolutions
-	FEMA Review Tool
Volume I: Basic Plan	Volume I: Basic Plan
Executive Summary	Plan Summary
Section 1: Introduction	Section 1: Introduction
Section 2: Risk Assessment	Section 2: Hazard Identification and Risk Assessment
Section 3 Mission, Goals, and Action Items	Section 3: Mitigation Strategy
Section 4: Plan Implementation and Maintenance	Section 4: Plan Implementation and Maintenance
Volume II: Hazard Annexes	
Drought	Incorporated into Volume I, Section 2
Earthquake	
Flood	
Landslide	
Severe Storm	
Volcanic Eruption	
Wildfire	
Volume III: City Addenda	Volume II: Jurisdictional Addenda
Canby	Canby
Damascus	-
Estacada	Estacada
Gladstone	Gladstone
Happy Valley	Happy Valley
Johnson City	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
Volume IV: Appendices	Volume III: Appendices
Appendix A: Action Items	Appendix A: Action Item Forms
Appendix B: Planning and Public Process	Appendix B: Planning and Public Process
Appendix C: Community Profile	Appendix C: Community Profile
Appendix D: Economic Analysis	Appendix E: Economic Analysis of Natural Hazard Mitigation Projects
Appendix E: Regional Hazard Mitigation Public Opinion Survey	Appendix G: Community Survey
Appendix F: Vulnerability Analysis Table	*Not included*
Appendix G: Grant Programs	Appendix F: Grant Programs and Resources
Appendix H: Clackamas Community Wildfire Protection Plan	*Incorporated by reference in Volume I, Section 2*
-	Appendix D: Natural Hazard and Base Maps

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.

Front Pages

1. The NHMP's cover has been updated.
2. Acknowledgements have been updated to include the 2018 project partners and planning participants.
3. 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 2018 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 1: 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 2018 NHMP update process, and provides an overview of how the NHMP is organized. Major changes to Section 1 include the following:

- Most of Section 1 includes new information that replaces out of date text found in the 2013 NHMP. The new text describes the federal requirements that the NHMP addresses and gives examples of the policy framework for natural hazards planning in Oregon.
- Section 1 of the 2018 update, outlines the entire layout of the NHMP update, which has been altered as described above.

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:

- The hazard information of the previous NHMP have been integrated into this section and within Volume III, Appendix C.
- 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 the Lower Columbia-Sandy Watershed including unincorporated communities, The

Villages at Mount Hood and Government Camps and the City of Sandy is incorporated into this section and within applicable city 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 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).

Section 3: Mitigation Strategy

This section provides the basis and justification for the mission, goals, and mitigation actions identified in the NHMP. The 2013 mission and goals were evaluated by the HMAC and no changes were made. The activities and status of mitigation strategies (actions) are noted on each Action Item Form within Volume III, Appendix A. Major changes to the mitigation strategies (actions) include the following:

- **Severe Storm Action #4 (2013)** "*Map and publicize locations around the county that have the highest incidence of extreme windstorms*" was deleted as an action item. Extreme windstorms are possible throughout the County and defined locations are currently available. At this time this action is considered unnecessary.
- **Severe Storm Action #5 (2013)** was renumbered to Severe Weather Action #4 (2018), see Volume III, Appendix A for more information.
- **Multi-Hazard Action #11 (2018)** "*Perform pre-disaster assessments on County owned and/or operated buildings and facilities, potential shelter sites, and essential facilities*" was added to the list of mitigation actions in 2018.
- **Wildfire Action #1 (2018)** "*Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan"* was added to the list of mitigation actions in 2018.
- **Wildfire Action #2 (2018)** "*Encourage private landowners to create and maintain defensible space around homes and other buildings"* was added to the list of mitigation actions in 2018.

The HMAC decided to modify the prioritization of action items in this update to reflect current conditions and needs. The following actions were removed from the list of priority actions with this update: Multi-Hazard #8, Multi-Hazard #10, Flood #3, Flood #4, Flood #5, Flood #7. The following actions were added to the list of priority actions with this update: Multi-Hazard #1, Multi-Hazard #2, Multi-Hazard #4, Multi-Hazard #7, Multi-Hazard #11, Earthquake #3, Flood #1, Flood #8, Landslide #3, Landslide #4, Severe Weather #3, Wildfire #1 and Wildfire #2. The following actions were retained in the list of priority actions with this update: Multi-Hazard #6 and Multi-Hazard #9.

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: Jurisdictional Addenda

The cities of Canby, Estacada, Gladstone, Happy Valley, Johnson City, Lake Oswego, Milwaukie, Molalla, Oregon City, Sandy, West Linn, and Wilsonville opted to participate and update their 2013 city addenda. The 2013 version of the city addenda was provided as a "changes memo" for each participating city, in this update the city addenda have been rewritten as complete addenda. Clackamas Fire District #1 was included with an addendum in this version of the NHMP.

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 the addenda and Attachment A of each addenda. The City of Damascus disincorporated in 2016, as such they do not have an addendum in this version of the NHMP, where appropriate hazard information and mitigation actions were incorporated into the County NHMP.

Volume III: Appendices

Below is a summary of the changes to the appendices included in the 2018 NHMP:

Appendix A: Action Item Forms

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

Appendix B: Planning and Public Process

This planning and public process appendix reflects changes made to the Clackamas County and documents the 2018 planning and public process.

Appendix C: Community Profile

The community profile has been updated to conform to the OPDR template and consolidates information for Clackamas County and census designated places. City and special district profiles are incorporated into their addenda within Volume II.

Appendix D: Clackamas County Natural Hazard and Base Maps

Appendix D includes maps of natural hazards. These maps have not changed since the previous version of the NHMP.

Appendix E: Economic Analysis of Natural Hazard Mitigation Projects

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

Appendix F: Grant Programs and Resources

Some of the previously provided resources were deemed unnecessary since this material is covered within the Oregon NHMP. Updates were made to the remaining grant programs and resources.

Appendix G: Community Survey

This survey was conducted with the 2018 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.

2018 NHMP
PUBLIC PARTICIPATION PROCESS

2018 NHMP Update

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. The NHMP will undergo review by the County NHMP HMAC on a semiannual basis and by the City and special district HMACs on an annual basis.

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

A survey was provided to the public during the early stages of the update cycle (Volume III, Appendix G). Information from this survey was used by the HMAC to help inform their risk assessment and mitigation strategies.

During the County public review period (see next page) there were no comments provided. See jurisdictional addenda (Volume II) for city and special district public involvement information.

Members of the HMAC provided edits and updates to the NHMP prior to the public review period as reflected in the final document.

Work Sessions: Clackamas County Board of County Commissioners

Clackamas County staff briefed the Clackamas County Board of County Commissioners on the updates to the Multi-Jurisdictional Clackamas County NHMP.

Press Release

Home Departments Services Government Search in webpages Search

Clackamas County seeks public feedback for strategy on disaster risk reduction

11/8/2018

Update (11-8-18): The headline has been edited for clarity.

From: Todd Loggan, Public & Government Affairs, 503-742-4562

Media and Interested Parties

Clackamas County is asking the public to provide perspective and feedback to improve our planning before, during and after a natural disaster. Officially titled the Multi-Jurisdictional Natural Hazards Mitigation Plan, it is intended to provide a roadmap for providing federal funding in the aftermath of a disaster by assessing beforehand identified risks associated with natural disasters, and work on long-term strategies for protecting people and property.

While it is impossible to predict precisely when these hazards will occur, the federal government requires communities to engage in this planning in order to receive disaster funding. Experience also shows that communities that participate in this planning are better equipped to deal with the impacts of natural disasters.

You can read the county's plan, or visit the NHMP webpage.

We want to hear from you!

Please take our NHMP survey.

Survey results will be sent with the plan to the Federal Emergency Management Agency (FEMA) in December-January.

For more information, members of the media may contact Todd Loggan at tloggan@clackamas.us or 503-742-4562.

Related news

11/8/2018	Clackamas County seeks public feedback for strategy on disaster risk reduction
2/6/2017	Open Houses: Disaster preparedness on the Clackamas River

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 #0: Risk MAP Resilience Workshop, October 30, 2017

Some members of the County and City HMACs participated in the Lower Columbia-Sandy Watershed Resilience Workshop and discussed resources to support efforts to combat the flood hazard associated with the channel migration of the Sandy River in the unincorporated area of the County particularly at The Villages at Mount Hood.

Meeting #1: Kickoff, November 7, 2017

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, reviewed and revised the NHMP's mission and goals, and discussed progress made toward the previous NHMP's action items.

Meeting #2: Risk Assessment, Mitigation Strategy, and Implementation and Maintenance, February 28, 2018

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. The HMAC also reviewed their existing mitigation strategy (actions), provided status updates, recommended the deletion of one action, and the addition of one action. 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 held at least one formal HMAC meeting with OPDR staff in attendance. 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. Jurisdictional addenda meetings were held: July 24, August 1, September 12, October 10, October 23, October 24, and December 19.

In addition to the meetings listed above, there were numerous informal meetings and email exchanges between HMAC members, OPDR, the County, and other state agencies.

The following pages includes copies of meeting agendas and sign-in sheets.

Upper Sandy River Basin Resilience Workshop

AGENDA
Resilience Workshop

UPPER SANDY RIVER BASIN, OREGON

DATE: October 30, 2017 • **TIME:** 8:30 AM – 12:30 PM

Clackamas County Development Services Bldg. Rm 115 • 150 Beaver Creek Rd. • Oregon City, OR

Conference Line: (571)-209-6390 • Access Code: 994 269 741 • WebEx Link: http://bit.ly/2xVOqhC

MEETING GOALS:

1. Bring together key local, State, and Federal Partners to recognize challenges of managing channel migration hazards in the Upper Sandy River Basin
2. Provide formal opportunity for community members to share concerns and Clackamas County to share perspectives and priorities
3. Identify and prioritize options for reducing long-term risk in the area

MODERATOR

Oregon Partnership for Disaster Resilience – University of Oregon
Josh Bruce
Director

PANELISTS

Clackamas County Disaster Management
Jay Wilson
Resilience Coordinator

Clackamas County Transportation Office
Mike Bezner
Assistant Director of Transportation

Water Environmental Services
Jeff Stallard
Civil Engineering Supervisor

Sandy River Basin Watershed Council
Steve Wise
Executive Director

Oregon Department of Land Conservation and Development
Dave Lentzner
State Risk MAP Coordinator

Oregon Solutions
Michael Mills
Project Manager

US Army Corps of Engineers
Paul Sclafani
Hydraulic Engineer

USDA Forest Service
Vicki Peterson
Acting Zigzag District Ranger

AGENDA

8:30 – 9:00	**Check-In, Snacks, and Informal Networking**
9:00 – 9:15	**Welcome and Introductions**
9:15 – 9:45	**History of Chanel Migration Initiatives to date** [Jay Wilson] •Chanel Migration Study and Findings •Advisory Mapping •Stakeholder Agencies •Support projects and funding
9:45 – 10:00	**Introduce Panelists and Format for Remainder of Meeting** [Josh Bruce]
10:00 – 10:30	**Connecting Challenges to Opportunities** [Jay Wilson]
10:30 – 10:45	**Break**
10:45 – 12:00	**Moderated Panel Discussion with Subject Matter Experts** [Josh Bruce]
12:00 – 12:30	**Looking forward – Next steps for participants** [Jay Wilson]
12:30 -	**Opportunity for informal discussion with Local, State and Federal partners**

FEMA

1

RiskMAP
Increasing Resilience Together

Clackamas County NHMP Update Kick-Off

Agenda

Meeting:	**Clackamas County NHMP Update - Kickoff**
Date:	November 7, 2017
Time:	9:00 am – 12:00 PM (3.0 hours)
Location:	County EOC room at 2200 Kaen Rd, Oregon City, 97045

I.	**Welcome and Background** a. Introductions b. Project context	**10 minutes**
II.	**Natural Hazard Mitigation Planning** a. Emergency Management Overview b. Natural Hazard Mitigation Plans (NHMP) Overview c. Project Timeline	**15 minutes**
III.	**Existing NHMP Overview and Review**	**20 minutes**
IV.	**Community Profile Update** a. Changes in development since previous plan b. Critical facilities	**15 minutes**
V.	**Hazard History** a. Hazard history since previous plan What are the critical hazard concerns for your community? Any changes since the previous plan?	**15 minutes**
	BREAK	**10 minutes**
VI.	**Mission and Goals review** a. Visioning Exercise	**60 minutes**
VII.	**Mitigation Actions Review** a. Review previous action categories b. Feedback and broad new action ideas	**15 minutes**
VIII.	**Public Outreach Strategy** a. Examples of outreach b. Document your outreach!	**15 minutes**
IX.	**Wrap Up and Next Steps** a. Next Steps/Questions?	**5 minutes**

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CLACKAMAS COUNTY DISASTER MANAGEMENT

UNIVERSITY OF OREGON

Meeting Sign-In

Clackamas NHMP Update:
Meeting #1: Kickoff November 7, 2017

OREGON PARTNERSHIP FOR DISASTER RESILIENCE

Name	Email	Representing
Ryan Kersey	RyanK@HappyValleyOR.gov	City of Happy Valley
Lance Calvert	lcalvert@westlinnoregon.gov	City of West Linn
Bonnie Hirshberger -	bhirshberger@ci.oswego.or.us.	Lake Oswego.
Martin Montalvo	mmontalvo@orcity.org	Oregon City
Nancy Bush	nbush@clackamas.us	CCDM
CLAIR KLOCK	cklock@conservationdistrict.org	Clack SWCD
Melanie Wagner	Wagner@Cityofestacada.org	City of Estacada

Name	Email	Representing
Jed Roberts	jed.roberts@oregon.gov	Dept. of Geology + Mineral Industries (DOGAMI)
PHILIP MASON	PMASON@CLACKAMAS.US	CLACKAMAS CO. PUBLIC HEALTH
Kim Swan	Kims@clackamasproviders.org	CRWP
GREGG RAMIREZ	gregg.ramirez@clackamasfire.com	CFD1
ERIC BOHARD	erichoh@clackamas.us	TS/GIS
DAVID LENTZNER	david.lentzner@state.or.us	Or. Dept of Land Conservation + Dev.
Ben Blessing	bblessing@clackamas.us	DTD - Planning

Clackamas County NHMP Update Meeting #2

Agenda

Meeting: **Clackamas County NHMP Update – Meeting #2**
Date: February 28, 2018
Time: 1:00 pm – 4:00 PM (3.0 hours)
Location: Development Services Building - Rm 401, 150 Beavercreek Rd, Oregon City

I.	**Welcome and Meeting Goals** a. Committee Introductions b. Project Updates	**10 minutes**
II.	**Public Outreach Strategy Updates** a. Next steps	**10 minutes**
III.	**Hazard Vulnerability Assessment** a. Clackamas review and update b. Lifeline sectors update and next steps	**20 minutes**
IV.	**Critical Facilities Update and Review** a. Overview of Critical Facilities inventory b. Additional facilities?	**15 minutes**
V.	**Action Item Update and Review** a. Present changes b. Discuss new actions c. Prioritize actions	**90 minutes**
VI.	**Plan Implementation and Maintenance** a. Recommended updates b. Discuss committee membership c. Discuss meeting schedule	**20 minutes**
VII.	**Questions and Discussion**	**10 minutes**
VIII.	**Wrap Up and Next Steps** a. Next Steps	**5 minutes**

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CLACKAMAS COUNTY DISASTER MANAGEMENT

UNIVERSITY OF OREGON

Meeting Sign-In

Clackamas NHMP Update:
Meeting #2: February 28, 2018

OREGON PARTNERSHIP FOR DISASTER RESILIENCE

Name	Email	Representing
GREGG RAMIREZ	gregg.ramirez@clackamasfire.com	CLACKAMAS FIRE DISTRICT #1
Bonnie Hirshberger	bhirshberger@lakeoswego.city	Lake Oswego.
Philip Mason-Joyner	PMason@clackamas.us	Clackamas Co. Public Health
Anna Menan	amenan@clackamas.us	CCPHI
Jack Nuttall	jnuttall@clackamas.us	CCPHD
Kim Swan	Kims@clackamasproviders.org	CRWP
Jay Wilson	jaywilson@clackamas.us	CCOM

Name	Email	Representing
Nicolia Mehrling	nicolia.mehrling@co.hood-river.or.us	Hood River County
Nancy Bush	nbush@clackamas.us	Clackamas Disaster Management
Scott Canfield	scottcan@clackamas.us	Clack. County Bldg Codes
Paul Sclafani	paul.sclafanie USACE.army.mil	USACE
Angie Lane, SHMO	angie.lane@state.or.us	OEM
Eric Bohard	ericboh@clackamas.us	TS/GIS.
David Lentzner	david.lentzner@state.or.us	DLCD
Clair Klock	cklock@conservationdistrict.org	Clack SWCD

Name	Email	Representing
Jed Roberts	jed.roberts@oregon.gov	DOGAMI
DELORIA KERBER	kerber@ci.wilsonville.or.us	City of Wilsonville
Melanie Wagner	Wagner@cityofestacada.org	City of Estacada

Clackamas County NHMP Update: Jurisdiction Addenda Meeting #1: Lake Oswego

Agenda

Meeting: **Clackamas County NHMP Update: Lake Oswego Addendum**
Date: June 24, 2018
Time: 1:00 – 3:00 PM
Location: 380 A Street, City Manager's Conference Room (3rd Floor),Lake Oswego, OR

I. Welcome and Introductions
- a. Overview of NHMP process

II. Hazard Identification
- a. Review County Hazard Identification
- b. Complete Jurisdiction Specific Hazard Inventories

III. Review Existing Vulnerability Information
- a. Review County Identified Vulnerabilities
- b. Identify Jurisdiction Specific Assets and Vulnerabilities

IV. Jurisdiction Specific Risk Assessment
- a. Review/ Revise Jurisdiction Specific Hazard Vulnerability Assessment (HVA)

V. Jurisdiction Specific Mitigation Strategy
- a. Review Process and County Strategy
- b. Review, Update, and Develop Jurisdiction Specific Actions
- c. Prioritize Actions

VI. Overview of Implementation and Maintenance

VII. Next Steps
- a. Prepare final draft of the NHMP for City Review
- b. Provide the OMD-Office of Emergency Management a Review Opportunity
- c. Submit updated plan to FEMA for review

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CLACKAMAS COUNTY DISASTER MANAGEMENT | UNIVERSITY OF OREGON

Meeting Sign-In

Clackamas NHMP Update:
Lake Oswego Addendum Meeting: July 24, 2018

OREGON PARTNERSHIP FOR DISASTER RESILIENCE

Name	Email	Representing
DARYL WRISLEY	Dwrisley@ci.oswego.or.us	LO POLICE
Bonnie Hirshberger.	bhirshberger@ci.oswego.or.us	
Rob D. Amsberry	ramsberry@ci.oswego.or.us	L.O. Engineering
Megan Phelan	mphelan@lakeoswego.city	city manager's Office
Leslie Hamilton	lhamilton@lakeoswego.city	Planning
Jim Bateman	jbateman@Lakeoswego.city	P.W
Gert Zoytendijk	GZoytendijk@ci.oswego.or.us	Fire

Clackamas County NHMP Update:
Jurisdiction Addenda Meeting #2: Estacada and Sandy

Agenda

Meeting: **Clackamas County NHMP Update: City Addenda Meeting**
Date: August 1, 2018
Time: 9:00 – 11:00 AM
Location: 475 SE Main St, Estacada City Hall (Council Chambers), Estacada, OR

I. Welcome and Introductions
- a. Overview of NHMP process

II. Hazard Identification
- a. Complete Jurisdiction Specific Hazard Inventories

III. Review Existing Vulnerability Information
- a. Identify Jurisdiction Specific Assets and Vulnerabilities

IV. Jurisdiction Specific Risk Assessment
- a. Review/ Revise Jurisdiction Specific Hazard Vulnerability Assessment (HVA)

V. Jurisdiction Specific Mitigation Strategy
- a. Review, Update, and Develop Jurisdiction Specific Actions
- b. Prioritize Actions

VI. Overview of Implementation and Maintenance

VII. Next Steps
- a. Prepare final draft of the NHMP addenda for City Review
- b. Provide the OMD-Office of Emergency Management a Review Opportunity
- c. Submit updated plan to FEMA for review

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CLACKAMAS COUNTY DISASTER MANAGEMENT | UNIVERSITY OF OREGON

Meeting Sign-In

Clackamas NHMP Update:
City Addenda Meeting (9:00 am): August 1, 2018

OREGON PARTNERSHIP FOR DISASTER RESILIENCE

Name	Email	Representing
Andi Howell	ahowell@ci.sandy.or.us	Sandy
Kim YAMASHITA	KYAMASHITA@ci.sandy.or.us	Sandy
Scott Crosby	crosbys@cuaccess.net	Reliance Connects
Tom Seal	seal@cityofestacada.org ~~City of Estacada~~	City of Estacada
Ernie Roberts	erroberts@ci.sandy.or.us	city of Sandy
Jason Crowe	jcrowe@estacadafire.org	Estacada FIRE
Denise Carey	carey@cityofestacada.org	City of Estacada
Melanie Wagner	wagner@cityofestacada.org	City of Estacada

Clackamas County NHMP Update: Jurisdiction Addenda Meeting #3: Wilsonville and Oregon City

Agenda

Meeting: **Clackamas County NHMP Update: City Addenda Meeting**
Date: August 1, 2018
Time: 1:30 – 3:30 PM
Location: 29799 Town Center Loop E, City Hall (Large Conference Room), Wilsonville, OR

I. Welcome and Introductions
- a. Overview of NHMP process

II. Hazard Identification
- a. Complete Jurisdiction Specific Hazard Inventories

III. Review Existing Vulnerability Information
- a. Identify Jurisdiction Specific Assets and Vulnerabilities

IV. Jurisdiction Specific Risk Assessment
- a. Review/ Revise Jurisdiction Specific Hazard Vulnerability Assessment (HVA)

V. Jurisdiction Specific Mitigation Strategy
- a. Review, Update, and Develop Jurisdiction Specific Actions
- b. Prioritize Actions

VI. Overview of Implementation and Maintenance

VII. Next Steps
- a. Prepare final draft of the NHMP addenda for City Review
- b. Provide the OMD-Office of Emergency Management a Review Opportunity
- c. Submit updated plan to FEMA for review

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CLACKAMAS COUNTY DISASTER MANAGEMENT | UNIVERSITY OF OREGON

Meeting Sign-In

Clackamas NHMP Update:
City Addenda Meeting (1:30 pm): August 1, 2018

OREGON PARTNERSHIP FOR DISASTER RESILIENCE

Name	Email	Representing
Tim Woodley	woodleyt@wlwv.k12.or.us	West Linn Wilsonville School District
Delora Kerber	kerber@ci.wilsonville.or.us	City of Wilsonville
DAN STARK	STARK@	"
Kelly Reid	kreid@orcity.org	Oregon City
John Lewis	jmlewis@orcity.org	Oregon City Public Works
Martin Montalvo	mmontalvo@orcity.org	" "
Jeff Rubin	jeff.rubin@tvfr.com	TVF+R

Name	Email	Representing
Dan Carlson	Carlson@ci.wilsonville.or.us	Wilsonville
Kerry Rappold	rappold@ci.wilsonville.or.us	Wilsonville
Dan Pauly	pauly@ "	Wilsonville

Clackamas County NHMP Update: Jurisdiction Addenda Meeting #4: Happy Valley and Clackamas Fire District #1

Agenda

Meeting: **Clackamas County NHMP Update: Addenda Meeting (Happy Valley/CFD #1)**
Date: September 12, 2018
Time: 2:00 – 4:00 PM
Location: 16000 SE Misty Drive, Happy Valley Oregon

I. **Welcome and Introductions**
   a. Overview of NHMP process

II. **Hazard Identification**
   a. Complete Jurisdiction Specific Hazard Inventories

III. **Review Existing Vulnerability Information**
   a. Identify Jurisdiction Specific Assets and Vulnerabilities

IV. **Jurisdiction Specific Risk Assessment**
   a. Review/ Revise Jurisdiction Specific Hazard Vulnerability Assessment (HVA)

V. **Jurisdiction Specific Mitigation Strategy**
   a. Review, Update, and Develop Jurisdiction Specific Actions
   b. Prioritize Actions

VI. **Overview of Implementation and Maintenance**

VII. **Next Steps**
   a. Prepare final draft of the NHMP addenda for City/CFD Review
   b. Provide the OMD-Office of Emergency Management a Review Opportunity
   c. Submit updated plan to FEMA for review

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CLACKAMAS COUNTY DISASTER MANAGEMENT | UNIVERSITY OF OREGON

Meeting Sign-In

Clackamas NHMP Update:
Addenda Meeting (2:00 pm): September 12, 2018

OREGON PARTNERSHIP FOR DISASTER RESILIENCE

Name	Email	Representing
Stephanie Walker	stephanie.walker @clackamasfire.com	CFD1
gregg Ramirez	gregg.ramirez @clackamasfire.com	CFD1
Chris Randall	chrisr@happyvalleyor.gov	City of Happy Valley Public works
RYAN KERSEY	RYANK@HAPPYVALLEYOR.GOV	City of HAPPY VALLEY
Steve Campbell	steevec@happyvalleyor.gov	HV

Clackamas County NHMP Update: Jurisdiction Addenda Meeting #5: West Linn

Agenda

Meeting: **Clackamas County NHMP Update: West Linn Addendum Meeting**
Date: October 10, 2018
Time: 10:30 – 12:00 PM
Location: West Linn City Hall, Bolton Room, 22500 Salamo Road

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I. Welcome and Introductions
   a. Overview of NHMP process

II. Hazard Identification
   a. Complete Jurisdiction Specific Hazard Inventories

III. Review Existing Vulnerability Information
   a. Identify Jurisdiction Specific Assets and Vulnerabilities

IV. Jurisdiction Specific Risk Assessment
   a. Review/ Revise Jurisdiction Specific Hazard Vulnerability Assessment (HVA)

V. Jurisdiction Specific Mitigation Strategy
   a. Review, Update, and Develop Jurisdiction Specific Actions
   b. Prioritize Actions

VI. Overview of Implementation and Maintenance

VII. Next Steps
   a. Prepare final draft of the NHMP addenda for City Review
   b. Provide the OMD-Office of Emergency Management a Review Opportunity
   c. Submit updated plan to FEMA for review

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CLACKAMAS COUNTY DISASTER MANAGEMENT

UNIVERSITY OF OREGON

Meeting Sign-In

Clackamas NHMP Update: West Linn
City Addendum Meeting (10:30 am): October 10, 2018

OREGON PARTNERSHIP FOR DISASTER RESILIENCE

Name	Email	Representing
Megan Fursdon	mfursdon@westlinnoregon.gov	City of West Linn
Jim Clark	jclark@westlinnoregon.gov	City of West Linn
John Boyd	JBoyd — same	Count
Lance Calvert	lcalvert@westlinnoregon.gov	"

Clackamas County NHMP Update: Jurisdiction Addenda Meeting #6: Johnson City, Molalla, and Canby

Agenda

Meeting: **Clackamas County NHMP Update: Johnson City Addendum Meeting**
Date: October 23, 2018
Time: 2:30 – 4:30 PM
Location: City Hall, 16121 SE 81st Avenue, Johnson City.

I. Welcome and Introductions
   a. Overview of NHMP process

II. Hazard Identification
   a. Complete Jurisdiction Specific Hazard Inventories

III. Review Existing Vulnerability Information
   a. Identify Jurisdiction Specific Assets and Vulnerabilities

IV. Jurisdiction Specific Risk Assessment
   a. Review/ Revise Jurisdiction Specific Hazard Vulnerability Assessment (HVA)

V. Jurisdiction Specific Mitigation Strategy
   a. Review, Update, and Develop Jurisdiction Specific Actions
   b. Prioritize Actions

VI. Overview of Implementation and Maintenance

VII. Next Steps
   a. Prepare final draft of the NHMP addendum for City Review
   b. Provide the OMD-Office of Emergency Management a Review Opportunity
   c. Submit updated plan to FEMA for review

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CLACKAMAS COUNTY DISASTER MANAGEMENT

UNIVERSITY OF OREGON

Meeting Sign-In

Clackamas NHMP Update: Johnson City
City Addenda Meeting (2:30 pm): October 23, 2018

OREGON PARTNERSHIP FOR DISASTER RESILIENCE

Name	Email	Representing
judy davis	johnson.city@hotmail.com	Johnson City
Elizabeth Collins	LIZZ1717@msn.com	Johnson City
BRIAN Johnson		Johnson City
Vincent Ballard	vballard.365@gmail.com	Johnson City
Dan Zinder	dzinder@cityofmolalla.com	Molalla
Jennifer Cline	CLINEJ@CANBYOREGON.GOV	CITY OF CANBY

Clackamas County NHMP Update: Jurisdiction Addenda Meeting #7: Milwaukie

Agenda

Meeting:	**Clackamas County NHMP Update: Milwaukie Addendum Meeting**
Date:	October 24, 2018
Time:	9:00 – 11:00 AM
Location:	Police Department, 3200 SE Harrison St, Milwaukie

I. Welcome and Introductions
- a. Overview of NHMP process

II. Hazard Identification
- a. Complete Jurisdiction Specific Hazard Inventories

III. Review Existing Vulnerability Information
- a. Identify Jurisdiction Specific Assets and Vulnerabilities

IV. Jurisdiction Specific Risk Assessment
- a. Review/ Revise Jurisdiction Specific Hazard Vulnerability Assessment (HVA)

V. Jurisdiction Specific Mitigation Strategy
- a. Review, Update, and Develop Jurisdiction Specific Actions
- b. Prioritize Actions

VI. Overview of Implementation and Maintenance

VII. Next Steps
- a. Prepare final draft of the NHMP addendum for City Review
- b. Provide the OMD-Office of Emergency Management a Review Opportunity
- c. Submit updated plan to FEMA for review

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CLACKAMAS COUNTY DISASTER MANAGEMENT

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OREGON PARTNERSHIP FOR DISASTER RESILIENCE

Meeting Sign-In

Clackamas NHMP Update: Milwaukie
City Addendum Meeting (9:00 am): October 24 2018

Name	Email	Representing
Samantha Vandagriff	vandagriffs@milwaukieoregon.gov	Building
DAMIEN FARWELL	farwelld@milwaukieoregon.gov	FACILITIES/FLEET
Nick Lindelkugel	lindelkugeln@milwaukieoregon.gov	GIS
PETER Passarelli	passarellip@milwaukieoregon.gov	Public Works
STEVE BARTOL	bartols@milwaukieoregon.gov	Police
MARK DYE	dyem@milwaukieoregon.gov	Police

Clackamas County NHMP Update: Jurisdiction Addenda Meeting #8: Gladstone

Agenda

Meeting: **Clackamas County NHMP Update: Gladstone Addendum Meeting**
Date: December 19, 2018
Time: 1:30 – 3:30 PM
Location: City Hall, 525 Portland Ave, Gladstone

I. Welcome and Introductions
- a. Overview of NHMP process

II. Hazard Identification
- a. Complete Jurisdiction Specific Hazard Inventories

III. Review Existing Vulnerability Information
- a. Identify Jurisdiction Specific Assets and Vulnerabilities

IV. Jurisdiction Specific Risk Assessment
- a. Review/ Revise Jurisdiction Specific Hazard Vulnerability Assessment (HVA)

V. Jurisdiction Specific Mitigation Strategy
- a. Review, Update, and Develop Jurisdiction Specific Actions
- b. Prioritize Actions

VI. Overview of Implementation and Maintenance

VII. Next Steps
- a. Prepare final draft of the NHMP addendum for City Review
- b. Provide the OMD-Office of Emergency Management a Review Opportunity
- c. Submit updated plan to FEMA for review

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CLACKAMAS COUNTY DISASTER MANAGEMENT

UNIVERSITY OF OREGON

Meeting Sign-In

Clackamas NHMP Update: Gladstone
City Addendum Meeting (1:30 pm): December 19, 2018

OREGON PARTNERSHIP FOR DISASTER RESILIENCE

Name	Email	Representing
Colin Black	black@ci.gladstone.or.us	City of Gladstone
Vera Smith	smithv@ci.gladstone.or.us	City of Gladstone
Jacque Betz	Betz@ci.gladstone.or.us	City of Gladstone

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APPENDIX C: COMMUNITY PROFILE

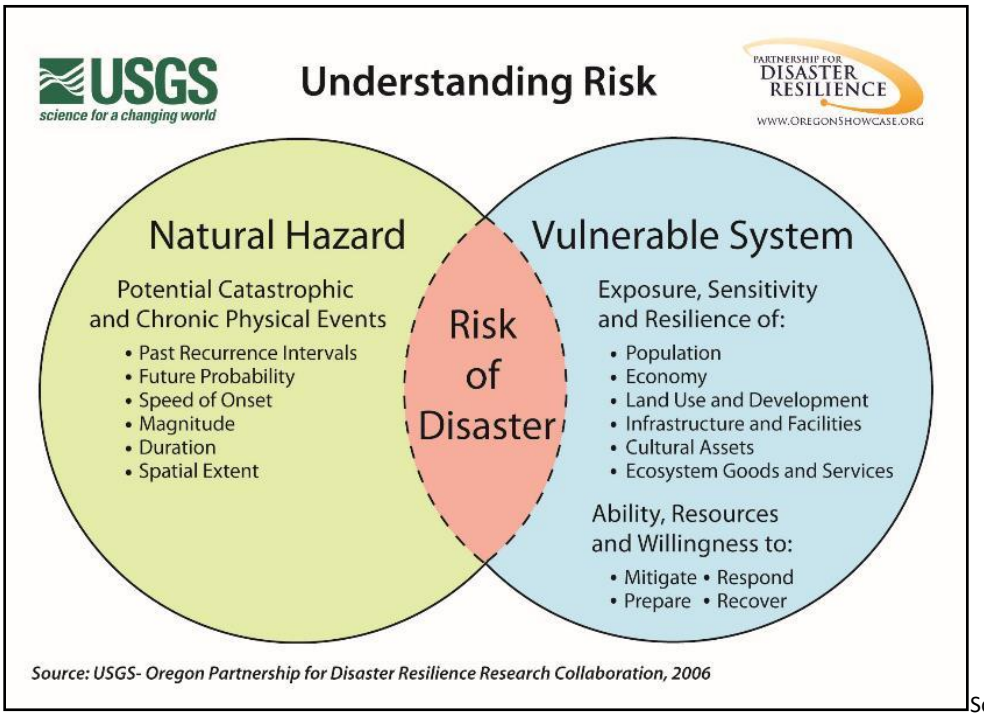
The following section describes the county from several perspectives in order to help define and understand the county's sensitivity and resilience to natural hazards. Sensitivity and resilience indicators are identified through the examination of community capitals which include natural environment, 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.[1]

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 county. 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 actions that reduce the county's sensitivity and increase its resiliency assist in reducing overall risk of disaster, the area of overlap in Figure C-1.

[1] Mary Emery and others, "Using Community Capitals to Develop Assets for Positive Community Change," *CD Practice* 13 (2006): 2

Figure C-1 Understanding Risk



Source: Oregon Partnership for Disaster Resilience

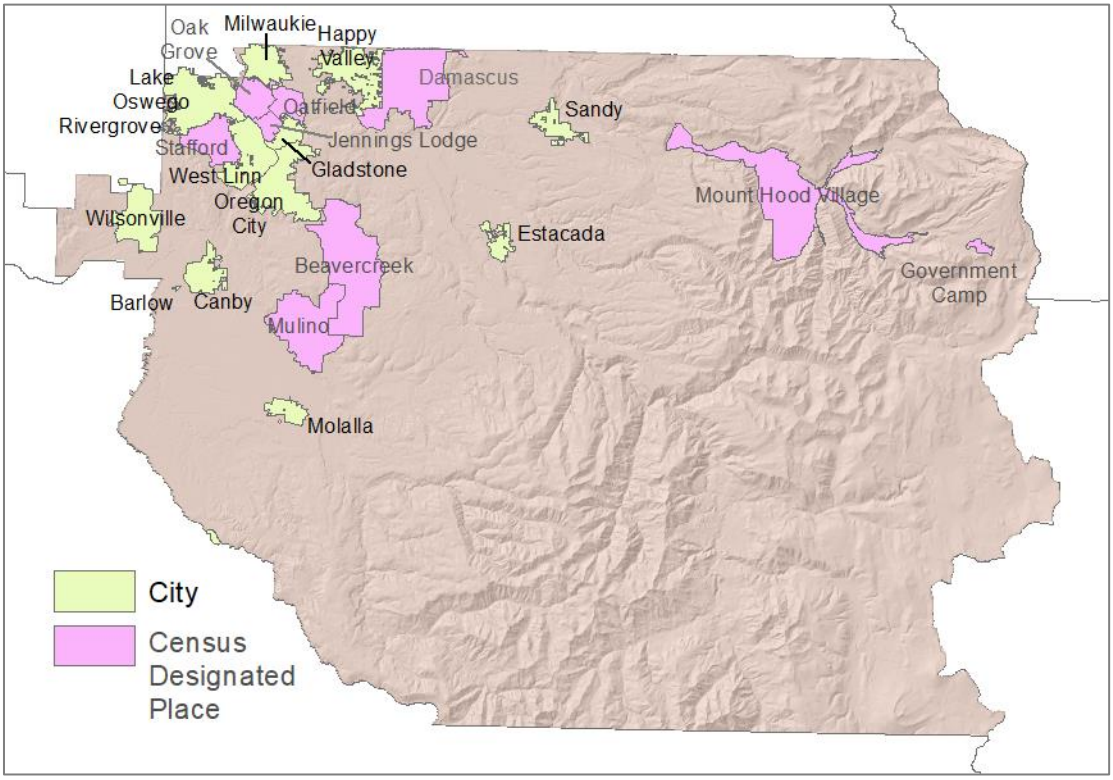
The U.S. Census delineates areas of settled population concentrations that are identifiable by name but are not legally incorporated as Census Designated Places (CDPs). There are nine CDPs in Clackamas County as shown in Table C-1 and Figure C-2.

Table C-1 Clackamas County Cities and Census Designated Places

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

Source: Portland State University Population Research Center, U.S. Census Bureau Tiger Lines Files
Notes: * - The majority 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 C-2 Clackamas County Cities and Census Designated Places



Source: OPDR, 2018, U.S. Census Bureau Tiger Lines Files

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).

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.[2] Natural resources such as wetlands and forested hill slopes play significant roles in protecting communities and the environment from weather-related hazards, such as flooding and landslides. However, natural systems are often impacted or depleted by human activities adversely affecting community resilience.

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-

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

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 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 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

As Oregon's tallest peak, Mount Hood borders the eastern edge of Clackamas County and rises to 11,235 feet. Nearby volcanic neighbors 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.[3]

Willamette River

The Willamette River Basin covers 11,500 square miles, encompassing 16,000 miles of streams and is ranked 12th among US rivers in volume.[4] The river is about 187 miles long and 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.[5] 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

[3] 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.
[4] Portland Bureau of Environmental Services. "Willamette Watershed." Accessed 19 December 2011. http://www.portlandonline.com/bes/index.cfm?a=231466&c=30938.
[5] Willamette River Water Coalition. "About the Willamette River." Accessed 19 December 2011. http://www.willametteriver.org/willamette.php.

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.[6] 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.[7]

The Clackamas River Basin is largely forested but has large areas of pasture used for grazing. More than 400,000 people depend on the Clackamas River for their drinking water. 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.[8]

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-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.[9]

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 Federal Wild and Scenic Waterways. Riverside trails offer spectacular scenery, easily observed 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.[10]

[6] Oregon Rivers. Accessed 19 December 2011. http://www.oregon.com/oregon_rivers.
[7] Ibid.
[8] 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.
[9] Ibid.
[10] Oregon Rivers. Accessed 19 December 2011. http://www.oregon.com/oregon_rivers.

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 may exceed 90°F in the summer 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 low 80s down to the low 50s, while average temperatures in the winter range from the mid-40s to the low 30s. 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).[11]

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 D 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).[12]

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

Increasing temperatures affects hydrology in the region. Spring snowpack has substantially decreased throughout the western part of the United States, particularly in areas with milder winter temperatures, such as the Cascade Mountains. In other areas of the West, such as east of the Cascades Mountains, snowfall is affected less by the increasing temperature because the temperatures are already cold and more by precipitation patterns.[13]

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 residents and damage property. Typical hazards to affect the county include floods, 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 seasonal floods that are characterized by periods of heavy rains in a short amount of time, as well as a hard snowfall and ice storm immediately followed by warm temperatures causing that fresh snow to melt at a faster rate. With the amount of volcanic sediment that has settled in the streams and valleys over the years since Mount Hood's last eruption, the houses located in this vicinity are vulnerable to landslides and floods as the water permeates in the soil more easily; another factor to consider is the

[11] Loy, W. G., ed. 2001. Atlas of Oregon, 2nd Edition. Eugene, OR: University of Oregon Press.
[12] Ibid.
[13] Mote, Philip W., et. al., "Variability and trends in Mountain Snowpack in Western North America," http://cses.Clackamas.edu/db/pdf/moteetalvarandtrends436.pdf

erosive behavior of the Sandy River's migrating channel. As this part of the county is mostly forested, wildfires also affect this area.

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.[14]

The eastern portion of the county is mostly rural and is where most of the US Forest Service owns their land. On the contrary, the western portion of the county is more urbanized with a higher percentage of privately owned land. The western portion also includes zoning for agriculture, forest, 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.[15]

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.[16] 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.[17] 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.[18] 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.[19] 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.[20]

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

[14] Loy, W. G., ed. 2001. *Atlas of Oregon,* 2nd Edition. Eugene, OR: University of Oregon Press.
[15] Loy, W. G., ed. 2001. *Atlas of Oregon,* 2nd Edition. Eugene, OR: University of Oregon Press.
[16] "Willamette Valley Land Use/Land Cover Map Informational Report," Pg. 25. Accessed 19 December 2011. http://nwhi.org/inc/data/gisdata/docs/willamette/wvveg24k.pdf.
[17] Ibid.
[18] Ibid.
[19] Ibid.
[20] Ibid.

are valley fill and semi-consolidated sedimentary rocks, basaltic lavas, marine sedimentary rocks, and Eocene-age volcanic and sedimentary rocks.[21]

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.[22]

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. Natural capital is essential in sustaining all forms of life including human life and plays an often under represented role in community resiliency to natural hazards. The growing population and increased development in Clackamas County increases its risk from natural hazard events by threatening loss of life, property, and long-term economic disruption.

With mild temperatures and diverse terrain, the most typical natural hazards that affect Clackamas County are widespread heavy rain events followed by major flood events, as well as the occasional wildfire. With eminent hazard events such as these, it is important that the county is able to react in the event that the county's water supply, supplied by several of the major rivers flowing throughout, is heavily impacted by disaster.

Oregon City experiences an annual mean temperature of 55°F, and the average of the annual amount of precipitation for parts of the county range from an average of 89 feet per year in Government Camp down to an average of 43 feet per year at the North Willamette Experiment Station near Canby. Contrastingly, snowfall rates are drastically different with Government Camp seeing an annual average of 253 feet of snow, while the North Willamette Experiment Station will only see an average of two feet of snow.

Highlighting natural capitals such as key river systems, as well as temperature and precipitation patterns, will allow the county to identify key hazard areas that need to be better prepared for and mitigated, to increase the resiliency of each community.

[21] 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.
[22] Ibid.

Table C-2 indicates where natural environment and related infrastructure vulnerabilities exist in relation to each of the natural hazards profiled in Volume I, Section 2.

Table C-2 Clackamas County Natural Environment Vulnerabilities

Clackamas County Asset	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Forest/woodland areas							X		
Streams/riparian zones (property damage, bridges/culverts)	X			X					
County/City parks				X			X	X	X
General groundwater issues	X			X		X	X		
Groundwater and surface water contamination from industrial area disruption		X		X	X				

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 2010 and 2016 (Table C-4). Clackamas County's population grew 7.5% from 2010 to 2016 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 and Oregon City are the county's largest cities at roughly 35,000 each, while Milwaukie is the third largest city with about two-thirds the population of the two larger cities (20,510).

The unincorporated area of the county accounts for about 48% of the overall population (194,008) and is growing slower than the incorporated cities (1.1% AAGR).

Oak Grove (16,848), Oatfield (13,592), and Damascus[23] (10,625) 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 C-3). According to the most recent forecast (2017), Clackamas County's population is expected to increase to over 516,000, a 28% increase from the 2016 estimate.[24]

Table C-3 Population Forecast for Tri-County Metro Area

Jurisdiction	2016		2035		Change		
	Number	Percent	Number	Percent	Number	Percent	AAGR
3-County Area	1,779,245	100%	2,226,974	100%	447,729	25%	1.2%
Clackamas County	**404,980**	**23%**	**516,744**	**23%**	**111,764**	**28%**	**1.3%**
Multnomah County	790,670	44%	944,785	42%	154,115	19%	0.9%
Washington County	583,595	33%	765,445	34%	181,850	31%	1.4%

Source: Portland State University, Population Research Center, "Annual Population Estimates", 2016; Portland State University, Population Research Center, "Population Forecasts", 2017.

[23] Damascus (along with the community of Carver) incorporated in 2004 and disincorporated in 2016.
[24] Office of Economic Analysis. Long Term County Population Forecast, 2010-2050 (2013 release).

Table C-4 Population Estimates and Change (2010 and 2016)

Jurisdiction	2010		2016		Change (2010-2016)		AAGR
	Number	Percent	Number	Percent	Number	Percent	
Oregon	3,837,300	100%	4,076,350	100%	239,050	6%	1.0%
3-County Area	1,644,635	43%	1,779,245	44%	134,610	8%	1.3%
Clackamas County	**376,780**	**23%**	**404,980**	**23%**	**28,200**	**7%**	**1.2%**
Multnomah County	736,785	45%	790,670	44%	53,885	7%	1.2%
Washington County	531,070	32%	583,595	33%	52,525	10%	1.6%
Unincorporated^	**181,402**	**48%**	**194,008**	**48%**	**12,606**	**7%**	**1.1%**
Beavercreek	**4,443**	**1%**	**4,034**	**1%**	**-409**	**-9%**	**-1.6%**
Damascus**	**10,540**	**3%**	**10,625**	**3%**	**85**	**1%**	**0.1%**
Government Camp	**56**	**<1%**	**121**	**<1%**	**65**	**116%**	**13.7%**
Jennings Lodge	**7,799**	**2%**	**7,727**	**2%**	**-72**	**-1%**	**-0.2%**
Mount Hood Village	**4,598**	**1%**	**5,231**	**1%**	**633**	**14%**	**2.2%**
Mulino	**2,183**	**1%**	**2,797**	**1%**	**614**	**28%**	**4.2%**
Oak Grove	**16,931**	**4%**	**16,848**	**4%**	**-83**	**<-1%**	**-0.1%**
Oatfield	**13,619**	**4%**	**13,592**	**3%**	**-27**	**<-1%**	**0.0%**
Stafford	**1,765**	**<1%**	**1,945**	**<1%**	**180**	**10%**	**1.6%**
Not Within a CDP^^	**119,468**	**32%**	**131,088**	**32%**	**11,620**	**10%**	**1.6%**
Incorporated	195,378	52%	210,972	52%	15,594	8%	1.3%
Barlow	135	<1%	135	<1%	0	0%	0.0%
Canby	**15,830**	**4%**	**16,420**	**4%**	**590**	**4%**	**0.6%**
Estacada	**2,730**	**1%**	**3,155**	**1%**	**425**	**16%**	**2.4%**
Gladstone	**11,495**	**3%**	**11,660**	**3%**	**165**	**1%**	**0.2%**
Happy Valley	**14,100**	**4%**	**18,680**	**5%**	**4,580**	**32%**	**4.8%**
Johnson City	**565**	**<1%**	**565**	**<1%**	**0**	**0%**	**0.0%**
Lake Oswego (part)*	**34,067**	**9%**	**34,855**	**9%**	**788**	**2%**	**0.4%**
Milwaukie	**20,290**	**5%**	**20,510**	**5%**	**220**	**1%**	**0.2%**
Molalla	**8,110**	**2%**	**9,085**	**2%**	**975**	**12%**	**1.9%**
Oregon City	**31,995**	**8%**	**34,240**	**8%**	**2,245**	**7%**	**1.1%**
Portland (part)*	744	<1%	766	<1%	22	3%	0.5%
Rivergrove (part)*	258	<1%	459	<1%	201	78%	10.1%
Sandy	**9,655**	**3%**	**10,655**	**3%**	**1,000**	**10%**	**1.7%**
Tualatin (part)*	2,869	1%	2,911	1%	42	1%	0.2%
West Linn	**25,150**	**7%**	**25,615**	**6%**	**465**	**2%**	**0.3%**
Wilsonville (part)*	**17,385**	**5%**	**21,260**	**5%**	**3,875**	**22%**	**3.4%**

Source: Portland State University, Population Research Center, "Annual Population Estimates", 2016. Social Explorer, Table T1, U.S. Census Bureau, 2012-2016 American Community Survey Estimates and 2006-2010 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.

** - Damascus incorporated in 2004 and unincorporated in 2016, its population is shown as unincorporated for 2010 & 2016.

^ - Population information is from the American Community Survey 5-Year Estimates

^^ - Population information is derived using PSU Annual Population Estimates and American Community Survey 5-Year Estimates

Tourists

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 2014-2016, approximately 71% 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). 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. Visitors staying at hotel/motels are less likely to benefit from local preparedness outreach efforts aimed at residents.

Table C-5 Annual Visitor Estimates in Person Nights

	2014 Person-Nights (1,000's)	Percent	2015 Person-Nights (1,000's)	Percent	2016p Person-Nights (1,000's)	Percent
All Overnight	7,012	100%	7,209	100%	7,392	100%
Hotel/Motel	1,340	19%	1,413	20%	1,496	20%
Private Home	5,069	72%	5,183	72%	5,275	71%
Other	603	9%	613	9%	621	8%

Source: Oregon Tourism Commission, Oregon Travel Impacts: 1991-2016p, Dean Runyan Associates

Tourists are specifically vulnerable due to the difficulty of locating or accounting for travelers within the region. Tourists are often at greater risk during a natural disaster because of unfamiliarity with evacuation routes, communication outlets, or even the type of hazard that may occur. Knowing whether the region's visitors are staying in friends/relative's homes in hotels/motels, or elsewhere can be instructive when developing outreach efforts.[25]

Vulnerable Populations

Vulnerable populations, including seniors, disabled citizens, women, and children, as well those people living in poverty, often experience the impacts of natural hazards and disasters more acutely. Hazard mitigation that targets the specific needs of these groups has the potential to greatly reduce their vulnerability. Examining the reach of hazard mitigation policies to special needs populations may assist in increasing access to services and programs. FEMA's Office of Equal Rights addresses this need by suggesting that agencies and organizations planning for natural hazards identify special needs populations, make recovery centers more accessible, and review practices and procedures to remedy any discrimination in relief application or assistance.

Population size itself is not an indicator of vulnerability. More important is the location, composition, and capacity of the population within the community. Research by social scientists demonstrates that human capital indices such as language, race, age, income,

25 MDC Consultants (n.d.). When Disaster Strikes – Promising Practices. Retrieved March 18, 2014, from http://www.mdcinc.org/sites/default/files/resources/When%20Disaster%20Strikes%20-%20Promising%20Practices%20- %20Tourists.pdf

education and health can affect the integrity of a community. Therefore, these human capitals can impact 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 should be given to populations who do not speak English as their primary language. Language barriers can be a challenge when disseminating hazard planning and mitigation resources to the general public, and it is less likely they will be prepared if special attention is not given to language and culturally appropriate outreach techniques.

There are various languages spoken across Clackamas County; the primary language is English. 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 (11% of Stafford's, and 10% of Mulino's, and 9% of Jennings Lodge's populations speak Spanish at home).[26] Overall, about 4% of the Clackamas County population is not proficient in English (Table C-6). Jennings Lodge (6%) and Mulino (5%) have the highest percentage of residents who have limited or no English language proficiency. Outreach materials used to communicate with, plan for, and respond to non-English speaking populations should take into consideration the language needs of these populations.

Table C-6 Clackamas County Language Barriers

Jurisdiction	Population 5 years and over	English Only		Multiple Languages		Limited or No English	
		Number	Percent	Number	Percent	Number	Percent
Clackamas County	373,421	328,068	88%	45,353	12%	16,613	4%
Beavercreek	3,809	3,631	95%	178	5%	52	1%
Damascus	10,457	9,486	91%	971	9%	309	3%
Government Camp	121	121	100%	0	0%	0	0%
Jennings Lodge	7,204	6,226	86%	978	14%	462	6%
Mount Hood Village	5,131	4,680	91%	451	9%	44	1%
Mulino	2,689	2,265	84%	424	16%	141	5%
Oak Grove	15,890	14,397	91%	1,493	9%	467	3%
Oatfield	13,072	12,246	94%	826	6%	236	2%
Stafford	1,835	1,539	84%	296	16%	75	4%
Incorporated*	199,191	174,070	87%	25,121	13%	8,899	4%

Source: Social Explorer, U.S. Census Bureau, 2012-2016 American Community Survey Estimates, Table 16002.
Note: * - Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County.

[26] Social Explorer, U.S. Census Bureau, 2012-2016 American Community Survey Estimates, Table 16001

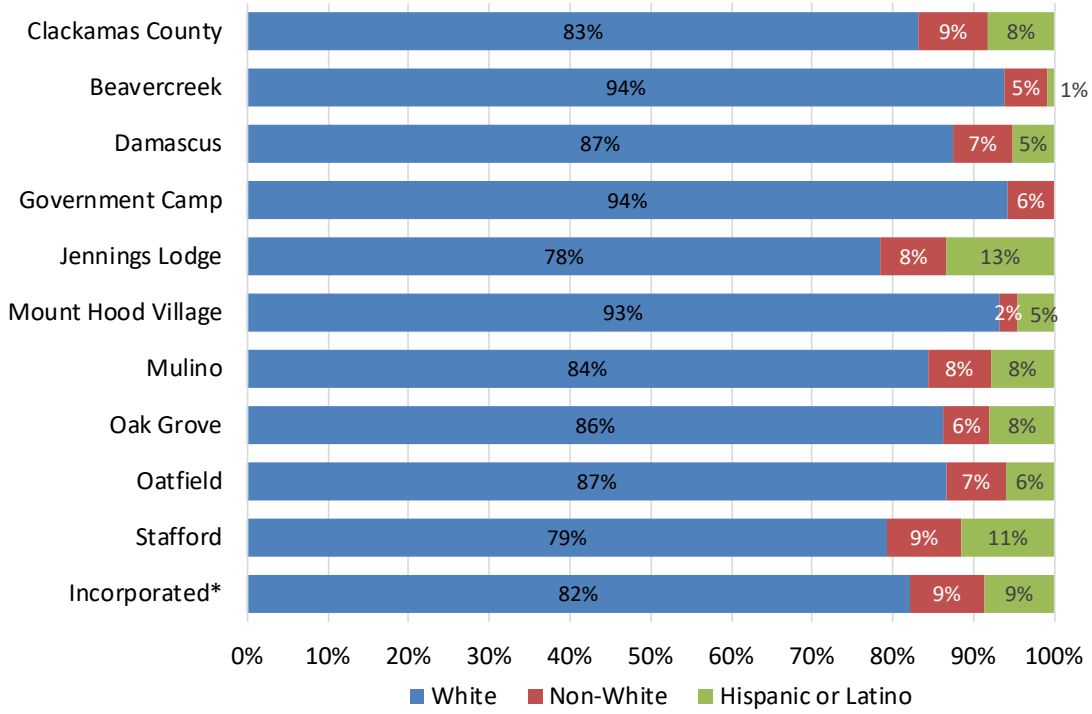
Race and Ethnicity

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 can be more vulnerable to natural disaster events. This is not reflective of individual characteristics; instead, historic patterns of inequality along racial or ethnic divides have often resulted in minority communities that are more likely to have inferior building stock, degraded infrastructure, or less access to public services. The table below describes Clackamas County's population by race and ethnicity.

The majority of the population in Clackamas County is racially white (83%); Stafford, and the incorporated areas of the County have the largest percentages of non-white population. About 13% of Jennings Lodge, and 11% of Stafford are Hispanic or Latino.

It is important to identify specific ways to support all portions of the community through hazard mitigation, preparedness, and response. Culturally appropriate, and effective outreach can include both methods and messaging targeted to diverse audiences. For example, connecting to historically disenfranchised populations through already trusted sources or providing preparedness handouts and presentations in the languages spoken by the population will go a long way to increasing overall community resilience.

Figure C-3 White, Non-White, and Hispanic or Latino



Source: Social Explorer, Table T14, U.S. Census Bureau, 2012-2016 American Community Survey Estimates.
Note: * - Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County.

Gender

Clackamas County has slightly more females than males (Female 51%, Male: 49%).[27] Government Camp, (64%), Stafford (57%), and Mount Hood Village (56%) have the highest male to female ratios comprising their populations.[28] It is important to recognize that women tend to have more institutionalized obstacles than men during recovery due to sector-specific employment, lower wages, and family care responsibilities.

Age

Of the factors influencing socio demographic capacity, the most significant indicator in Clackamas County may be age of the population. Depicted in Table C-7 as of 2016, 16% of the county population is over the age of 64, a percentage that is projected to rise to 22% by 2035. The Clackamas County age dependency ratio[29] is 52.0 (Oatfield has the largest age dependency ration at 60.6). 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 66.1 in 2035, largely because of the rise in the older age cohorts (population 65+, 22% in 2035). 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.

Table C-7 Population by Vulnerable Age Groups

		< 15 Years Old		> 64 Years Old			
Jurisdiction	Total	Number	Percent	Number	Percent	15 to 64 Years Old	Age Dependency Ratio
Clackamas County	394,967	71,291	18%	63,787	16%	259,889	52.0
Beavercreek	4,034	611	15%	832	21%	2,591	55.7
Damascus	10,842	1,660	15%	1,697	16%	7,485	44.8
Government Camp	121	16	13%	27	22%	78	55.1
Jennings Lodge	7,727	1,520	20%	1,170	15%	5,037	53.4
Mount Hood Village	5,231	670	13%	1,219	23%	3,342	56.5
Mulino	2,797	637	23%	382	14%	1,778	57.3
Oak Grove	16,848	2,739	16%	3,411	20%	10,698	57.5
Oatfield	13,592	1,943	14%	3,184	23%	8,465	60.6
Stafford	1,945	370	19%	256	13%	1,319	47.5
Incorporated*	211,806	41,249	19%	30,696	14%	139,861	51.4
2035							
Oregon		865,889	17%	1,082,781	22%	3,046,530	64.0
Clackamas County		92,126	18%	113,495	22%	311,123	66.1

Source: Social Explorer, Table 17, U.S. Census Bureau, 2012-2016 American Community Survey Estimates, Office of Economic Analysis, Long-Term County Population Forecast, 2010-2050 (2013 release). Portland State University, Population Research Center, "Population Forecasts", 2017.
Note: * - Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County.

[27] Social Explorer, Table 4, U.S. Census Bureau, 2012-2016 American Community Survey Estimates
[28] Ibid.
[29] The age dependency ratio is derived by dividing the combined under 15 and 65-and-over populations by the 15-to-64 population and multiplying by 100. A number close to 50 indicates about twice as many people are of working age than non-working age. A number that is closer to 100 implies an equal number of working age population as non-working age population. A higher number indicates greater sensitivity.

The age profile of an area has a direct impact both on what actions are prioritized for mitigation and how response to hazard incidents is carried out. School age children rarely make decisions about emergency management. Therefore, a larger youth population in an area will increase the importance of outreach to schools and parents on effective ways to teach children about fire safety, earthquake response, and evacuation plans. Furthermore, children are more vulnerable to the heat and cold, have few transportation options and require assistance to access medical facilities. Older populations may also have special needs prior to, during and after a natural disaster. Older populations may require assistance in evacuation due to limited mobility or health issues. Additionally, older populations may require special medical equipment or medications, and can lack the social and economic resources needed for post-disaster recovery.[30]

Families and Living Arrangements

Two ways the census defines households are by type of living arrangement and family structure. A householder may live in a "family household" (a group related to one another by birth, marriage or adoption living together); in a "nonfamily household" (a group of unrelated people living together); or alone. Table C-8 shows that Clackamas County is predominately comprised of family households (69%). Of all households, 24% are one-person non-family households (householder living alone). Countywide about 10% of householders live alone and are age 65 or older (about 16% and 18% of all households in Jennings Lodge and Oak Grove respectively).

Table C-8 Household by Type, Including Living Alone

Jurisdiction	Total Households	Family Households		Householder Living Alone		Householder Living Alone (age 65+)	
	Estimate	Estimate	Percent	Estimate	Percent	Estimate	Percent
Clackamas County	151,150	103,760	69%	36,824	24%	15,621	10%
Beavercreek	1,453	1,178	81%	226	16%	134	9%
Damascus	3,723	3,100	83%	484	13%	269	7%
Government Camp	53	37	70%	0	0%	0	0%
Jennings Lodge	3,139	1,740	55%	1,086	35%	496	16%
Mount Hood Village	2,215	1,458	66%	597	27%	211	10%
Mulino	838	669	80%	131	16%	78	9%
Oak Grove	7,038	4,097	58%	2,367	34%	1,239	18%
Oatfield	5,201	3,857	74%	1,158	22%	609	12%
Stafford	718	595	83%	115	16%	22	3%
Incorporated*	81,742	55,133	67%	20,944	26%	8,563	10%

Source: Social Explorer, Table 165, U.S. Census Bureau, 2012-2016 American Community Survey Estimates.
Note: * - Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County.

Table C-9 shows household structures for families with children. Nearly 22% of all households within the county are married family households that have children. Jennings Lodge (12%) and Oak Grove (9%) have the highest percentage of single-parent households.

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

These populations will likely require additional support during a disaster and will inflict strain on the system if improperly managed.

Table C-9 Married-Couple and Single Parent Families with Children

Jurisdiction	Total Households Estimate	Married-Couple with Children		Single Parent with Children	
		Estimate	Percent	Estimate	Percent
Clackamas County	151,150	33,797	22%	13,366	9%
Beavercreek	1,453	400	28%	18	1%
Damascus	3,723	1,070	29%	256	7%
Government Camp	53	9	17%	0	0%
Jennings Lodge	3,139	483	15%	388	12%
Mount Hood Village	2,215	323	15%	109	5%
Mulino	838	271	32%	48	6%
Oak Grove	7,038	1,107	16%	614	9%
Oatfield	5,201	973	19%	355	7%
Stafford	718	204	28%	5	1%
Incorporated*	81,742	19,719	24%	8,133	10%

Source: U.S. Census Bureau, 2012-2016 American Community Survey Estimates, Table DP02.
Note: * - Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County.

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 C-10 shows the distribution of household income for 2010 and 2016.

Table C-10 Household Income

Household Income	2010^		2016		Change in Share	
	Households	Percent	Households	Percent	Households	Percent
Less than $15,000	11,022	8%	11,215	7%	193	-0.3%
$15,000-$29,999	16,378	11%	17,613	12%	1,235	0.2%
$30,000-$44,999	17,335	12%	18,635	12%	1,300	0.2%
$45,000-$59,999	17,610	12%	18,256	12%	646	-0.2%
$60,000-$74,999	15,375	11%	16,344	11%	969	0.1%
$75,000-$99,999	20,563	14%	21,764	14%	1,201	0.1%
$100,000-$199,999	34,698	24%	36,308	24%	1,610	-0.2%
$200,000 or more	10,379	7%	11,015	7%	636	0.0%

Source: Social Explorer, Table 56, U.S. Census Bureau, 2012-2016 American Community Survey and 2006-2010 American Community Survey.
Note: ^ - 2010 dollars adjusted for 2016 via Social Explorer's Inflation Calculator

Countywide, between 2010 and 2016 all income cohorts increased in households, however, 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.

The 2016 median household income across Clackamas County is $68,915; this is about the same as the inflation adjusted 2010 figure, representing a 1% increase in real incomes (Table C-11). Stafford has the highest median household income (and had the greatest gain), Jennings Lodge has the lowest median household income. The table below shows decreases, or modest gains, in real incomes across most of Clackamas County, except for Stafford which increased by 37%.

Table C-11 Median Household Income

Jurisdiction	Median Household Income 2010^	Median Household Income 2016	Percent Change
Clackamas County	$68,281	$68,915	1%
Beavercreek	$85,726	$83,550	-3%
Damascus	$90,107	$82,830	-8%
Government Camp	na	na	na
Jennings Lodge	$56,651	$53,101	-6%
Mount Hood	$65,185	$60,572	-7%
Mulino	$78,786	$72,813	-8%
Oak Grove	$57,573	$59,545	3%
Oatfield	$72,686	$74,663	3%
Stafford	$91,422	$125,556	37%
Incorporated*	$69,258	$69,473	< 1%

Source: Social Explorer, Table 57, U.S. Census Bureau, 2012-2016 American Community Survey Estimates and 2006-2010 American Community Survey Estimates.
Note: ^ - 2010 dollars adjusted for 2016 via Social Explorer's Inflation Calculator

Table C-12 identifies the percentage of individuals and cohort groups that are below the poverty level in 2016. It is estimated that about 9% of individuals, 11% of children under 18, and 7% of seniors live below the poverty level across the county. Jennings Lodge, Mulino, and Government Camp have the highest poverty rates. Jennings Lodge also has the highest poverty rate for children under 18 and for adults age 65 and older. Overall, 4% of Clackamas County residents live in "deep poverty" (having incomes below half the federal poverty level), the percent is greatest in Jennings Lodge at 9%.[31]

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

[31] Social Explorer Tables 117, U.S. Census Bureau, 2012-2016 American Community Survey Estimates

absorb the impacts of a disaster more easily. Conversely, poverty, at both an individual and community level, can drastically alter recovery time and quality.[32]

Table C-12 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
Clackamas County	36,160	9%	9,464	11%	22,544	9%	4,152	7%
Beavercreek	217	5%	50	6%	123	5%	44	5%
Damascus	819	8%	232	10%	545	8%	42	3%
Government Camp	16	13%	0	0%	16	21%	0	0%
Jennings Lodge	1,119	15%	309	19%	583	12%	227	19%
Mount Hood Village	383	7%	18	2%	273	9%	92	8%
Mulino	382	14%	93	12%	268	17%	21	6%
Oak Grove	1,552	9%	368	12%	973	10%	211	6%
Oatfield	1,091	8%	143	6%	664	8%	284	9%
Stafford	161	8%	0	0%	161	13%	0	0%
Incorporated*	19,021	9%	5,496	11%	11,674	9%	1,851	6%

Source: Social Explorer Tables 114, 115, 116, U.S. Census Bureau, 2012-2016 American Community Survey Estimates.
Note: * - Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County.

Federal assistance programs such as food stamps are another indicator of poverty or lack of resource access. Statewide social assistance programs like the Supplemental Nutritional Assistance Program (SNAP) and Temporary Assistance for Needy Families (TANF) aid individuals and families. In Clackamas County, TANF reaches approximately 1,083 families per month and SNAP helps to feed about 22,059 people per month.[33] Those reliant on state and federal assistance are more vulnerable in the wake of disaster because of a lack of personal financial resources and reliance on government support.

Education

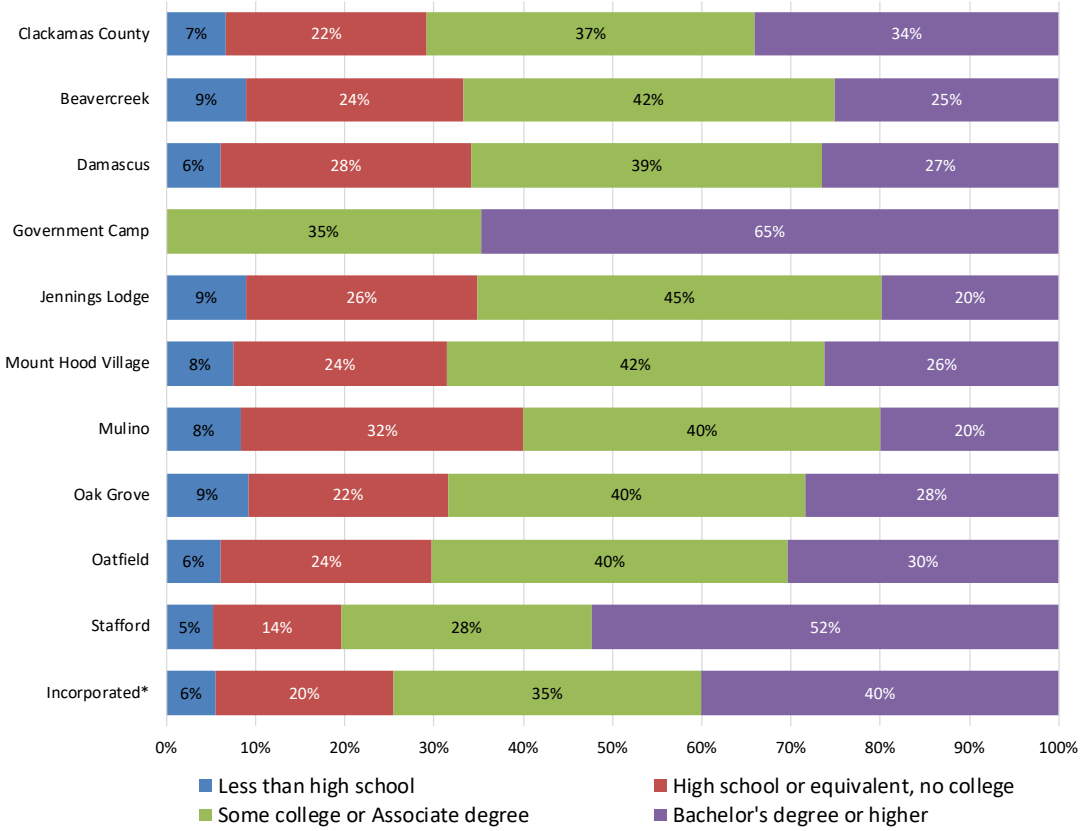
Educational attainment of community residents is also identified as an influencing factor in socio demographic capacity. Educational attainment often reflects higher income and therefore higher self-reliance. Widespread educational attainment is also beneficial for the regional economy and employment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

Approximately 7% 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 37% have some college or an Associate degree and

[32] Statewide Supplemental Nutrition Assistance Program Activity - Nov. 2014 (SSP, APD, and AAA combined); P. 3 of report. Temporary Assistance for Needy Families One and two Parent Families Combined; P. 3 of report. http://www.oregon.gov/dhs/assistance/Pages/data/main.aspx
[33] Sabatino, J. (2016). Oregon TANF Caseload FLASH, "One and Two Parent Families Combined", District 15; February 2018 data, and Sabatino, J. (2018). Oregon SNAP Program Activity, "SSP, APD and AAA Combined", District 15; February 2018 data. Retrieved from State of Oregon Office of Business Intelligence website: http://www.oregon.gov/DHS/ASSISTANCE/Pages/Data.aspx, accessed March 21, 2018.

34% have earned a Bachelor's degree or higher (Figure C-4). Beavercreek, Jennings Lodge, and Oak Grove have the lowest percentages of high school graduates. Government Camp and Stafford have the highest percentages of people with a Bachelor's degree or higher.

Figure C-4 Educational Attainment



Source: Social Explorer, Table 25, U.S. Census Bureau, 2012-2016 American Community Survey Estimates
Note: * - Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County.

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 the impacts of a disaster.

The Resilience Capacity Index recognizes those who lack health insurance or are impaired with sensory, mental or physical disabilities, have higher vulnerability to hazards and will likely require additional community support and resources. Clackamas County has 8% of its population without health insurance; Jennings Lodge (13%) and Mount Hood Village (12%) have the highest percentages. The percentage of uninsured changes with age, the highest rates of uninsured are within the 18 to 64-year cohort; Jennings Lodge and Mount Hood

Village have about 20% of this age cohort that is uninsured. The ability to provide services to the uninsured populations may burden local providers following a natural disaster.

Table C-13 Health Insurance Coverage

Jurisdiction	Total Population	Without Health Insurance							
		Total		Under 18 years		18 to 64 years		65+	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Clackamas County	393,403	31,774	8%	3,427	4%	28,107	12%	240	<1%
Beavercreek	4,034	211	5%	0	0%	211	9%	0	0%
Damascus	10,832	409	4%	71	3%	338	5%	0	0%
Government Camp	121	0	0%	0	0%	0	0%	0	0%
Jennings Lodge	7,727	977	13%	64	4%	913	19%	0	0%
Mount Hood Village	5,217	633	12%	44	5%	589	19%	0	0%
Mulino	2,797	206	7%	29	4%	177	11%	0	0%
Oak Grove	16,786	1,397	8%	0	0%	1,388	14%	9	< 1%
Oatfield	13,564	1,092	8%	56	2%	1,036	13%	0	0%
Stafford	1,945	13	1%	0	0%	13	1%	0	0%
Incorporated*	209,214	15,184	7%	1,720	3%	13,315	10%	149	< 1%

Source: Social Explorer, Table 146, U.S. Census Bureau, 2012-2016 American Community Survey Estimates.
Note: * - Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County.

The table below describes disability status of the population. Approximately 12% of the Clackamas County civilian non-institutionalized population identifies with one or more disabilities. Government Camp has the highest percentage of its total population with a disability (36%), as well as individuals under 18 and 65 years and older with a disability (hearing and/or cognitive).

Table C-14 Disability Status by Age Group

Jurisdiction	Population Estimate^	With a disability		Under 18 years with a disability		65 years and over with a disability	
		Estimate	Percent	Estimate	Percent**	Estimate	Percent**
Clackamas County	393,403	46,829	12%	3,409	4%	21,261	34%
Beavercreek	4,034	465	12%	23	3%	247	30%
Damascus	10,832	1,499	14%	152	7%	457	27%
Government Camp	121	43	36%	16	100%	27	100%
Jennings Lodge	7,727	1,034	13%	57	3%	426	36%
Mount Hood Village	5,217	1,084	21%	65	8%	339	28%
Mulino	2,797	291	10%	35	4%	157	41%
Oak Grove	16,786	2,848	17%	98	3%	1,430	43%
Oatfield	13,564	1,430	11%	126	5%	860	27%
Stafford	1,945	322	17%	20	4%	88	34%
Incorporated*	209,214	22,045	11%	1,733	3%	10,123	34%

Source: Social Explorer, U.S. Census Bureau, 2012-2016 American Community Survey Estimates, Table B18101.
Notes: ^ Non-institutionalized civilian population, * Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County, ** Percent of age group

Table C-15 displays disability status of the population by type and age. Older populations tend to have more disabilities than younger populations in Clackamas County. Approximately 19% of the population 65 and over has an ambulatory disability, 17% have a hearing disability, and 13% have an independent living disability. Among unincorporated

communities 30% of Government Camp's population has a hearing disability, 10% of Jennings Lodge and Oak Grove populations 65 and over have a vision disability, 44% of Government Camps population under 18 has a cognitive disability, approximately one-quarter of Jennings Lodge, Mulino, and Oak Grove populations 65 and over population have an ambulatory disability, and 13% of Jennings Lodge's population 65 and over has an independent living disability.[34] Depending on the type of disability outreach, mitigation, and response efforts may need to be adjusted.

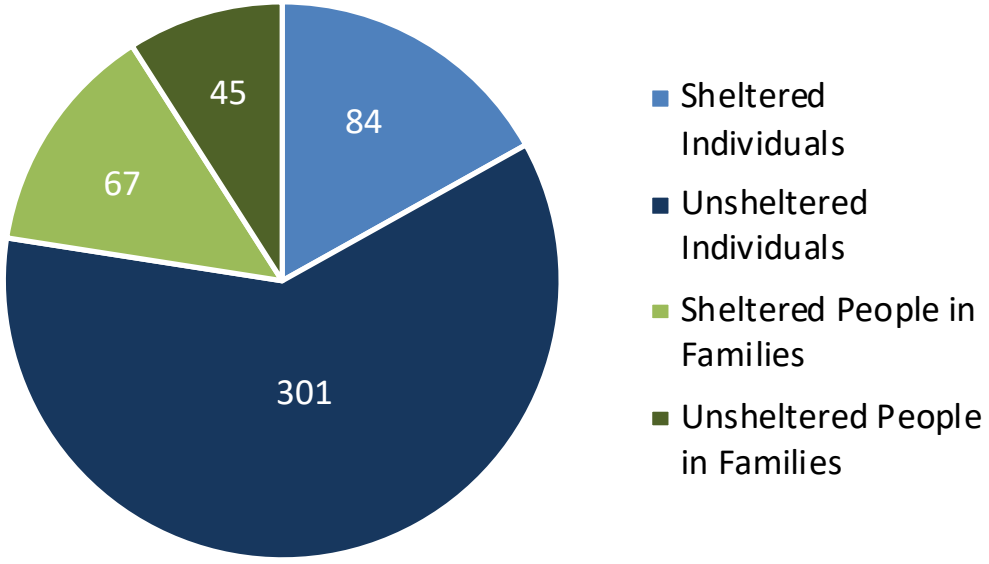
Table C-15 Disability Type by Age Group – Clackamas County

	Hearing Disability	Vision Disability	Cognitive Disability	Ambulatory Disability	Self-Care Disability	Independent Living Disability
Total Population^	4%	2%	5%	6%	2%	5%
Under 18*	1%	< 1%	4%	< 1%	1%	-
18 to 64*	2%	1%	4%	4%	2%	3%
65 and over*	17%	5%	9%	19%	7%	13%

Source: Social Explorer, U.S. Census Bureau, 2012-2016 American Community Survey Estimates, Tables B18102 through B18106.
Notes: ^ Non-institutionalized civilian population, * Percent of age group

In 2017, 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 497 individuals and persons in families in Clackamas County identify as homeless; 30%, 151 people, were sheltered (84 individuals and 67 persons in families), and 70%, 346 people, were unsheltered (301 individuals and 45 persons in families).

Figure C-5 Clackamas County PIT Homeless Count (2017)



Source: Oregon Housing and Community Services, 2017 Point-in-Time Homeless Count

[34] Social Explorer, U.S. Census Bureau, 2012-2016 American Community Survey Estimates, Tables B18102 through B18106

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 5% of all occupied households, and 14% of renter-occupied households, have no vehicle available (Table C-16). The percentage of all households without a vehicle available is greatest in Jennings Lodge (13%) and Oak Grove (13%); for renter occupied households the percentage is greatest in Oak Grove (27%), Oatfield (26%), and Jennings Lodge (23%). 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 C-16 Vehicles Available (All Households and Renter Occupied)

	Occupied Housing			Renter Occupied Housing		
Jurisdiction	Housing Units	No Vehicle (Percent)	One Vehicle (Percent)	Housing Units	No Vehicle (Percent)	One Vehicle (Percent)
Clackamas County	151,150	5%	28%	47,026	14%	43%
Beavercreek	1,453	3%	11%	105	17%	19%
Damascus	3,723	2%	13%	388	4%	25%
Government Camp	53	0%	17%	0	-	-
Jennings Lodge	3,139	13%	34%	1,497	23%	40%
Mount Hood Village	2,215	5%	28%	543	12%	36%
Mulino	838	0%	13%	133	0%	0%
Oak Grove	7,038	13%	30%	2,756	27%	39%
Oatfield	5,201	6%	24%	1,025	26%	26%
Stafford	718	0%	24%	162	0%	48%
Incorporated*	81,742	5%	31%	28,061	13%	46%

Source: Social Explorer, Tables 182 and 199, U.S. Census Bureau, 2012-2016 American Community Survey Estimates

Note: * - Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County.

Synthesis

Socio demographic capacity is a significant indicator of county hazard resiliency. Clackamas County is the third largest county in the state of Oregon, in terms of population. With 404,980 residents, resiliency and hazard mitigation efforts can be a lot harder to manage. The characteristics and qualities of the community population such as age, race, education, 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 ultimately affecting future resiliency of Clackamas County.

One important thing to consider is that there are a high number of residents who are not proficient in English. Four-percent (about 16,600) residents are not proficient in English.

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. It is also important to think about the county's population in terms of its age groups; it is important to cater information towards each of these populations individually, as it is necessary to be able to reach out to all age groups. In 2016, the percentage of residents age 65 and older was 16%; by 2035, that percentage is expected t increase to 22%. While disasters don't affect certain age groups more than others, information can be dispersed and catered depending on who may be the most vulnerable.

Clackamas County socio-economic factors to consider include:

- With 1% growth from 2010 to 2016, the median household income across the county has increased to $68,915. "Real" median household incomes are decreasing in all rural communities except Oak Grove, Oatfield, and Stafford.
- 9% of the population is considered in poverty; the rates are highest in Government Camp, Jennings Lodge, and Mulino.
- Children in poverty is greatest in Jennings Lodge, Mulino, Oak Grove, and Damascus, while those 65 or over in poverty is greatest in Jennings Lodge.
- 12% of the population has a disability, 34%, of this population is 65 years or older

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 C-17 indicates where population related physical infrastructure vulnerabilities exist in relation to each of the natural hazards profiled in Volume I, Section 2.

Table C-17 Clackamas County Population related Infrastructure Vulnerabilities

Clackamas County Asset	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Schools (particularly those identified in the 2007 Rapid Visual Survey)		X							
Childcare Facilities		X	X	X		X	X		
Adult Care Homes/ Assisted Living Facilities		X	X	X			X		
Homeonwers in the Wildfire Urban Interface							X		
Hospitals		X		X			X	X	X
Mass Transit		X		X				X	X
Clackamas County Jail		X							

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

The evaluation of regional affordability supplements the identification of Social/demographic capacity indicators, i.e. median income, and is a critical analysis tool to understanding the economic status of a community. This information can capture the likelihood of individuals' ability to prepare for hazards, through retrofitting homes or purchasing insurance. If the community reflects high-income inequality or housing cost burden, the potential for home-owners and renters to implement mitigation can be drastically reduced. Therefore, regional affordability is a mechanism for generalizing the abilities of community residents to get back on their feet without Federal, State or local assistance.

Income Equality

Income equality is a measure of the distribution of economic resources, as measured by income, across a population. It is a statistic defining the degree to which all persons have a similar income. The table below illustrates the county and cities level of income inequality. The Gini index is a measure of income inequality. The index varies from zero to one. A value of one indicates perfect inequality (only one household has any income). A value of zero indicates perfect equality (all households have the same income).[35]

Table C-18 shows that the countywide income inequality coefficient is 0.44. The areas of greatest income inequality are Jennings Lodge (0.46) and Stafford (0.44). The areas of greatest income equality are Government Camp (0.31), Oatfield (0.37), and Mulino (0.38). 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[36].

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

[36] Susan Cutter, Christopher G. Burton, and Christopher T. Emrich. 2010. "Disaster Resilience Indicators for Benchmarking Baseline Conditions," Journal of Homeland Security and Emergency Management 7, no.1: 1-22

Table C-18 Regional Income Inequality

Jurisdiction	Income Inequality Coefficient
Clackamas County	0.44
Beavercreek	0.41
Damascus	0.40
Government Camp	0.31
Jennings Lodge	0.46
Mount Hood	0.41
Mulino	0.38
Oak Grove	0.41
Oatfield	0.37
Stafford	0.44
Incorporated*	na

Source: Social Explorer, Table 157, U.S. Census Bureau,
2012-2016 American Community Survey Estimates
Note: * - Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County.

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.[37] Households spending more than 30% are considered housing cost burdened. Table C-19 displays the percentage of homeowners and renters reflecting housing cost burden across the region.

Countywide roughly 45% of homeowners with a mortgage have a housing cost burden, compared to over 47% of renters. The communities of Mount Hood Village, Mulino, Government Camp, Beavercreek, and Stafford have more than 50% of owners (with or without a mortgage) with a housing cost burden. Amongst renters, Oak Grove, Oatfield, Jennings Lodge, and Mount Hood Village 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.[38] This disparity imposes challenges for a community recovering from a disaster as housing costs may exceed the ability of local residents to repair or move to a new location. These populations may live paycheck to paycheck and are extremely dependent on their employer, in the event their employer is also impacted it will further the detriment experienced by these individuals and families.

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

Table C-19 Households Spending > 30% of Income on Housing

Jurisdiction	Owners		Renters
	With Mortgage	Without Mortgage	
Clackamas County	45%	22%	47%
Beavercreek	58%	26%	15%
Damascus	49%	33%	40%
Government Camp	0%	64%	-
Jennings Lodge	41%	21%	54%
Mount Hood Village	52%	32%	51%
Mulino	64%	26%	32%
Oak Grove	43%	31%	61%
Oatfield	36%	16%	58%
Stafford	51%	36%	12%
Incorporated*	43%	21%	48%

Source: Social Explorer, Tables 103 and 109, U.S. Census Bureau, 2012-2016 American Community Survey Estimates.
Note: * - Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County.

Economic Diversity

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

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

Table C-20 shows that Clackamas County has an economic diversity rank of 1 as of 2016, 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 stayed constant since 2013.

Table C-20 Regional Herfindahl Index Scores

County	2013			2016		
	Employment	Number of Industries	State Rank	Employment	Number of Industries	State Rank
Clackamas	127,242	267	1	140,827	274	1
Multnomah	381,347	281	2	416,693	285	4
Washington	235,258	261	16	260,196	261	18

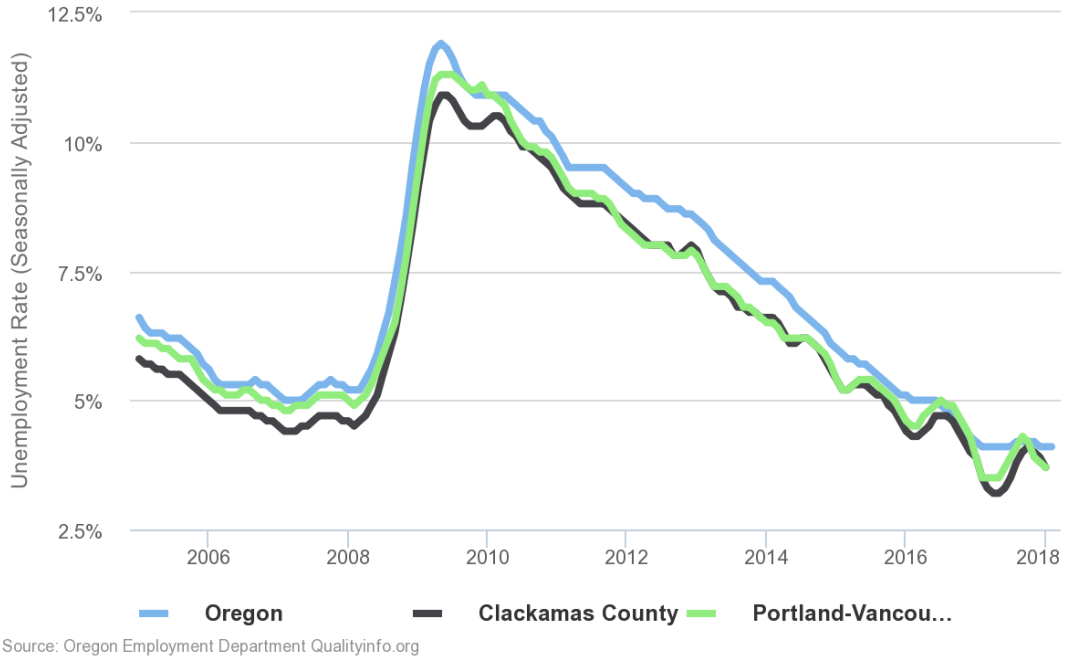
Source: Oregon Employment Department

While illustrative, economic diversity is not a guarantor of economic vitality or resilience. Clackamas County, as of December 2017, is not listed as an economically distressed community as prescribed by Oregon Law. The economic distress measure is based on indicators of decreasing new jobs, average wages and income, and is associated with an increase of unemployment.[39]

Employment and Wages

According to the Oregon Employment Department (Figure C-6), unemployment has declined since 2009 (10.9%) and remains at a rate similar to the State of Oregon and other counties in the region (3.8%).

Figure C-6 Unemployment Rate



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

Labor and Commute Shed

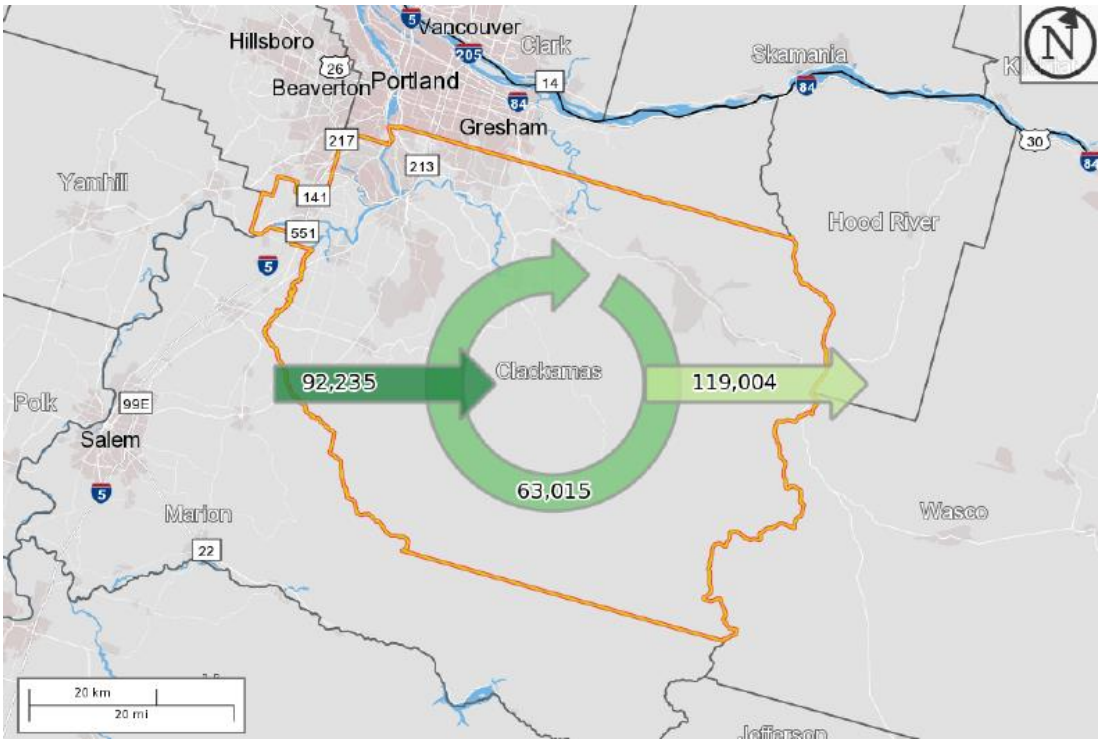
Most hazards can happen at any time during the day or night. It may be possible to give advance warning to residents and first responders who can take immediate preparedness and protection measures, but the variability of hazards is one part of why they can have such varied impact. A snow storm during 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 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

[39] Business Oregon – Oregon Economic Data "Distressed Communities List", http://www.oregon4biz.com/Publications/Distressed-List/

intended to document where county residents work and where people who work in Clackamas County reside.

Clackamas County employers draw in more than 59% (92,235) of their workers from outside the county. The Clackamas County economy is a cornerstone of regional economic vitality. Figure C-7 shows the county's laborshed; the map shows that about 41% of workers live and work in the county (63,015), 59% of workers come from outside the county (92,235), and about 65% of residents work outside of the county (119,004).

Figure C-7 Clackamas County Laborshed



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

Table C-21 shows where workers commute to, who reside in Clackamas County. Approximately two-thirds of Clackamas County employed residents work outside of the County; 36.3% work in Multnomah County. Almost 55% of commuters outside of the County work in the Portland Metro Area (including 1.5% who commute over the Columbia River to Clark County, WA) and another 4.2% work in neighboring Marion County. Approximately 6% of workers are employed in other regions.

Table C-21 Commute Shed (Where Workers are Employed who Live in Clackamas County), 2015

Jurisdiction	Number of Jobs	Share
All Jurisdictions	182,019	100%
Metro Area	162,589	89.3%
Multnomah County	65,986	36.3%
Clackamas County	63,015	34.6%
Washington County	30,844	16.9%
Clark County (WA)	2,744	1.5%
Marion County	7,632	4.2%
Yamhill County	1,528	0.8%
Lane County	1,554	0.9%
King County (WA)	804	0.4%
Deschutes County	733	0.4%
Linn County	706	0.4%
All other Locations	6,473	3.6%

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

Table C-22 shows where workers live who work in Clackamas County. Approximately 60% of Clackamas County workers live outside of the County; 24.3% live in Multnomah County. Almost 44% of commuters into the County live elsewhere in the Portland Metro Area (including 4.2% who commute over the Columbia River from Clark County, WA) and another 5.2% work in neighboring Marion County. Approximately 11% of workers live in other regions.

Table C-22 Labor Shed (Where Workers Live who are Employed in Clackamas County), 2015

Jurisdiction	Number of Jobs	Share
All Jurisdictions	155,250	100%
Metro Area	129,944	83.7%
Clackamas County	63,015	40.6%
Multnomah County	37,751	24.3%
Washington County	22,682	14.6%
Clark County (WA)	6,496	4.2%
Marion County	8,137	5.2%
Yamhill County	2,519	1.6%
Lane County	1,870	1.2%
Deschutes County	1,226	0.8%
Columbia County	1,117	0.7%
Polk County	1,079	0.7%
All other Locations	9,358	6.0%

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). Table C-23 shows that 86% of Clackamas County commuters utilized motorized vehicles (cars, trucks, vans, or motorcycles) and an additional 3% use public transportation. Three-percent of commuters bike or walk to work, and 7% work from home. Stafford (17%), Beavercreek (15%), and Damascus (10%) have the highest percentage of workers who work from home.

Table C-23 Means of Transportation to Work

Jurisdiction	Workers (16 and older)	Motorized Vehicle^ (Percent)	Public Transportation (Percent)	Bike/Walked (Percent)	Other (Percent)	Worked at Home (Percent)
Clackamas County	188,117	86%	3%	3%	1%	7%
Beavercreek	1,851	82%	0%	1%	2%	15%
Damascus	4,934	87%	1%	1%	<1%	10%
Government Camp	34	100%	0%	0%	0%	0%
Jennings Lodge	3,604	87%	4%	4%	0%	5%
Mount Hood Village	2,182	84%	3%	5%	0%	7%
Mulino	1,082	91%	2%	2%	0%	5%
Oak Grove	7,872	86%	5%	4%	1%	4%
Oatfield	6,448	84%	5%	3%	0%	8%
Stafford	804	77%	1%	3%	2%	17%
Incorporated*	101,029	86%	3%	3%	1%	7%

Source: Social Explorer, Table 128, U.S. Census Bureau, 2012-2016 American Community Survey Estimates
Notes: ^ - includes car, truck, van, or motorcycle, * Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County.

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.

Industry

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

This is of specific concern when the businesses belong to the basic sector industry. Basic sector industries are those that are dependent on sales outside of the local community; they bring money into a local community via employment. The farm and ranch, information, and wholesale trade industries are all examples of basic industries. Non-basic sector industries are those that are dependent on local sales for their business, such as retail trade, construction, and health services.

Employment by Industry

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

Table C-24 identifies Employment by industry. The industry sectors in Clackamas County with the highest percentage of the workforce are Education and Health Services (14.0%), Professional and Business Services (12.5%), Retail Trade (11.9%), Manufacturing (11.0%), Government (10.8%; 8.4% local government), and Leisure and Hospitality (10.0%).

Table C-24 Total Non-Farm Employment by Industry 2016, Expected Growth 2024

	2016				Percent Change in Employment (2012-2016)	Employment Forecast* (2014-2024)
Employment Sector	Firms	Employees	Percent Workforce	Average Wage		
Total Payroll Employment	14,258	157,738	100%	$49,501	13.0%	15%
Total Private	13,936	140,773	89.2%	$49,640	14.0%	17%
Natural Resources and Mining	328	4,172	2.6%	$32,747	2.2%	-1%
Construction	1,736	11,104	7.0%	$54,189	30.1%	24%
Manufacturing	612	17,419	11.0%	$63,342	5.8%	9%
Trade, Transportation & Utilities	2,592	33,819	21.4%	$44,845	9.5%	13%
Wholesale Trade	1,148	10,955	6.9%	$67,255	9.0%	12%
Retail Trade	1,154	18,780	11.9%	$31,186	11.7%	13%
Information	256	2,069	1.3%	$80,149	0.7%	8%
Financial Activities	1,369	7,425	4.7%	$72,440	2.6%	10%
Professional and Business Services	2,372	19,662	12.5%	$64,319	24.1%	25%
Education and Health Services	1,375	22,038	14.0%	$52,128	16.4%	23%
Leisure and Hospitality	1,044	15,799	10.0%	$19,072	17.6%	22%
Other Services	2,177	7,225	4.6%	$28,886	22.4%	12%
Private Non-Classified	74	41	0.0%	$60,873	-32.8%	-
Government	322	16,965	10.8%	$48,349	4.7%	3%
Federal	52	1,079	0.7%	$65,241	-13.9%	-6%
State	35	2,640	1.7%	$36,131	15.3%	5%
Local	234	13,246	8.4%	$49,408	4.6%	3%

Source: Oregon Employment Department, "2012 and 2016 Covered Employment and Wages Summary Reports" and "Regional Employment Projections by Industry & Occupation 2014-2024". 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.

High Revenue Sectors

Table C-25 shows the revenue generated by each reported economic sector (not all sectors are reported). In 2012, the three sectors with the highest revenue, each with revenues over $5 billion, were Wholesale Trade, Manufacturing, and Retail Trade. All of the reported sectors combined generated more than $21.77 billion in revenue for the county in 2012.

Table C-25 Revenue of Top Sectors in Clackamas County 2007 and 2012

	Firms		Sector Revenue		Percent Change in Revenue
Sector Meaning (NAICS code)	2007	2012	2007^ ($1,000)	2012 ($1,000)	(2007 to 2012)
Wholesale trade	598	563	$5,858,741	$5,388,581	-8%
Manufacturing	619	553	$6,274,736	$5,371,545	-14.4%
Retail trade	1,269	1,188	$5,641,022	$5,125,309	-9.1%
Health care and social assistance	963	1,136	$1,884,376	$2,424,207	28.6%
Professional, scientific, and technical services	1,238	1,231	$0	$1,215,906	-
Accommodation and food services	775	777	$672,441	$637,512	-5.2%
Administrative and support and waste management and remediation services	644	616	$530,543	$522,126	-1.6%
Transportation and warehousing(104)	-	276	-	$491,387	-
Real estate and rental and leasing	693	564	$623,345	$451,887	-27.5%
Arts, entertainment, and recreation	147	150	$120,817	$104,327	-13.6%
Educational services	81	100	$73,487	$39,646	-46.1%
Utilities	-	16	-	Q	
Information	167	165	$0	N	-
Finance and insurance	-	700	-	N	-
Other services (except public administration)	660	677	$348,086	D	-
Total	7,854	8,712	$22,027,594	$21,772,433	-1.2%

Source: U.S. Census Bureau, 2007 and 2012 Economic Census, Table EC1200A1.
D = Withheld to avoid disclosing data for individual companies; data are included in higher level totals
N = Not available or not comparable
Q= Revenue not collected at this level of detail for multi-establishment firms
^ 2007 dollars are adjusted for 2012 using the Social Explorer Inflation Calculator.

Clackamas County relies on both basic and non-basic sector industries and it is important to consider the effects each may have on the economy following a disaster. Basic sector businesses have a multiplier effect on a local economy that can spur the creation of new jobs, some of which may be non-basic. The presence of basic sector jobs can help speed the local recovery; however, if basic sector production is hampered by a natural hazard event, the multiplier effect could be experienced in reverse. In this case, a decrease in basic sector purchasing power results in lower profits and potential job losses for the non-basic businesses that are dependent on them.

The *Wholesale trade* sector of Clackamas County brought in the most revenue during 2012, generating more than $5.39 billion. Wholesale trade sector is highly reliant upon transportation network for distribution of merchandise. This sector is reliant upon retail trade and manufacturing to purchase their merchandise. Depending on the type and scale, a disaster could affect all segments of the sector.

The *Manufacturing* sector of Clackamas County brought in the second most revenue during 2012, generating more than $5.37 billion. As revenue is dependent on how fast a product can be made and distributed to consumers, this sector is highly dependent on its facility. It is highly dependent upon the transportation network in order to access supplies and send finished products to outside markets. As a base industry, manufacturers are not dependent

on local markets for sales, which contribute to the economic resilience of this sector. It is important to note that depending on the severity of a natural disaster and the pace of recovery, revenue generated from this sector could be greatly impacted during a natural hazard event.

The *Retail Trade* sector of Clackamas County brought in the third highest revenue in 2012, generating almost $5.13 billion. The *Retail Trade* sector typically relies on local residents and tourists and their discretionary spending ability. Residents' discretionary spending diminishes after a natural disaster when they must pay to repair their homes and properties. In this situation, residents will likely concentrate their spending on essential items that would benefit some types of retail (e.g., grocery) but hurt others (e.g., gift shops). The potential income from tourists also diminishes after a natural disaster as people are deterred from visiting the impacted area. Retail trade is also largely dependent on wholesale trade and the transportation network for the delivery of good for sale. Disruption of the transportation system could have severe consequences for retail businesses. In summary, depending on the type and scale, a disaster could affect specific segments of retail trade, or all segments.

In the event that any of these primary sectors are impacted by a disaster, Clackamas County may experience a significant disruption of economic productivity.

Future Employment in Industry

Table C-24 shows that between 2012 and 2016, the sectors that experienced the largest percent growth were Construction (30.1%), Professional and Business Services (24.1%), Other Services (22.4%), Leisure and Hospitality (17.6%), and Education and Health Services (16.4%). Some of these sectors often require more training and education, while others require less education and have lower wages.

Sectors that are anticipated to be major employers in the future also warrant special attention in the hazard mitigation planning process. Table C-24 shows that, between 2014 and 2024, the largest employment growth in the region is anticipated within Professional and Business Services (25%), Construction (24%), Education and Health Services (23%), and Leisure and Hospitality (22%). Mitigation activities that respond to the needs of these sectors may help to ensure the resilience of the economy and help the community stay open for business following a disaster.

Synthesis

Regional economic capacity refers to the present financial resources and revenue generated in the community to achieve a higher quality of life. Forms of economic capital include income equality, housing affordability, economic diversifications, employment, and industry. 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.

The current and anticipated financial conditions of a community are strong determinants of community resilience, as a strong and diverse economic base increases the ability of individuals, families and the community to absorb disaster impacts for a quick recovery. Because Local Government, Education and Health Services, and Manufacturing are key to post-disaster recovery efforts, the region is bolstered by its diverse and strong employment

sectors. The county's economy is expected to grow by 2024. 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 from an economic focus are imperative and should focus on risk management for the county's dominant 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 of 3.8% that is about equal with that of the state. And although the county is ranked number 1 as having the most diverse economy throughout all of Oregon, more Clackamas County residents are paying greater than 35% of their income on housing, than the State as a whole.

Several industries, including Construction, Professional and Business Services, and Other Services, saw significant increases in employment from 2012 to 2016. While relying heavily on its top revenue-producing industries, wholesale trade, manufacturing, and retail, it is important for the county to consider the economic impacts that affect its residents in the event of a disaster. Strategies and actions to reduce vulnerability from an economic focus are imperative and should focus on risk management for the county's dominant industries.

Table C-26 indicates where economy related physical infrastructure vulnerabilities exist in relation to each of the natural hazards profiled in Volume I, Section 2.

Table C-26 Clackamas County Economy Related Infrastructure Vulnerabilities

Clackamas County Asset	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Clackamas Town Center		X							
Precision Cast Parts		X							
Fred Meyer Distribution Center		X							
Agriculture (feed procurement, seasonal worker procurement, harvest delivery, refrigeration, etc.)	X		X				X	X	X
Forestry							X	X	X
Tourism (Hotels and Restaurants)		X		X			X	X	X
County/City water supplies	X	X		X	X				
Transportation Corridors/Bridges		X			X				

Source: Clackamas County HMAC

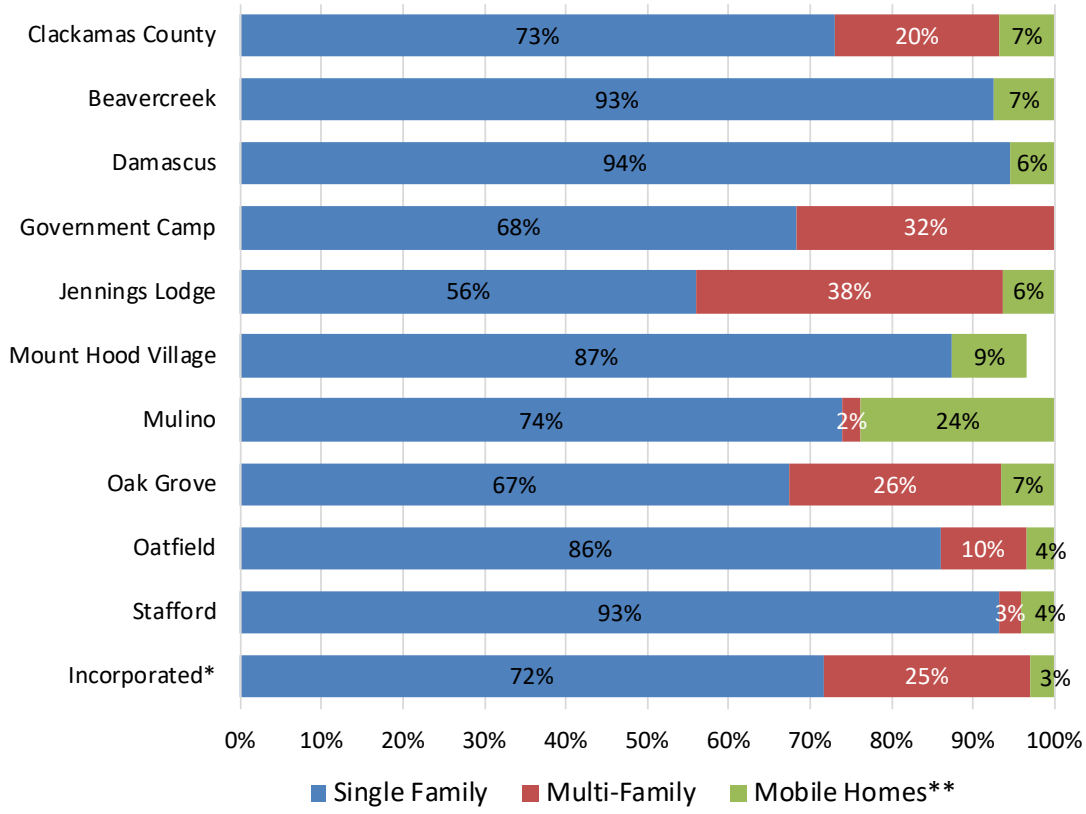
Physical Infrastructure Capacity

Physical infrastructure capacity refers to the built environment and infrastructure that supports the community. The various forms, quantity, and quality of built capital mentioned above contribute significantly to community resilience. Physical infrastructures, including utility and transportation lifelines, are critical during a disaster and are essential for proper functioning and response. The lack or poor condition of infrastructure can negatively affect a community's ability to cope, respond and recover from a natural disaster.

Housing

The table below identifies the types of housing most common throughout the county. Of particular interest are mobile homes, which account for about 7% of the housing in countywide; 24% in Mulino (Figure C-8). 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 C-8 Housing Profile



Source: Social Explorer, Table 97, U.S. Census Bureau, 2012-2016 American Community Survey
Note: * - Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County, ** Also includes boats, RVs, vans, etc. that are used as a residence.

Aside from location and type of housing, the year structures were built has implications. 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 (2008 for Johnson City) 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.[40] 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 C-27.

Table C-27 Oregon's Seismic Design Level Benchmark Years

Building Type	Year Built	Design Level	Basis
Single Family Dwelling (including Duplexes)	prior to 1976 1976-1991 1992-2003 2004-present	Pre Code Low Code Moderate Code High Code	Interpretation of Judson (2012)
Manufactured Housing	**prior to 2003** 2003-2010	Pre Code Low Code	Interpretation of Oregon Manufactured Dwelling Special Codes (Oregon Building Codes Division, 2002)
	2011-present	Moderate Code	Interpretation of Oregon Manufactured Dwelling Special Codes Update (Oregon Building Codes Division, 2010)
All other buildings	prior to 1976 1976-190 1991-present	Pre Code Low Code Moderate Code	Interpretation of Oregon Benefit-Costs Analysis Tool (Business Oregon, 2015, p. 24)

Source: DOGAMI, Lower Columbia-Sandy Watershed Natural Hazard Risk Report (March 2018 Draft), Table 10.1.

The Oregon Department of Geology and Mineral Industries (DOGAMI) conducted a multi-hazard risk assessment (DOGAMI, IMS-59) for portions of unincorporated Clackamas County within the Lower Columbia-Sandy Watershed, including the unincorporated communities of Government Camp and The Villages at Mt. Hood. The study was funded through the FEMA Risk MAP program and was completed in 2018. The Risk Report provides a quantitative risk

[40] State of Oregon Building Codes Division. *Earthquake Design History: A summary of Requirements in the State of Oregon*, February 7, 2012. http://www.oregon.gov/OMD/OEM/osspac/docs/history_seismic_codes_or.pdf

assessment that informs communities of their risks related to the following natural hazards: channel migration, earthquake, flood, lahar (volcanic event), landslide, and wildfire.

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 C-28. Fifty-percent of buildings, representing 40% of total building value, within the County were built prior to seismic codes.

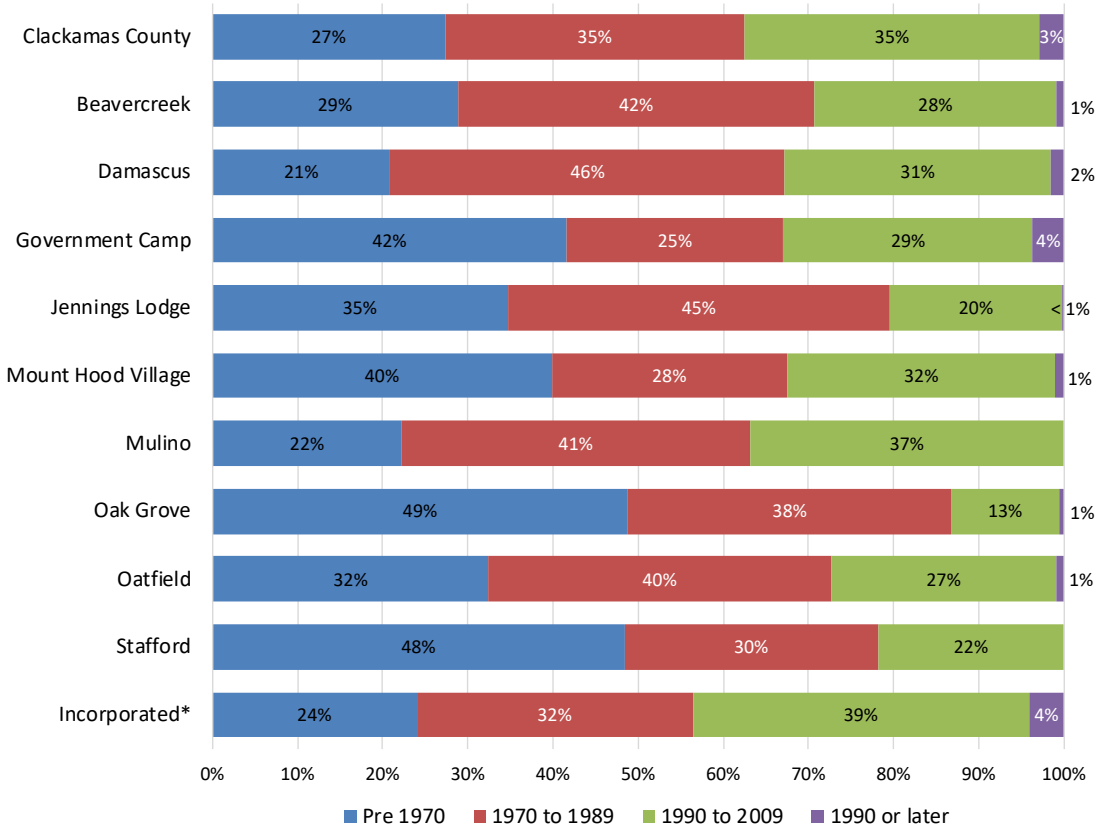
Table C-28 Building Statistics by Seismic Design Level

Seismic Design Level	Number of Buildings	Building Percent	Building Value ($ Million)	Building Value Percent
Pre Code	89,647	50%	24,922	40%
Low Code	43,530	24%	19,523	31%
Moderate Code	30,638	17%	11,550	19%
High Code	15,349	9%	6,394	10%
Total	**179,164**	**100%**	**62,389**	**100%**

DOGAMI, Lower Columbia-Sandy Watershed Natural Hazard Risk Report (March 2018 Draft), Table 10.2.

Figure C-9 shows that, countywide, 27% of the housing stock was built prior to 1970, before the implementation of floodplain management ordinances; Oak Grove and Stafford have about one-half of their housing units built prior to 1970.

Figure C-9 Year Structure Built



Source: U.S. Census Bureau, 2012-2016 American Community Survey Estimates, Table B25034
Note: * - Includes portions of Lake Oswego, Rivergrove, and Wilsonville that are outside Clackamas County; does not include portions of Portland and Tualatin that are inside Clackamas County.

Countywide, 62% of the housing stock was built before 1990 and the codification of stricter seismic building standards (Table C-27). Government Camp (4%) and the incorporated cities (4%) have had the largest percent growth since 2010.

Infrastructure Profile

Physical infrastructure such as dams, roads, bridges, railways, and airports support Clackamas County communities and economies. Critical facilities are those facilities that are vital in government response and recovery activities and are important to consider as there can be serious secondary impacts to such facilities when disrupted. Critical facilities and infrastructure can be a wide range of things depending on the social, environmental, economic, and physical makeup of the area under consideration. Such facilities can include emergency services, communication services, transportation systems, government facilities, healthcare and public health facilities, information technology, water services, and energy generation and transmission. Due to the fundamental role that infrastructure plays both pre- and post-disaster, special attention in the context of creating more resilient communities is important. The information provided in this section will outline important infrastructures throughout the county which will help provide a basis for informed decisions about how to reduce the county's infrastructural vulnerabilities to natural hazards.

Dams

These critical infrastructure pieces not only protect water resources that are used for drinking, agriculture, and recreation, but they protect downstream development from inundation. Dams may also be multifunction, serving two or more of these purposes.

The National Inventory of Dams, NID, which is maintained by the United States Army Corps of Engineers, is a database of approximately 76,000 dams in the United States. The NID does not include all dams in the United States. Rather, the NID includes dams that are deemed to have a high or significant hazard potential and dams deemed to pose a low hazard if they meet inclusion criteria based on dam height and storage volume.

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

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

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

The Oregon Water and Resources Department maintains an inventory of all dams located in Oregon. There are a total of 69 dams located throughout Clackamas County (Table C-29). Three dams are categorized as high hazard in Clackamas County Bull Run Dam 1, Bull Run

Dam 2, and North Fork Dam. There are also 19 dams categorized as significant hazard and 42 low hazard dams.

Table C-29 Clackamas County Dam Inventory

Threat Potential	Number of Dams	Dam Name (storage over 9,500 cu.ft.)
High	8	*Bull Run Dam 1 (Upper, 33,760)* , Bull Run Dam 2 (Lower, 21,000), North Fork Dam (21,000)
Significant	19	-
Low	42	Timothy Lake (81,000), River Mill Dam (12,200), Lake Oswego Dam (9,800)
Total	**69**	

Source: Oregon Water Resources Department, "Dam Inventory Query"

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

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.

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 24 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.

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 via I-5 or along the Columbia via I-84. Other highways that service Clackamas County include:

- 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 and 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 and create gridlock, and will make evacuations difficult.

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 C-30 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.[41] The table shows that overall 20% of the county owned bridges are distressed, compared to 29% of the city owned bridges and 19% of State Owned (ODOT) bridges. There are 16 historic bridges in the County; 9 state-owned and 7 county-owned.

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

Table C-30 Bridge Inventory

Bridge Owner	Number	Distressed	Percent Distressed	Historic
State	114	22	19%	9
County	180	36	20%	7
City	17	5	29%	N/A
Total	311	63	20%	16

Source: Oregon Department of Transportation, 2014; Oregon Department of Transportation (2013), Oregon's Historic Bridge Field Guide
Note: ODOT bridge classifications overlap and suC-total is not used to calculate percent distressed, calculation for ODOT distressed bridges accounts for this overlap.

Utility Lifelines

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

The network of electricity transmission lines running throughout Clackamas County is operated by Portland General Electric.[42] 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.[43] These lines may be vulnerable as infrequent natural hazards, like earthquakes, could disrupt service to natural gas consumers across the region.

Seismic lifeline

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.[44]

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.

[42] Allan, Stuart et. al., Atlas of Oregon. Pg. 102.
[43] Williams, Gas Pipeline, Natural Gas Transportation & Storage. Accessed 3 January 2011. http://www.williams.com/gas_pipeline/.
[44] CH2MHILL, Prepared for Oregon Department of Transportation. Oregon Seismic Lifeline Routes Identification Project, *Lifeline Selection Summary Report,* May 15 2012.

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. Table C-31 identifies the types and numbers the critical facilities located throughout Clackamas County.

Clackamas County is served by the Clackamas County Sheriff's office, as well as individual city law enforcement teams. The county Sheriff's office provides services to unincorporated parts of the county as well as contracts police services to the incorporated cities of Wilsonville, Estacada, Happy Valley, and Damascus, while the rest of the incorporated cities have their own law enforcement agency that provides services within the city limits. [45] There are 13 structural fire agencies and two (2) wildland fire agencies for a total of 15. Clackamas Fire District #1 is one of the largest fire protection districts in Oregon, serving over 220,000 residents across the region.[46] 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.[47]

Table C-31 Critical Facilities in Clackamas County

Type of Facility	County Total
Hospitals (# of beds)	3 (408)
Police Stations	11
Fire & Rescue Stations	17
Dams	69 (8 Hight Threat)
Bridges	285
State	114 (22 distressed)
County	154 (36 distressed)
City	17 (5 distressed)
School Districts & Institutes of Higher Education	10 School Districts, 1 Community College, 1 University
Airports - General Aviation	4

Source: State of Oregon Natural Hazards Mitigation Plan, Region 2: Northern Willamette Valley/Portland Metro Regional Profile, 2012. Updated 2018.

[45] Clackamas County Website, Clackamas County Sheriff's Office. Accessed 30 December 2011. http://www.clackamas.us/sheriff/info.jsp?name=contractcities.htm.
[46] Clackamas County Wildfire Protection Plan.
[47] Ibid.

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.[48] 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). The County's Disaster Management Office is also located within the C-COM building.[49]

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.[50]

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.

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[48] Clackamas County Website. Accessed 30 December 2011. http://www.clackamas.us/about.htm.
[49] Clackamas County Website, Clackamas County Communications. Accessed 30 December 2011. http://clackamas911.org/.
[50] Clackamas County Website. Clackamas County Social Services Resource Guide. https://www.clackamas.us/socialservices/housingresources.html#assisted

- 73% of the housing stock in Clackamas County is single-family units, another 27% is comprised of Mobile Homes and Multi-Family buildings, which are particularly prone to the effects of natural hazards and disasters.
- 74% of the total housing units throughout the county were built before building codes enforced a stricter policy for seismic building standards (pre-code or low code).
- 29% of the housing stock is renter-occupied.

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 eight (8) dams throughout the county classified with a high threat potential. 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 C-32 indicates where built infrastructure related vulnerabilities exist in relation to each of the natural hazards profiled in Volume I, Section 2.

Table C-32 Clackamas County Built Infrastructure Related Vulnerabilities

Clackamas County Asset	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Homeowners in Forest Edge Apartments		X			X				
Carver Mobile Home Ranch				X					X
Development on established floodplains, historic and pre-historic debris flow plains		X		X	X	X			
Decentralized water and sewage systems	X	X		X	X				
Increased development in the wildland-urban interface							X	X	X

Source: Clackamas County HMAC

Table C-33indicates where critical infrastructure and services related vulnerabilities exist in relation to each of the natural hazards profiled in Volume I, Section 2.

Table C-33 Clackamas County Critical Infrastructure and Services Related Vulnerabilities

Clackamas County Asset	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Electric grid		X	X	X	X			X	X
All highways and bridges		X		X	X			X	X
County and City buildings		X							
Cellular communications infrastructure		X						X	X
Fiber optic lines		X						X	X
Water intake facilities		X		X	X				
Emergency Services (fire departments, police departments, hospitals, EOCs)		X		X	X		X	X	X
Water treatment plants/sewer		X		X					

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.

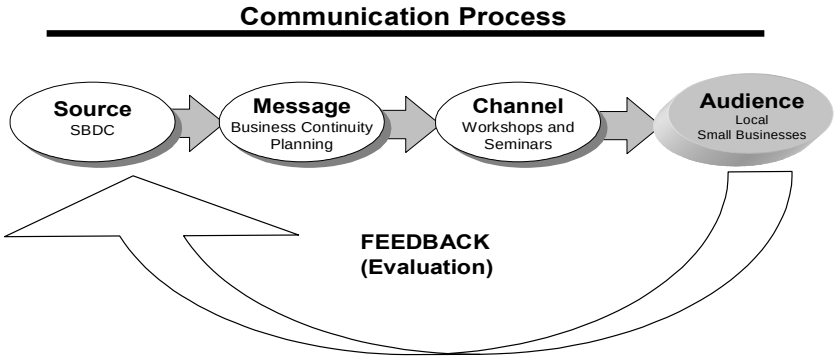
Social Systems and Service Providers

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 five essential elements for communicating effectively to a target audience:
- The source of the message must be credible,
- The message must be appropriately designed,
- The channel for communicating the message must be carefully selected,
- The audience must be clearly defined, and
- The recommended action must be clearly stated and a feedback channel established for questions, comments and suggestions.

Figure C-10 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 – organization could partner with the community to educate the public or provide outreach assistance on natural hazard preparedness and mitigation.
- Information dissemination – organization could partner with the community to provide hazard related information to target audiences.
- Plan/project implementation – organization may have plans and/or policies that may be used to implement mitigation activities or the organization could serve as the coordinating or partner organization to implement mitigation actions.

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

Civic Engagement

Civic engagement and involvement in local, state and national politics are important indicators of community connectivity. Those who are more invested in their community may have a higher tendency to vote in political elections. The 2016 Presidential General Election resulted in 82% voter turnout in the county.[51] These results are relatively equal to voter participation reported across the State (81%).[52] 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 C-34 categorizes the 83 different National Historic Sites located throughout Clackamas County by their distinction and function.

[51] Oregon Blue Book, Voter Participation, http://sos.oregon.gov/elections/Documents/statistics/participation-stats-11-2016.pdf
[52] Ibid.

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.

Table C-34 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	3
Churches	4
Schools	1
Historic Districts	2
Miscellaneous Buildings	6
Total	83

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.[53] 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.[54] There are 2 county libraries, 11 city run libraries, and 3 college/university libraries.

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.

[53] Clackamas County Website, Library District. Accessed 6 December 2011. http://www.clackamas.us/librarydistrict/.

[54] Libraries in Clackamas County. Accessed 6 December 2011. http://www.lincc.org/uhtbin/cgisirsi/?ps=sonPjuH8pE/NT/199190208/1/520/X#.

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.[55]

Residential Geographic Stability

The table below estimates residential stability across the region. It is calculated by the number of people who have lived in the same house and those who have moved within the same county a year ago, compared to the percentage of people who have migrated into the region. Clackamas County overall has a geographic stability rating of about 92% (i.e., 92% of the population lived in the same house or moved within the county). Government Camp has the highest geographic stability (100%) while Jennings Lodge has the lowest (90%).

Table C-35 Regional Residential Stability

Jurisdiction	Population	Geographic Stability	Same House	Moved Within Same County
Clackamas County	391,057	92%	84%	8%
Beavercreek	4,003	98%	86%	12%
Damascus	10,788	93%	86%	7%
Government Camp	121	100%	100%	0%
Jennings Lodge	7,594	90%	83%	8%
Mount Hood Village	5,199	94%	88%	6%
Mulino	2,797	91%	88%	3%
Oak Grove	16,690	92%	82%	10%
Oatfield	13,494	94%	90%	4%
Stafford	1,931	100%	99%	2%
Incorporated*	209,289	92%	83%	9%

Source: Social Explorer, Table 130, U.S. Census Bureau, 2012-2016 American Community Survey Estimates

Homeownership

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

Collectively, about 64.3% of the occupied housing units in Clackamas County are owner-occupied; about 35.7% are renter occupied. Falls City (82.9%) has the highest rate of owner-occupied units. Monmouth (51.7%) and Independence (45.1%) have the highest rate of renter-occupied households. Falls City (9.2%) and Independence (8.4%) have the highest

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

vacancy rates within the county. In addition, seasonal or recreational housing accounts for approximately 11% of the county's vacant housing stock.[56]

Table C-36 Housing Tenure and Vacancy

Jurisdiction	Housing Units	Owner-occupied		Renter-occupied		Seasonal^		Vacant^^	
		Estimate	Percent	Estimate	Percent	Estimate	Percent	Estimate	Percent
Clackamas County	161,005	104,124	65%	47,026	29%	2,917	2%	6,938	4%
Beavercreek	1,490	1,348	90%	105	7%	10	1%	27	2%
Damascus	3,996	3,335	83%	388	10%	8	0%	265	7%
Government Camp	683	53	8%	0	0%	582	85%	48	7%
Jennings Lodge	3,218	1,642	51%	1,497	47%	0	0%	79	2%
Mount Hood Village	3,972	1,672	42%	543	14%	1,483	37%	274	7%
Mulino	913	705	77%	133	15%	0	0%	75	8%
Oak Grove	7,579	4,282	56%	2,756	36%	41	1%	500	7%
Oatfield	5,405	4,176	77%	1,025	19%	0	0%	204	4%
Stafford	787	556	71%	162	21%	32	4%	37	5%
Incorporated*	85,401	53,681	63%	28,061	33%	440	1%	3,219	4%

Source: Social Explorer, Tables 94, and 95, U.S. Census Bureau, 2012-2016 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 Cutter, wealth increases resiliency and recovery from disasters. Renters often do not have personal financial resources or insurance to assist them post-disaster. On the other hand, renters tend to be more mobile and have fewer assets at risk of natural hazards.[57] 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.

[56] U.S. Census Bureau, 2012-2016 American Community Survey Estimates, Table B25004.

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

Political Capacity

Political capacity is recognized as the government and planning structures established within the community. In terms of hazard resilience, it is essential for political capital to encompass diverse government and non-government entities in collaboration; as disaster losses stem from a predictable result of interactions between the physical environment, social and demographic characteristics and the built environment.[58] 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 assessment, disaster exercises, training, public education and outreach, a city liaison program, and is an active participant in the Portland Urban Area Security Initiative (UASI).
- **Department of Transportation and Development**: Among other things, the DTD is responsible for a broad range of county services involving land use planning and permitting, building permits, county code enforcement, sustainability, and road construction and maintenance.
    - **Building Codes**: Can collaborate to do outreach with owners of structures that were not built up to modern, resilient code. Professionals from this department could even be called on to help survey buildings after an incident.
    - **Planning and Zoning**: Conducts both short and long-range plans that determine much of the built, physical community. Through the county Comprehensive Plan

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

and subsequent polices, this department guides decisions about growth, development, and conservation of natural resources. The Planning Department 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.

    - **Transportation Maintenance**: Is responsible for maintaining the integrity and safety of over 1,407 miles of county roads, 180 bridges, 1,400 miles of road striping, 2,398 miles of rock shoulder, 26,453 road signs and operates the Canby Ferry for more than 85,000 vehicles a year.[59] As transportation and infrastructure is a critical component of mobility, this department 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.[60]
    - **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 department s 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.
    - **Public Heath**: Provides community-wide health promotion and disease prevention services to assure the physical and mental well-being of county residents.[61] 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.
- **Technology Services**: focuses on providing high quality, innovative, cost-effective technology for citizens, county departments, and county commissioners to conduct daily business.[62] 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**: Develops and maintains a Geographic Information System (GIS) 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.[63] The GIS is composed of computer maps and associated databases. Examples of the maps include soils, flood hazard areas, and streams. In all phases of the disaster cycle, information is key. Building robust data that catalogues not only the county's risk and vulnerability, but also resources and response capability can ensure that efficient and effective mitigation activities.

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[59] Clackamas County Website. Transportation Maintenance. https://www.clackamas.us/roads.
[60] Clackamas County Website. Department of Health, Housing and Human Services. https://www.clackamas.us/h3s
[61] Clackamas County Website. Public Health. https://www.clackamas.us/publichealth.
[62] Clackamas County Website. Technology Services.http://www.clackamas.us/ts/.
[63] Clackamas County Website. Geographic Information Systems. https://www.clackamas.us/gis.

- **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.[64]

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

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

Goal 7 for coastal and riverine flood hazards by adopting and implementing local floodplain regulations that meet the minimum National Flood Insurance Program (NFIP) requirements.

Goal 7 Planning Guidelines

- In adopting plan policies and implementing measures for protection from natural hazards, local governments should consider:
    - the benefits of maintaining natural hazard areas as open space, recreation, and other low density uses;
    - the beneficial effects that natural hazards can have on natural resources and the environment; and
    - the effects of development and mitigation measures in identified hazard areas on the management of natural resources.
- Local governments should coordinate their land use plans and decisions with emergency preparedness, response, recovery and mitigation programs.

Goal 7 Implementation Guidelines

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

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

Existing Plans and Policies

Communities often have existing plans and policies that guide and influence land use, land development, and population growth. Such existing plans and policies can include comprehensive plans, zoning ordinances, and technical reports or studies. Plans and policies already in existence have support from local residents, businesses and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can adapt easily to changing conditions and needs.[65]

The Clackamas County NHMP includes a range of recommended action items that, when implemented, will reduce the county's vulnerability to natural hazards. Many of these recommendations are consistent with the goals and objectives of the county's existing plans and policies. Linking existing plans and policies to the NHMP helps identify what resources already exist that can be used to implement the action items identified in the plan. Implementing the natural hazards mitigation plan's action items through existing plans and policies increases their likelihood of being supported and getting updated and maximizes the county's resources.

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

In addition to the plans listed below the county and incorporated cities also have zoning ordinances (including floodplain development regulations) and building regulations.

Existing plans that can incorporate mitigation actions include (for more information on these plans see the county website):

The following is a list of plans and policies already in place in Clackamas County:

- Clackamas County Comprehensive Plan
- Clackamas County Community Wildfire Protection Plan
- Clackamas County Transportation System Plan
- Clackamas County Emergency Operations Plan
- Mt. Hood Coordination Plan
- Housing and Community Development Plan
- Capital Improvement Plan
- Clackamas County Strategic Plan
- Clackamas County Community Health Assessment
- Clackamas County Blueprint for Health (Community Health Improvement Pan)

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.

Appendix D:
Natural Hazard and Base Maps

Note: The maps provided in this appendix are unchanged since the previous version of this NHMP.

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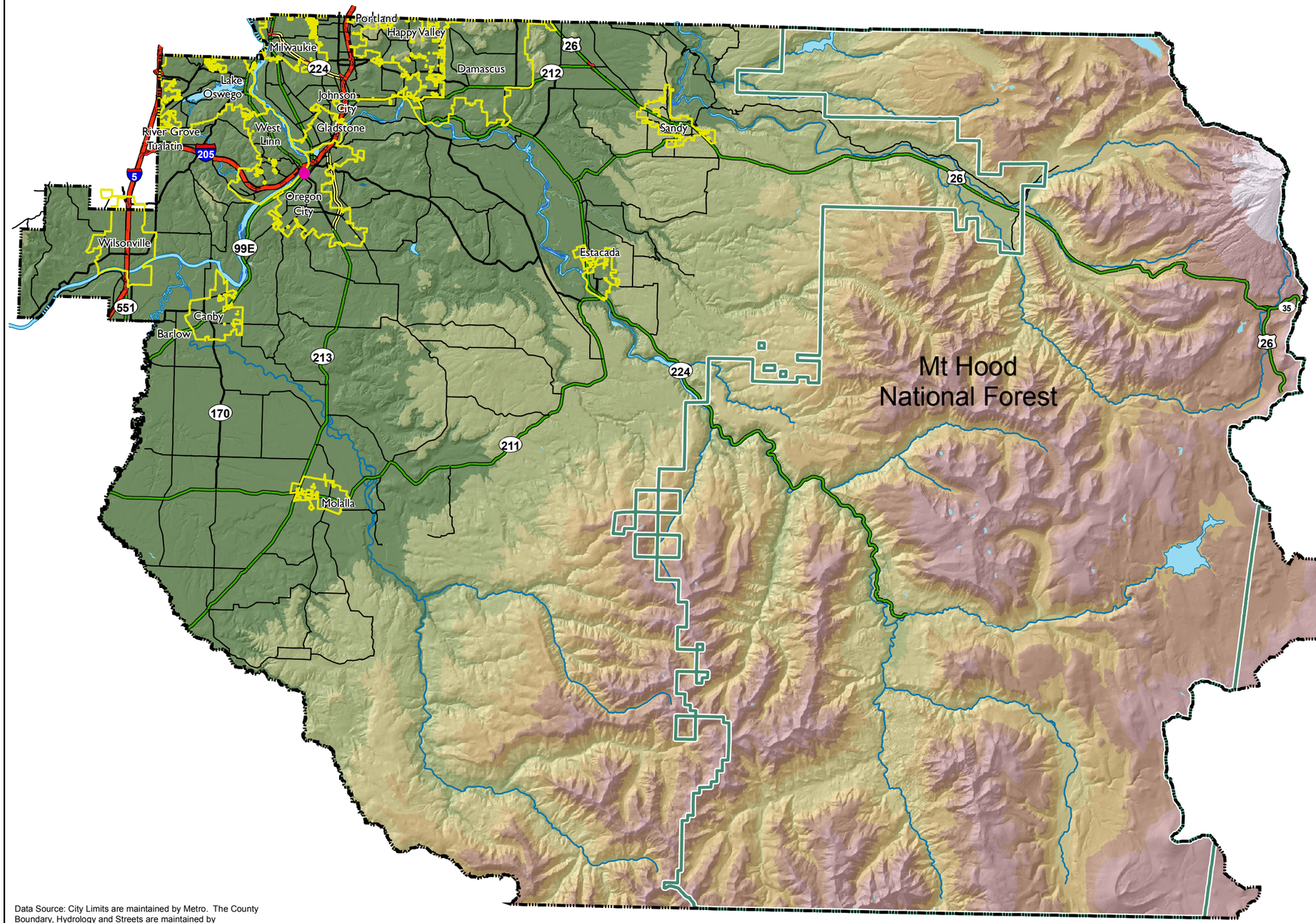
Map 1

Clackamas County



Data Source: City Limits are maintained by Metro. The County Boundary, Hydrology and Streets are maintained by Clackamas County GIS Staff.

County Features

- County Seat
- Cities
- County Boundary
- Mt Hood National Forest

Water Features

- Major Rivers and Lakes
- Rivers, Creeks and Streams

Streets

- Freeway
- Expressway / State Highway
- Major Arterial / State Highway
- Major Arterial
- Minor Arterial

N

0 2 4 8 12 Miles

CLACKAMAS COUNTY

GEOGRAPHIC INFORMATION SYSTEMS

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OREGON CITY, OREGON 97045

Clackamas County - GIS - Eric Laufer - BaseMap_Map1.mxd - February 13th, 2012

Map 2

Clackamas County Average Precipitation

Portland
Happy Valley
Damascus
Milwaukie
Lake Oswego
Johnson City
Gladstone
River Grove
Tualatin
West Linn
Oregon City
Wilsonville
Canby
Barlow
Molalla
Sandy
Estacada
224
26
212
211
205
5
99E
551
213
170
35

Data Source: City Limits are maintained by Metro. The County Boundary, Hydrology and Streets are maintained by Clackamas County GIS Staff.
Thirty year precipitation information was provided by the Oregon State Climate Center.

County Features

- County Seat
- Cities
- County Boundary

Streets

- Freeway
- Expressway / State Highway
- Major Arterial / State Highway
- Major Arterial
- Minor Arterial

30 Year Average Rainfall

- 40 - 50 inches
- 51 - 60 inches
- 61 - 70 inches
- 71 - 80 inches
- 81 - 90 inches
- 91 - 100 inches
- 101+ inches

N

0 2 4 8 12 Miles

CLACKAMAS COUNTY

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Clackamas County - GIS - Eric Laufer - PrecipMap_Map2.mxd - February 13th, 2012

Map 3

Clackamas County FEMA Firm 100 Year Flood Plain

Portland
Damascus
Milwaukie
Happy Valley
Lake Oswego
Johnson City
Gladstone
River Grove
Tualatin
West Linn
Oregon City
Sandy
Wilsonville
Estacada
Canby
Barlow
Molalla
205
224
212
26
211
5
99E
213
551
170
35

Data Source: City Limits are maintained by Metro. The County Boundary, Hydrology and Streets are maintained by Clackamas County GIS Staff.
The flood plain data is from the Federal Emergency Management Agency. The data is from 2008.

County Features

- County Seat
- Cities
- County Boundary

Streets

- Freeway
- Expressway / State Highway
- Major Arterial / State Highway
- Major Arterial
- Minor Arterial

Water Features

- FEMA 100 Year Flood Plain
- Major Rivers and Lakes
- Rivers, Creeks and Streams

N

0 2 4 8 12 Miles

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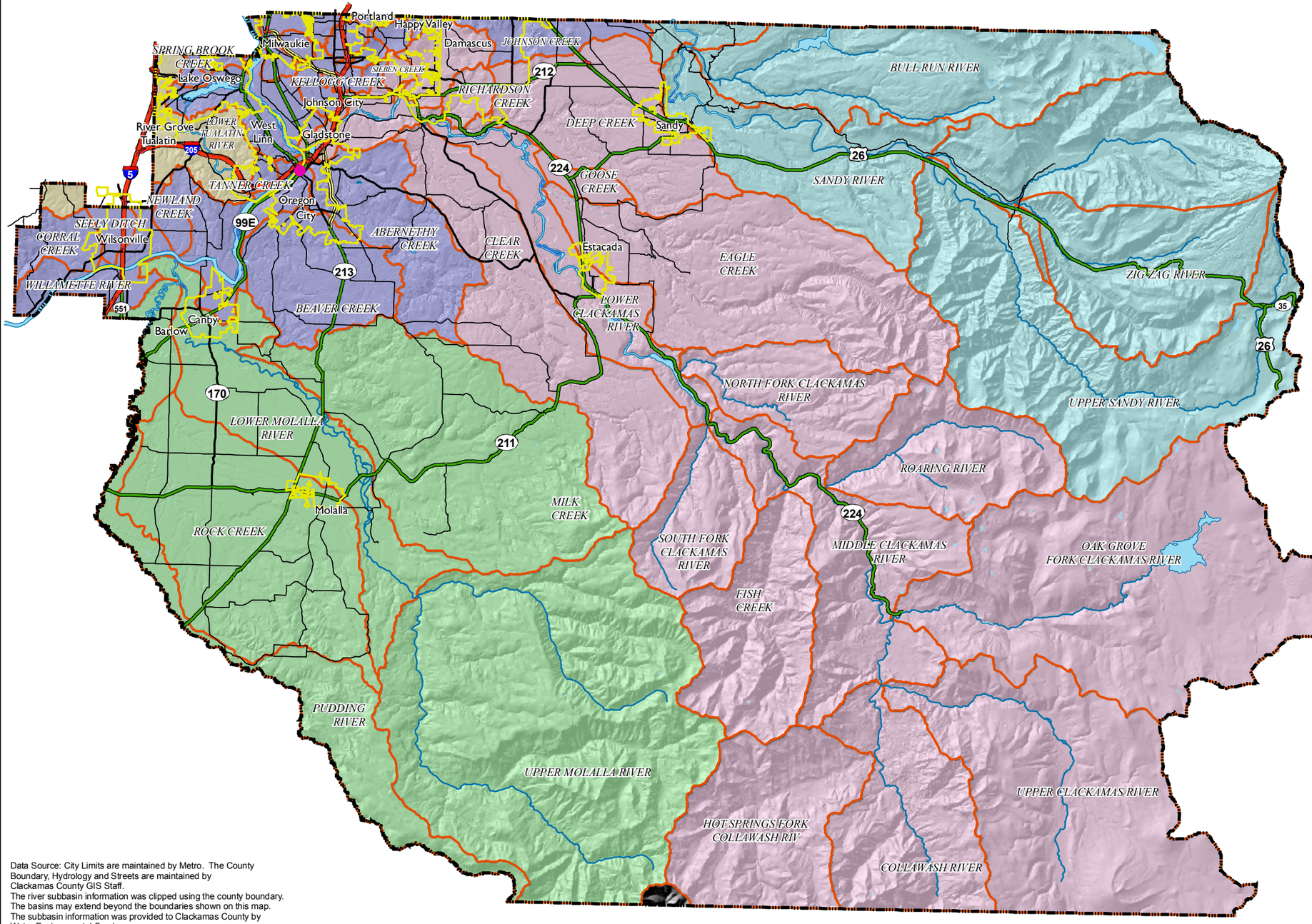
Clackamas County - GIS - Eric Laufer - FEMAMap_Map3.mxd - February 15th, 2012

Map 4

Clackamas County River SubBasins



Data Source: City Limits are maintained by Metro. The County Boundary, Hydrology and Streets are maintained by Clackamas County GIS Staff.
The river subbasin information was clipped using the county boundary.
The basins may extend beyond the boundaries shown on this map.
The subbasin information was provided to Clackamas County by Water Environmental Services.

County Features

- County Seat
- Cities
- County Boundary

Water Features

- Major Rivers and Lakes
- Rivers, Creeks and Streams

Streets

- Freeway
- Expressway / State Highway
- Major Arterial / State Highway
- Major Arterial
- Minor Arterial

Basin Names

- Clackamas River
- Molalla River
- Sandy River
- Tualatin River
- Willamette River

SubBasins

- Boundary

N

0 2 4 8 12 Miles

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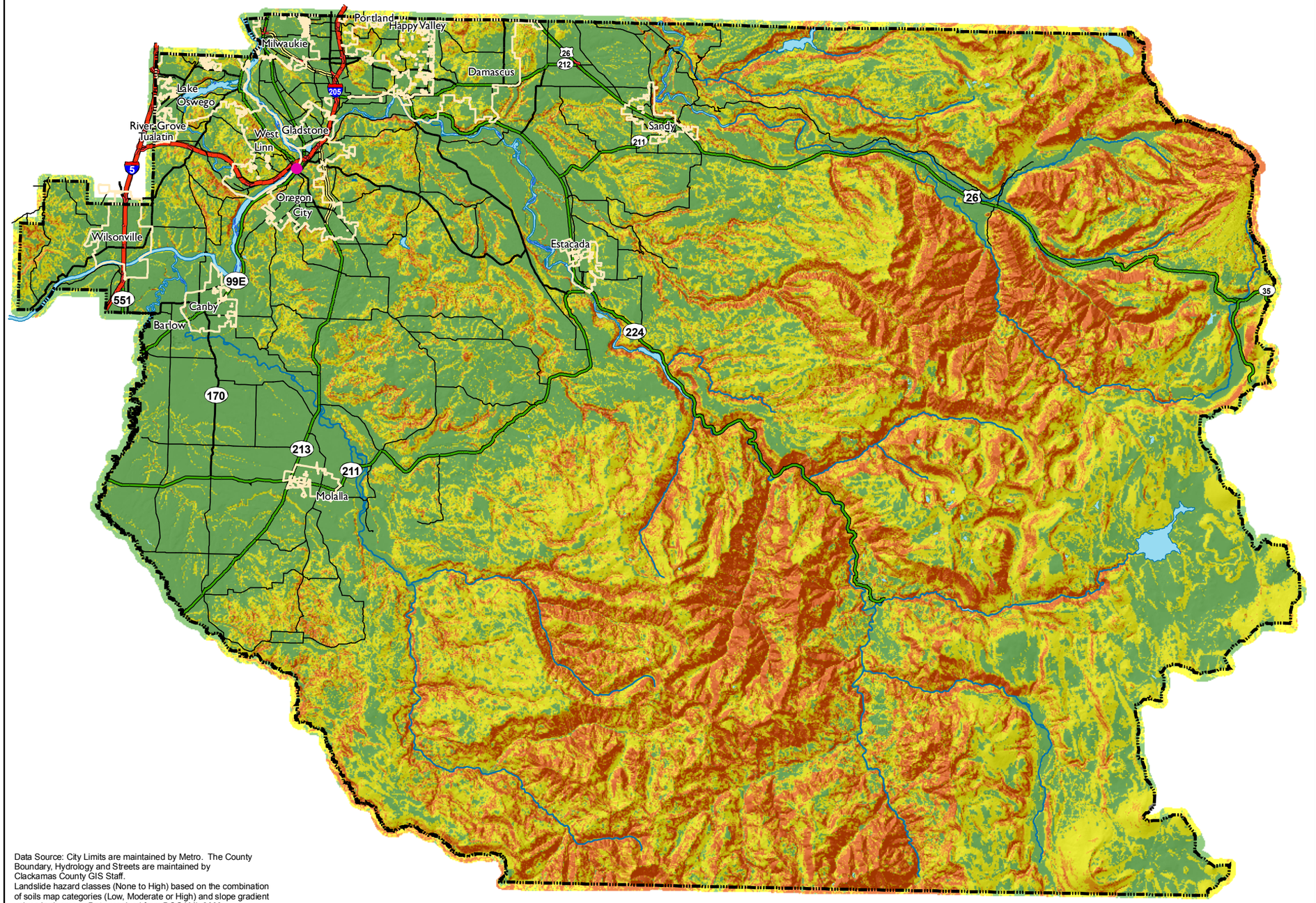
Clackamas County - GIS - Eric Laufer - RivSubBasinsMap_Map4.mxd - February 13th, 2012



Data Source: City Limits are maintained by Metro. The County Boundary, Hydrology and Streets are maintained by Clackamas County GIS Staff.
Landslide hazard classes (None to High) based on the combination of soils map categories (Low, Moderate or High) and slope gradient values in degrees. Data received from DOGAMI, 2003.

Map 5
Clackamas County Slope Stability

County Features
- County Seat
- Cities
- County Boundary

Water Features
- Major Rivers and Lakes
- Rivers, Creeks and Streams

Streets
- Freeway
- Expressway / State Highway
- Major Arterial / State Highway
- Major Arterial
- Minor Arterial

Slope Stability
- Slope Stability only in unusual localized conditions
- Slopes between 15 percent (8.5deg) and 30 percent (16.7deg)
- Slopes between 30 percent and 45 percent (24.2deg)
- Slopes greater than 45 percent (24.2deg) and existing landslides

N

0 2 4 8 12 Miles

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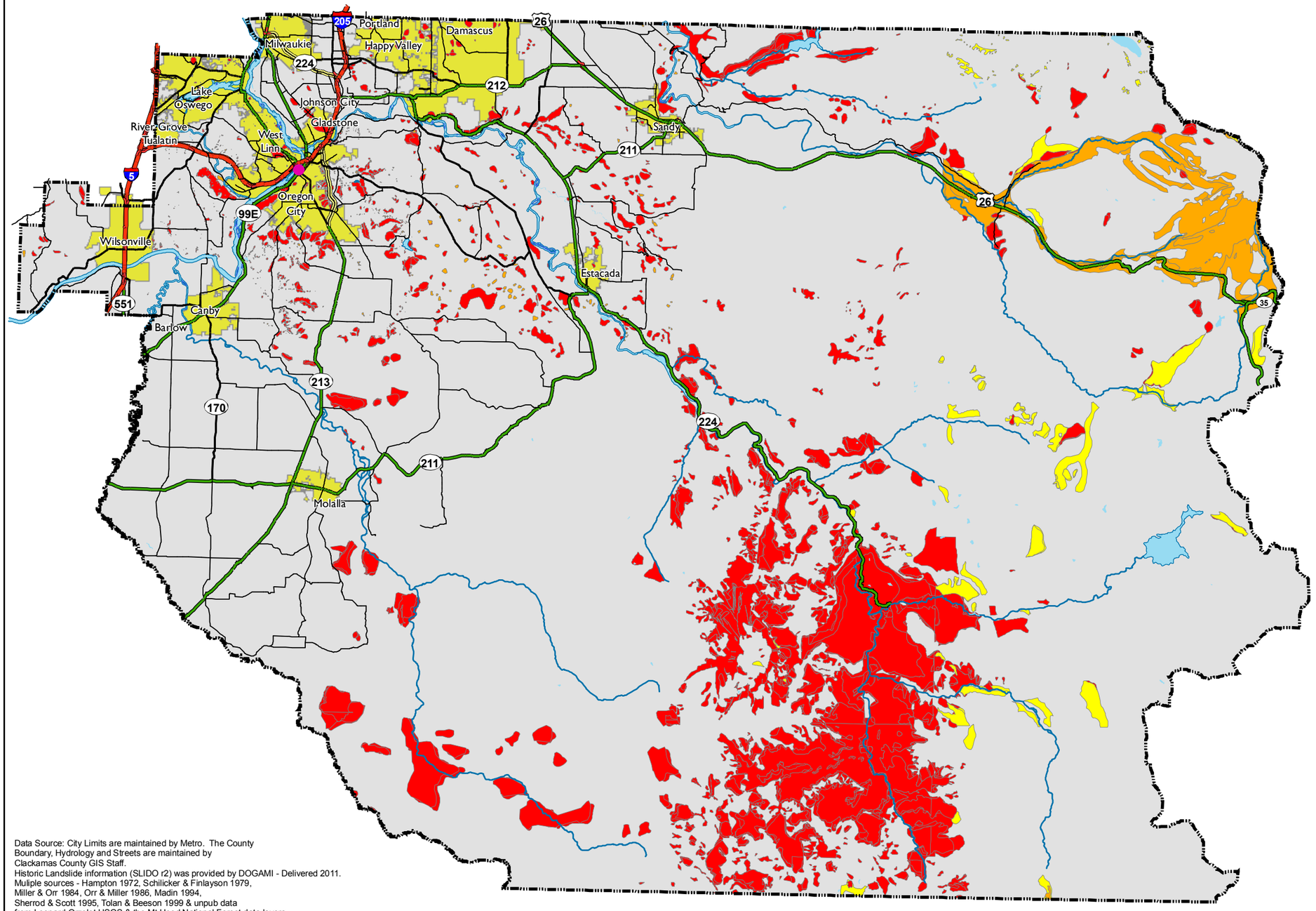
Clackamas County - GIS - Eric Laufer - SlopeStabMap_Map5.mxd - February 16th, 2012



Data Source: City Limits are maintained by Metro. The County Boundary, Hydrology and Streets are maintained by Clackamas County GIS Staff.
Historic Landslide information (SLIDO r2) was provided by DOGAMI - Delivered 2011.
Muliple sources - Hampton 1972, Schilicker & Finlayson 1979, Miller & Orr 1984, Orr & Miller 1986, Madin 1994, Sherrod & Scott 1995, Tolan & Beeson 1999 & unpub data from Leonard Orzolat USGS & the Mt Hood National Forest data layers.

Map 6

Clackamas County Historic Landslides

County Features
- County Seat
- Cities
- County Boundary

Hazard
- Landslide
- Fan
- Talus-Colluvium

Water Features
- Major Rivers and Lakes
- Rivers, Creeks and Streams

Streets
- Freeway
- Expressway / State Highway
- Major Arterial / State Highway
- Major Arterial
- Minor Arterial

N

0 2 4 8 12 Miles

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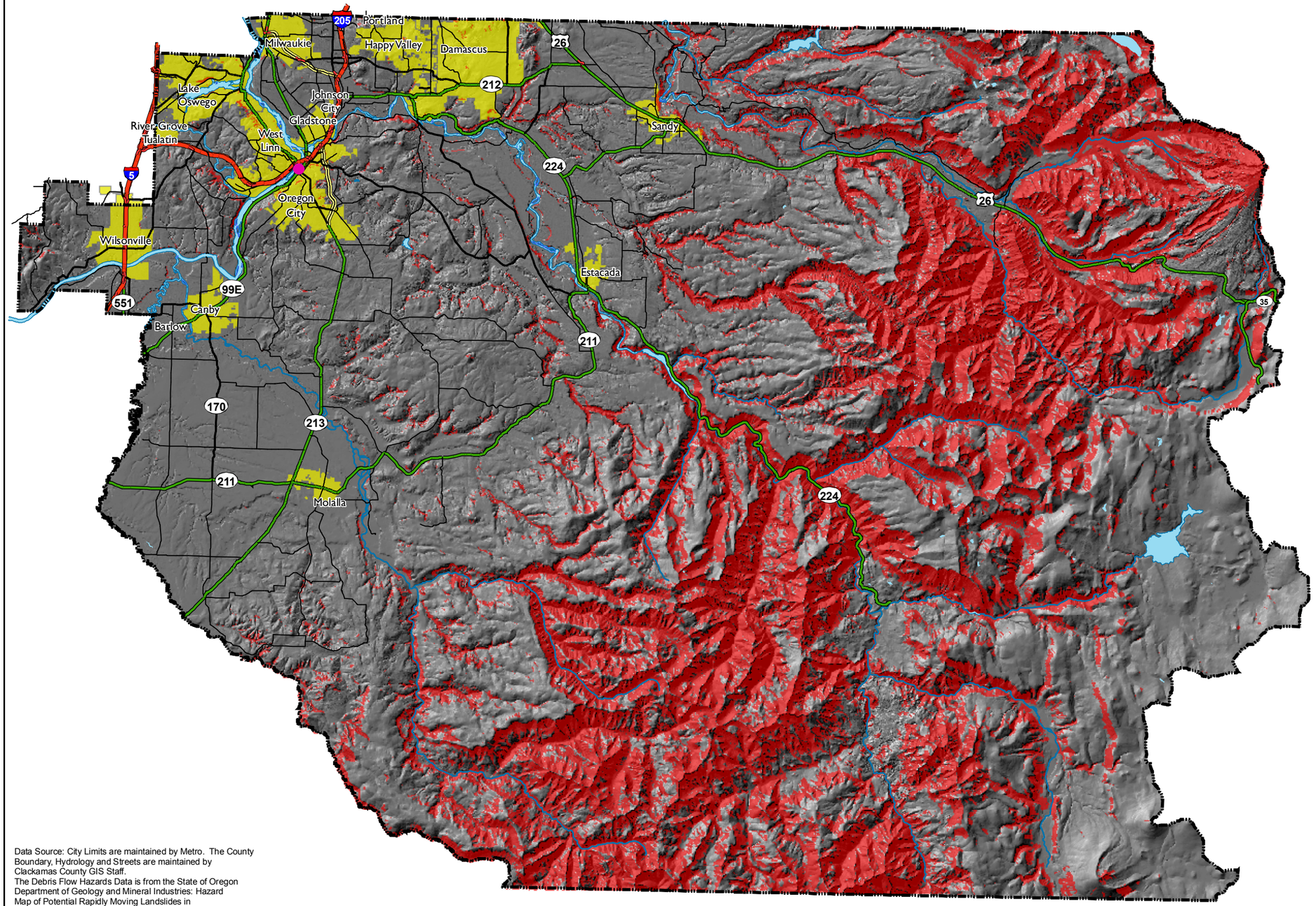
Clackamas County - GIS - Eric Laufer - LandslideMap_Map6.mxd - February 16th, 2012



Data Source: City Limits are maintained by Metro. The County Boundary, Hydrology and Streets are maintained by Clackamas County GIS Staff.
The Debris Flow Hazards Data is from the State of Oregon Department of Geology and Mineral Industries: Hazard Map of Potential Rapidly Moving Landslides in Wester Oregon 2002.

Map 7

Clackamas County Debris Flows

County Features

- County Seat
- Cities
- County Boundary

Hazard

- Potential Rapidly Moving Landslides

Water Features

- Major Rivers and Lakes
- Rivers, Creeks and Streams

Streets

- Freeway
- Expressway / State Highway
- Major Arterial / State Highway
- Major Arterial
- Minor Arterial

N

0 2 4 8 12 Miles

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Clackamas County - GIS - Eric Laufer - DebrisMap_Map7.mxd - February 16th, 2012

Map 8
Clackamas County Soil Liquefaction

Portland
Happy Valley
Damascus
Milwaukie
Lake Oswego
Johnson City
Gladstone
West Linn
River Grove
Tualatin
Oregon City
Wilsonville
Canby
Barlow
Molalla
Sandy
Estacada
212
205
5
99E
551
213
211
224
26
35
170

Data Source: City Limits are maintained by Metro. The County Boundary, Hydrology and Streets are maintained by Clackamas County GIS Staff.
DOGAMI geographically combined available GIS data from previous hazard studies with surface geology layers (1994-2001). GIS outputs simplified into relative hazard calsses of None/Very Low, Low, Moderate and High. Liquefaction susceptibility classes were assigned based on dominant lithologies for each geologic unit. (Youd and Perkins 1978 classification system).

County Features

- County Seat
- Cities
- County Boundary

Liquefaction Hazard

- HIGH - Areas with a thickness of liquefiable material > 30 ft where water table is 15 - 30 ft deep or areas with liq material where the water table is < 15 ft.
- MODERATE - Areas with a thickness of liquefiable material less than 20 ft where the water table is 15-30 ft.
- LOW - Area with materials that are liquefiable when they are intermittently saturated.
- NONE/VERY LOW - Areas not liquefiable or liquefiable only due to unusual local conditions

Water Features

- Major Rivers and Lakes
- Rivers, Creeks and Streams

Streets

- Freeway
- Expressway / State Highway
- Major Arterial / State Highway
- Major Arterial

N

0 2 4 8 12 Miles

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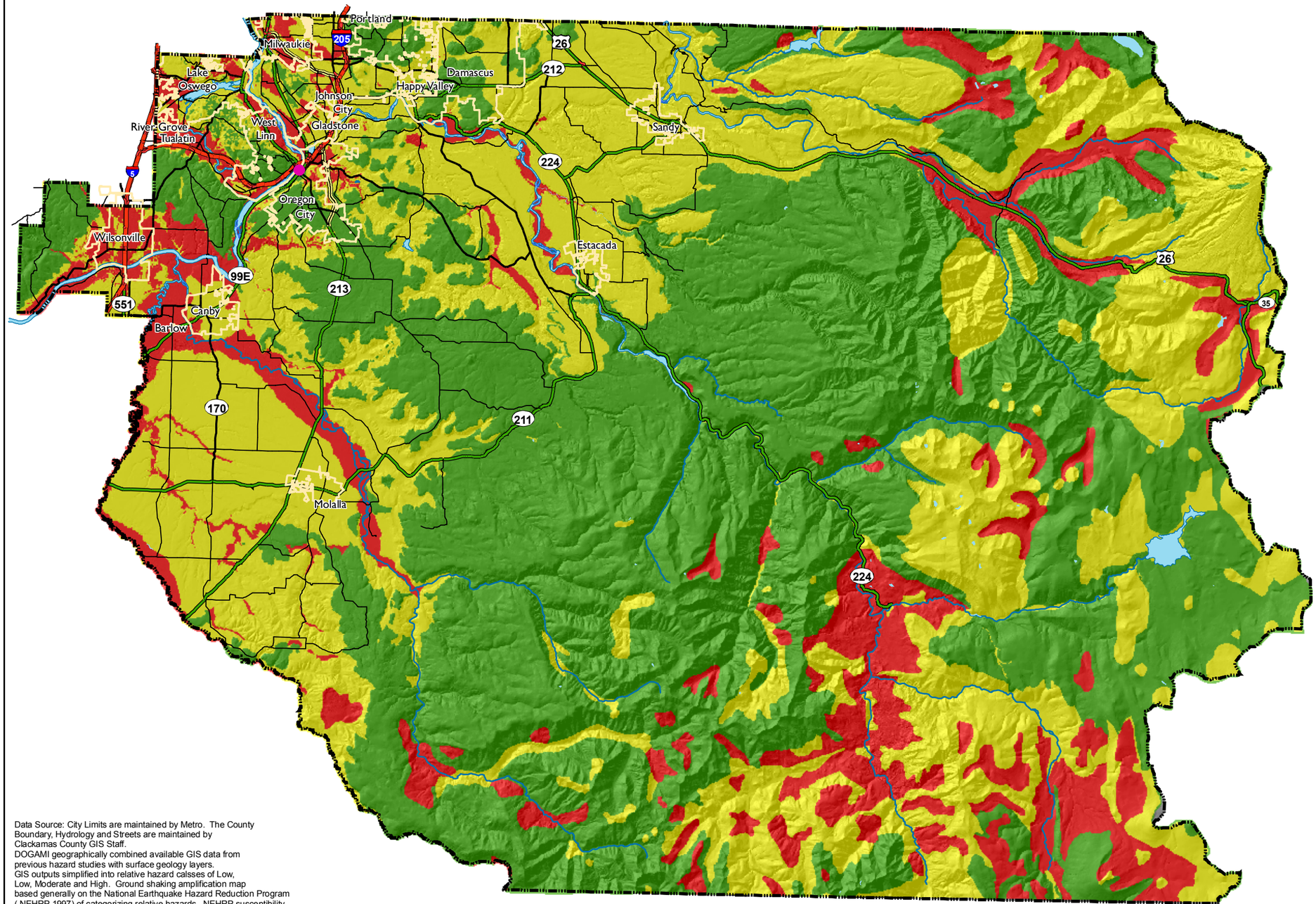
Clackamas County - GIS - Eric Laufer - LiquifactionMap_Map8.mxd - February 16th, 2012

Map 9
Clackamas County Soil Amplification



Data Source: City Limits are maintained by Metro. The County Boundary, Hydrology and Streets are maintained by Clackamas County GIS Staff.
DOGAMI geographically combined available GIS data from previous hazard studies with surface geology layers.
GIS outputs simplified into relative hazard calsses of Low, Low, Moderate and High. Ground shaking amplification map based generally on the National Earthquake Hazard Reduction Program (NEHRP 1997) of categorizing relative hazards. NEHRP susceptibility classes based on dominant lithologies for each geologic unit.

County Features
- County Seat
- Cities
- County Boundary

Soil Amplification Hazard
- HIGH - Areas with amplification greater than 1.50.
- MODERATE - Areas with amplification between 1.25 and 1.50.
- LOW - Areas with amplification less than 1.25

Water Features
- Major Rivers and Lakes
- Rivers, Creeks and Streams

Streets
- Freeway
- Expressway / State Highway
- Major Arterial / State Highway
- Major Arterial
- Minor Arterial

N

0 2 4 8 12 Miles

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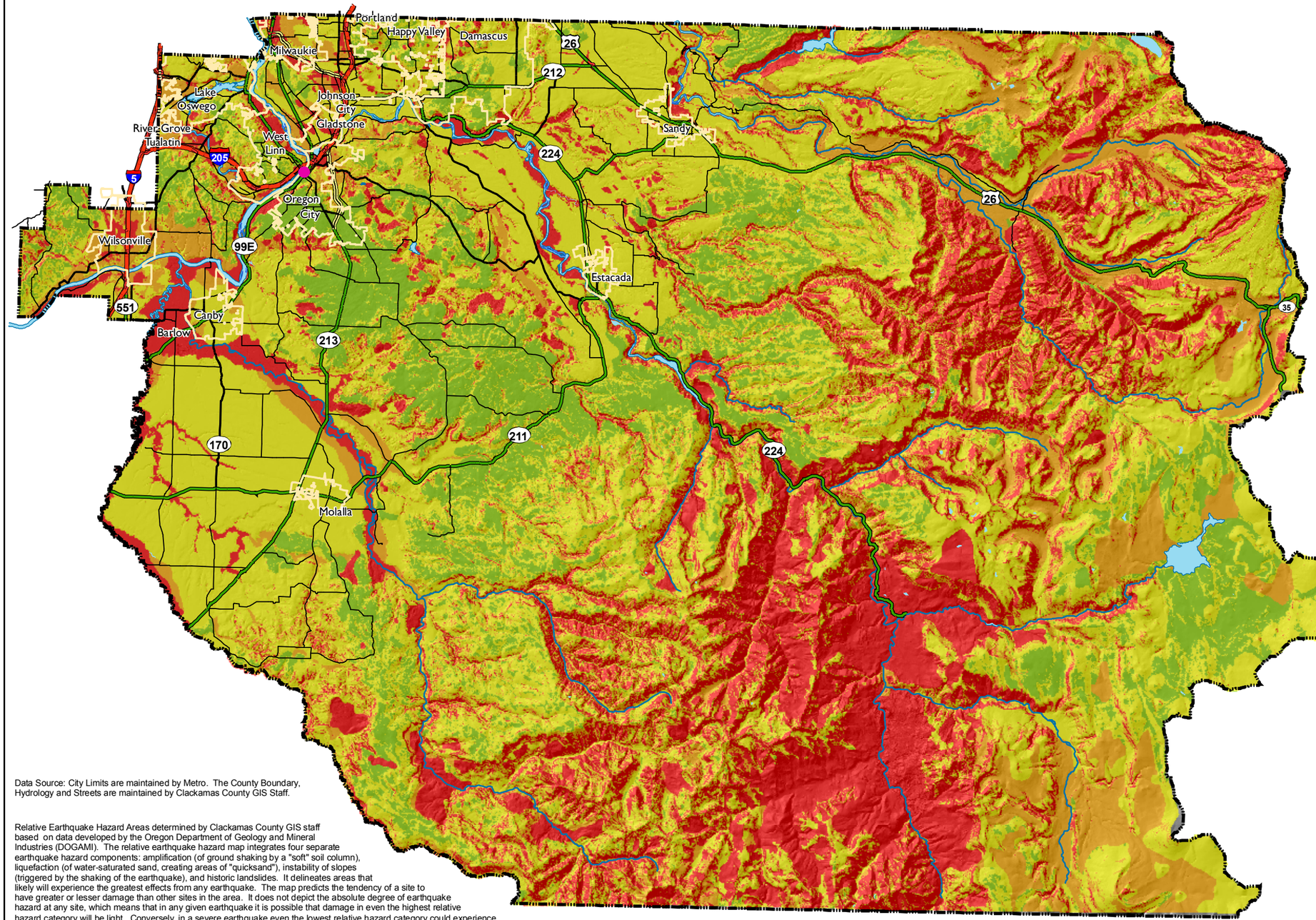
Clackamas County - GIS - Eric Laufer - AmplificationMap_Map9.mxd - February 16th, 2012

Map 10
Clackamas County Earthquake Hazard



Data Source: City Limits are maintained by Metro. The County Boundary, Hydrology and Streets are maintained by Clackamas County GIS Staff.

Relative Earthquake Hazard Areas determined by Clackamas County GIS staff based on data developed by the Oregon Department of Geology and Mineral Industries (DOGAMI). The relative earthquake hazard map integrates four separate earthquake hazard components: amplification (of ground shaking by a "soft" soil column), liquefaction (of water-saturated sand, creating areas of "quicksand"), instability of slopes (triggered by the shaking of the earthquake), and historic landslides. It delineates areas that likely will experience the greatest effects from any earthquake. The map predicts the tendency of a site to have greater or lesser damage than other sites in the area. It does not depict the absolute degree of earthquake hazard at any site, which means that in any given earthquake it is possible that damage in even the highest relative hazard category will be light. Conversely, in a severe earthquake even the lowest relative hazard category could experience severe damage. The areas depicted should not be used as the sole basis for any type of restrictive or exclusionary policy.

County Features
- County Seat
- Cities
- County Boundary

Relative Earthquake Hazard
- HIGH
- MODERATE
- LOW
- NONE/VERY LOW

Water Features
- Major Rivers and Lakes
- Rivers, Creeks and Streams

Streets
- Freeway
- Expressway / State Highway
- Major Arterial / State Highway
- Major Arterial
- Minor Arterial

N

0 2 4 8 12 Miles

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Clackamas County - GIS - Eric Laufer - RelEarthquakeMap_Map10.mxd - February 16th, 2012

Appendix E: 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 – Office of Emergency Management, 2000), and Federal Emergency Management Agency Publication 331, *Report on Costs and Benefits of Natural Hazard Mitigation*. This section is not intended to provide a comprehensive description of benefit/cost analysis, nor is it intended to evaluate local projects. It is intended to (1) raise benefit/cost analysis as an important issue, and (2) provide some background on how an economic analysis can be used to evaluate mitigation projects.

Why Evaluate Mitigation Strategies?

Mitigation activities reduce the cost of disasters by minimizing property damage, injuries, and the potential for loss of life, and by reducing emergency response costs, which would otherwise be incurred. Evaluating possible natural hazard mitigation activities provides decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Evaluating mitigation projects is a complex and difficult undertaking, which is influenced by many variables. First, natural disasters affect all segments of the communities they strike, including individuals, businesses, and public services such as fire, law enforcement, utilities, and schools. Second, while some of the direct and indirect costs of disaster damages are measurable, some of the costs are non-financial and difficult to quantify in dollars. Third, many of the impacts of such events produce "ripple-effects" throughout the community, greatly increasing the disaster's social and economic consequences.

While not easily accomplished, there is value from a public policy perspective, in assessing the positive and negative impacts from mitigation activities, and obtaining an instructive benefit/cost comparison. Otherwise, the decision to pursue or not pursue various mitigation options would not be based on an objective understanding of the net benefit or loss associated with these actions.

Mitigation Strategy Economic Analyses Approaches

The approaches used to identify the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into three general categories: benefit/cost analysis, cost-effectiveness analysis and the STAPLE/E approach. The distinction between the three methods is outlined below:

Benefit/Cost Analysis

Benefit/cost analysis is a key mechanism used by the state Oregon Office 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. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, to avoid disaster-related damages later. Benefit/cost analysis is based on calculating the frequency and severity of a hazard, avoiding future damages, and risk. In benefit/cost analysis, all costs and benefits are evaluated in terms of dollars, and a net benefit/cost ratio is computed to determine whether a project should be implemented. A project must have a benefit/cost ratio greater than 1 (i.e., the net benefits will exceed the net costs) to be eligible for FEMA funding. 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.

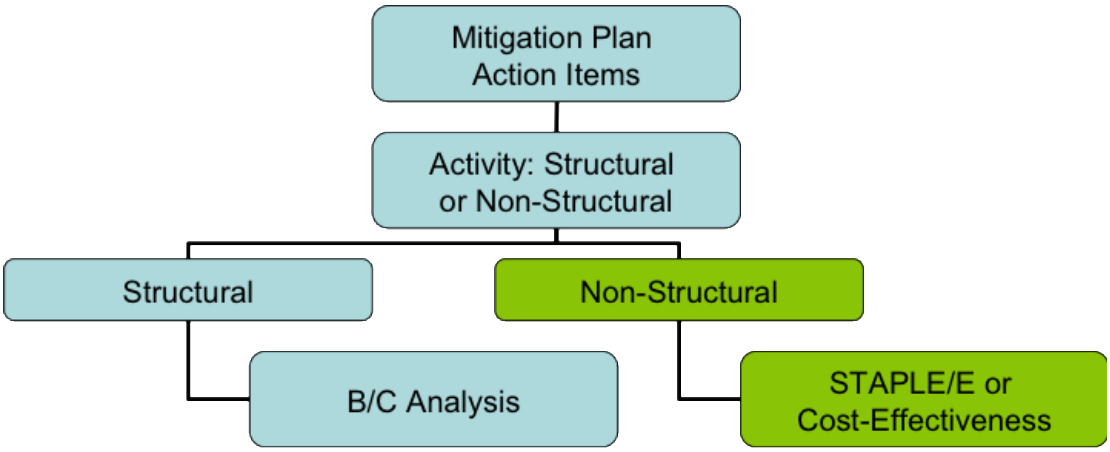
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

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 E-1 Economic Analysis Flowchart



Source: Oregon Partnership for Disaster Resilience. 2005.

Implementing the Approaches

Benefit/cost analysis, cost-effectiveness analysis, and the STAPLE/E are important tools in evaluating whether to implement a mitigation activity. A framework for evaluating

mitigation activities is outlined below. This framework should be used in further analyzing the feasibility of prioritized mitigation activities.

1. Identify the Activities

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

2. Calculate the Costs and Benefits

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

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

3. Analyze and Rank the Activities

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

- ***Net present value***. Net present value is the value of the expected future returns of an investment minus the value of the expected future cost expressed in today's dollars. If the net present value is greater than the projected costs, the project may be determined feasible for implementation. Selecting the discount rate and

identifying the present and future costs and benefits of the project calculates the net present value of projects.

- ***Internal rate of return***. Using the internal rate of return method to evaluate mitigation projects provides the interest rate equivalent to the dollar returns expected from the project. Once the rate has been calculated, it can be compared to rates earned by investing in alternative projects. Projects may be feasible to implement when the internal rate of return is greater than the total costs of the project. Once the mitigation projects are ranked 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 – Office of Emergency Management, July 1999.

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

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APPENDIX F:
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, it is important to periodically review available funding sources for current guidelines and program descriptions.

Post-Disaster Federal Programs

Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (HMGP) provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. 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

When physical disaster loans are made to homeowners and businesses following disaster declarations by the U.S. Small Business Administration (SBA), up to 20% of the loan amount can go towards specific measures taken to protect against recurring damage in similar future disasters. http://www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/disaster-loans

Pre-Disaster Federal Programs

Pre-Disaster Mitigation Grant Program

The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds. The PDM 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.
http://www.fema.gov/pre-disaster-mitigation-grant-program

Flood Mitigation Assistance Program

The overall goal of the Flood Mitigation Assistance (FMA) Program is to fund cost-effective measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other National Flood Insurance Program (NFIP) insurable structures. This specifically includes:

- Reducing the number of repetitively or substantially damaged structures and the associated flood insurance claims;
- Encouraging long-term, comprehensive hazard mitigation planning;
- Responding to the needs of communities participating in the NFIP to expand their mitigation activities beyond floodplain development activities; and
- Complementing other federal and state mitigation programs with similar, long-term mitigation goals.

http://www.fema.gov/flood-mitigation-assistance-program

Detailed program and application information for federal post-disaster and pre-disaster programs can be found in the FY15 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. Flood mitigation assistance is usually 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.

For Oregon Office of Emergency Management (OEM) grant guidance on Federal Hazard Mitigation Assistance, visit:
https://www.oregon.gov/OEM/emresources/Grants/Pages/HMA.aspx

Contact: Angie Lane, angie.lane@state.or.us

State Programs

Seismic Rehabilitation Grant Program

The Seismic Rehabilitation Grant Program (SRGP) provides state funds to strengthen public schools and emergency services buildings so they will be less damaged during an earthquake. Reducing property damage, injuries, and casualties caused by earthquakes is the goal of the SRGP. http://www.orinfrastructure.org/Infrastructure-Programs/Seismic-Rehab/

Community Development Block Grant Program

The Community Development Block Grant Program promotes viable communities by providing: 1) decent housing; 2) quality living environments; and 3) economic opportunities, especially for low and moderate income persons. Eligible activities most relevant to natural hazards mitigation include: acquisition of property for public purposes; construction/reconstruction of public infrastructure; community planning activities. Under special circumstances, CDBG funds also can be used to meet urgent community development needs arising in the last 18 months which pose immediate threats to health and welfare.
http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs

Oregon Watershed Enhancement Board

While OWEB's primary responsibilities are implementing projects addressing coastal salmon restoration and improving water quality statewide, these projects can sometimes also benefit efforts to reduce flood and landslide hazards. In addition, OWEB conducts watershed workshops for landowners, watershed councils, educators, and others, and conducts a biennial conference highlighting watershed efforts statewide. Funding for OWEB programs comes from the general fund, state lottery, timber tax revenues, license plate revenues, angling license fees, and other sources. OWEB awards approximately $20 million in funding annually. More information at: http://www.oregon.gov/OWEB/Pages/index.aspx

Federal Mitigation Programs, Activities & Initiatives

Basic & Applied Research/Development

National Earthquake Hazard Reduction Program (NEHRP), National Science Foundation.

Through broad based participation, the NEHRP attempts to mitigate the effects of earthquakes. Member agencies in NEHRP are the US Geological Survey (USGS), the National Science Foundation (NSF), the Federal Emergency Management Agency (FEMA), and the National Institute for Standards and Technology (NIST). The agencies focus on research and development in areas such as the science of earthquakes, earthquake performance of buildings and other structures, societal impacts, and emergency response and recovery. http://www.nehrp.gov/

Decision, Risk, and Management Science Program, National Science Foundation.

Supports scientific research directed at increasing the understanding and effectiveness of decision making by individuals, groups, organizations, and society. Disciplinary and interdisciplinary research, doctoral dissertation research, and workshops are funded in the areas of judgment and decision making; decision analysis and decision aids; risk analysis, perception, and communication; societal and public policy decision making; management science and organizational design. The program also supports small grants for exploratory research of a time-critical or high-risk, potentially transformative nature. http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5423

Hazard ID and Mapping

National Flood Insurance Program: Flood Mapping; FEMA

Flood insurance rate maps and flood plain management maps for all NFIP communities. http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping

National Map: Orthoimagery, 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 FEMA Public Assistance (PA) Grant Program is to aid 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/

Appendix G
Community Survey

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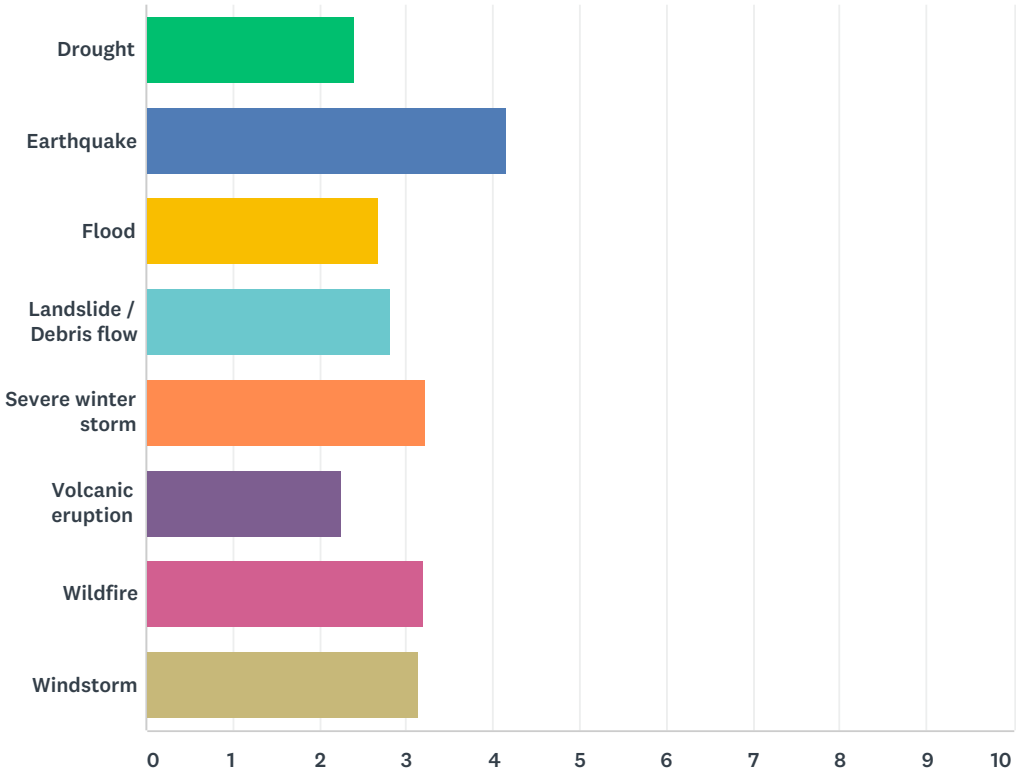
Q1 How concerned are you about the following natural disasters affecting Clackamas County? Please assign a number to your concern, with "1" meaning "Not at all concerned," and "5" meaning "Very concerned."

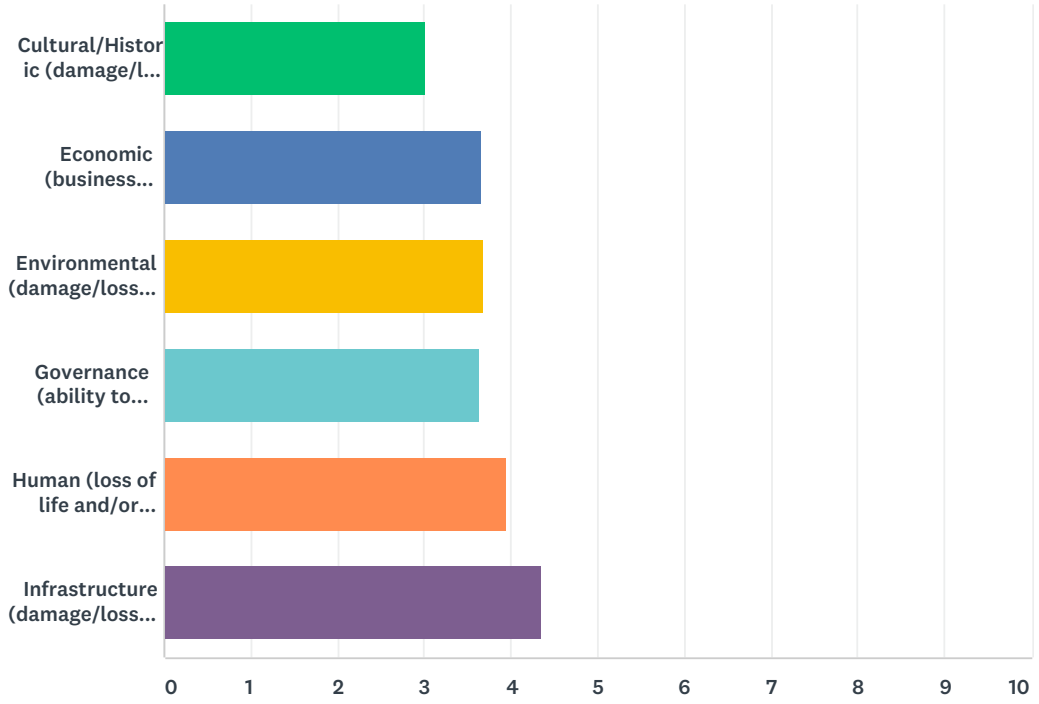
Answered: 1,740 Skipped: 0



	(NOT AT ALL CONCERNED)1	2	3	4	(VERY CONCERNED)5	TOTAL	WEIGHTED AVERAGE
Drought	25.48% 439	32.56% 561	24.84% 428	10.97% 189	6.15% 106	1,723	2.40
Earthquake	2.14% 37	5.57% 96	15.07% 260	28.64% 494	48.58% 838	1,725	4.16
Flood	15.33% 261	30.53% 520	31.47% 536	16.68% 284	5.99% 102	1,703	2.67
Landslide / Debris flow	14.25% 246	26.77% 462	29.14% 503	20.92% 361	8.92% 154	1,726	2.83
Severe winter storm	7.49% 130	20.29% 352	28.36% 492	30.20% 524	13.66% 237	1,735	3.22
Volcanic eruption	29.62% 513	34.30% 594	22.29% 386	9.35% 162	4.45% 77	1,732	2.25
Wildfire	8.35% 144	21.45% 370	29.57% 510	23.42% 404	17.22% 297	1,725	3.20
Windstorm	7.79% 134	21.51% 370	30.47% 524	29.07% 500	11.16% 192	1,720	3.14

Q2 Of the following Clackamas County assets, which do you think are the most vulnerable to the impacts caused by a natural disaster? Please assign a number, with "1" meaning "Not at all vulnerable and "5" meaning "very vulnerable."

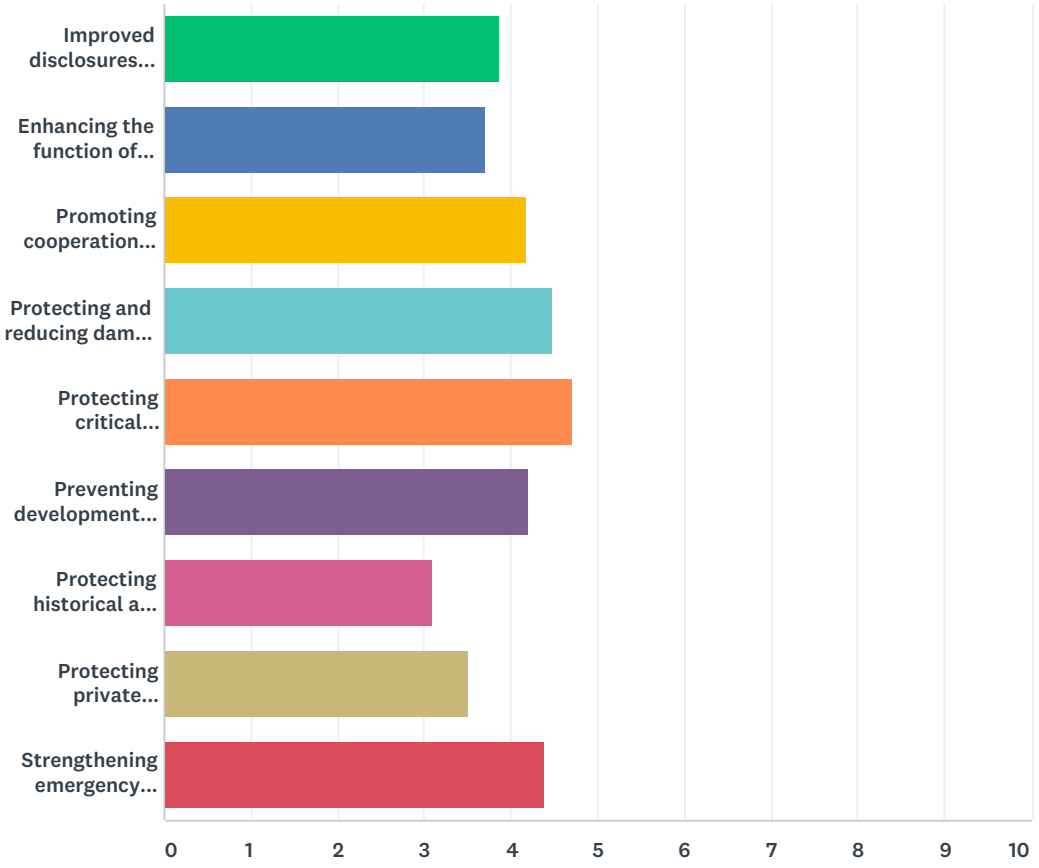
Answered: 1,737 Skipped: 3



	(NOT AT ALL VULNERABLE)1	2	3	4	(VERY VULNERABLE)5	TOTAL	WEIGHTED AVERAGE
Cultural/Historic (damage/loss of libraries, museums, fairgrounds)	6.81% 117	26.21% 450	35.35% 607	21.03% 361	10.60% 182	1,717	3.02
Economic (business closures/job losses)	1.57% 27	10.61% 182	30.01% 515	35.43% 608	22.38% 384	1,716	3.66
Environmental (damage/loss of forests, rangeland, waterways)	2.02% 35	11.57% 200	29.38% 508	30.83% 533	26.20% 453	1,729	3.68
Governance (ability to maintain order/provide public services)	2.03% 35	13.05% 225	28.42% 490	32.48% 560	24.01% 414	1,724	3.63
Human (loss of life and/or injuries)	0.98% 17	8.56% 148	22.57% 390	30.09% 520	37.79% 653	1,728	3.95
Infrastructure (damage/loss of bridges, utilities, schools)	0.52% 9	3.30% 57	10.25% 177	31.17% 538	54.75% 945	1,726	4.36

Q3 Planning for natural hazards can lessen event impacts on communities. Prioritizing goals for such times of hardship 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."

Answered: 1,643 Skipped: 97

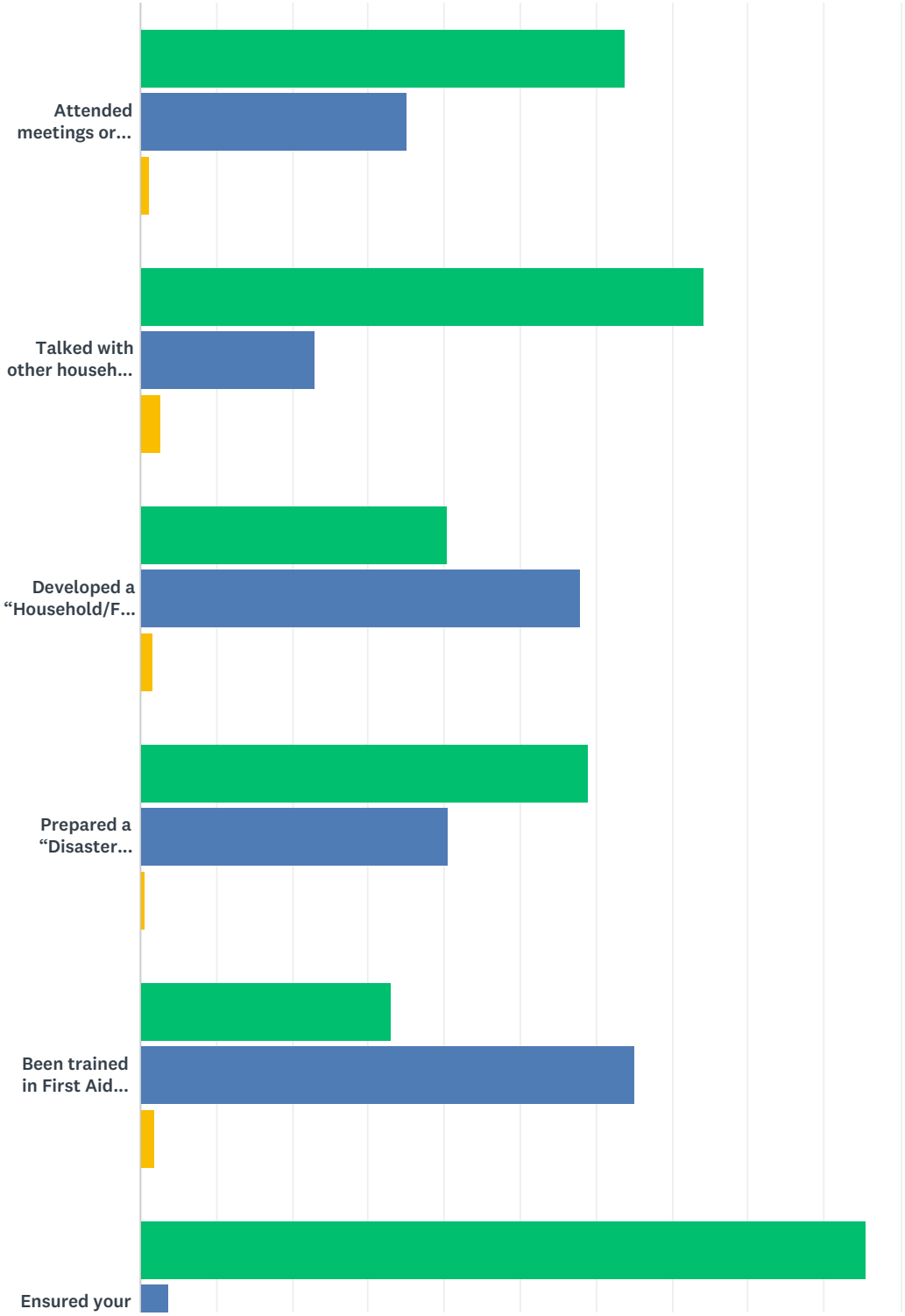


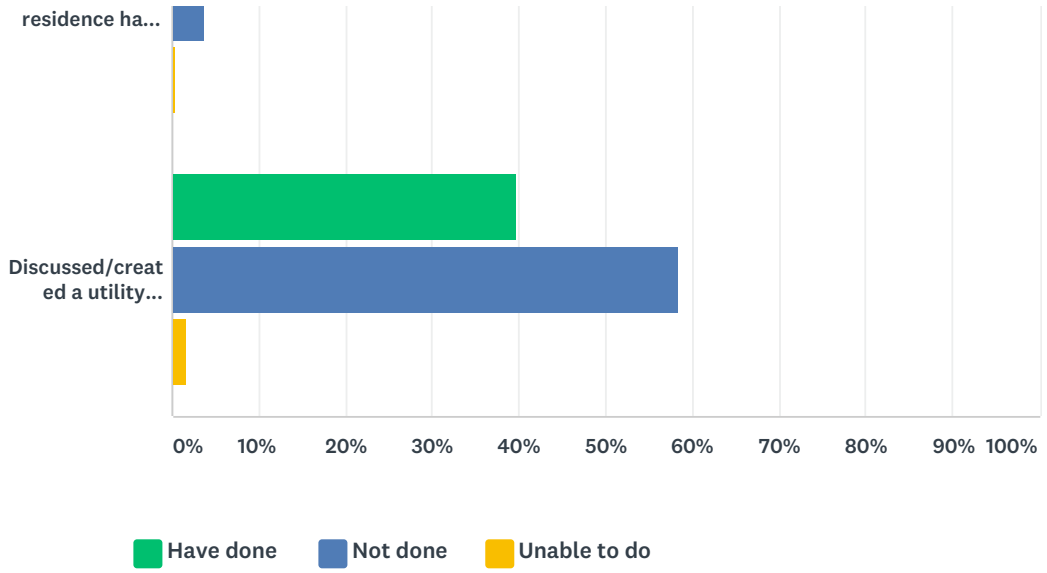
	(NOT AT ALL IMPORTANT)1	2	3	4	(VERY IMPORTANT)5	TOTAL	WEIGHTED AVERAGE
Improved disclosures about natural hazard risks during real estate transactions	3.05% 50	9.47% 155	21.93% 359	28.65% 469	36.90% 604	1,637	3.87
Enhancing the function of natural features (flood water absorption in wetlands)	2.15% 35	11.18% 182	27.58% 449	31.57% 514	27.52% 448	1,628	3.71
Promoting cooperation among public agencies, residents, nonprofit organizations, and businesses	1.29% 21	4.66% 76	16.18% 264	30.09% 491	47.79% 780	1,632	4.18
Protecting and reducing damage to utilities	0.25% 4	1.23% 20	8.34% 136	30.18% 492	60.00% 978	1,630	4.48
Protecting critical facilities (transportation networks, hospitals, fire stations)	0.24% 4	1.16% 19	4.27% 70	16.05% 263	78.28% 1,283	1,639	4.71

Preventing development (housing, infrastructure) in areas susceptible to hazards	1.47% 24	4.90% 80	15.44% 252	28.06% 458	50.12% 818	1,632	4.20
Protecting historical and cultural landmarks	6.58% 107	21.02% 342	38.48% 626	23.36% 380	10.57% 172	1,627	3.10
Protecting private property	2.49% 40	13.55% 218	34.43% 554	28.84% 464	20.70% 333	1,609	3.52
Strengthening emergency services (police, fire, ambulance)	0.43% 7	2.75% 45	11.68% 191	26.36% 431	58.78% 961	1,635	4.40

Q4 For each activity listed below, please select the choice that applies to ANY member of your household. For example, for the first answer, if ANY member of your household "has attended meetings or received written information on natural disasters or emergency preparedness," please select "Have done."

Answered: 1,642 Skipped: 98

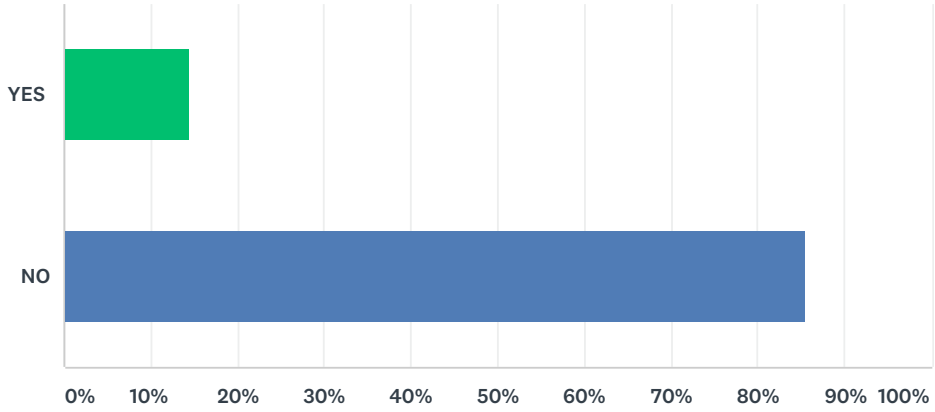




	HAVE DONE	NOT DONE	UNABLE TO DO	TOTAL
Attended meetings or received written information on natural disasters or emergency preparedness	63.78% 1,046	35.06% 575	1.16% 19	1,640
Talked with other household members about what to do in case of a natural disaster or emergency	74.31% 1,212	23.05% 376	2.64% 43	1,631
Developed a “Household/Family Emergency Plan” detailing what everyone would do during a disaster	40.44% 662	57.85% 947	1.71% 28	1,637
Prepared a “Disaster Supply Kit” (stored extra food, water, batteries, other supplies)	58.91% 962	40.54% 662	0.55% 9	1,633
Been trained in First Aid or CPR during the last 12 months	33.03% 539	65.13% 1,063	1.84% 30	1,632
Ensured your residence has smoke detectors on each level	95.71% 1,562	3.80% 62	0.49% 8	1,632
Discussed/created a utility shutoff procedure in the event of a natural disaster.	39.82% 651	58.47% 956	1.71% 28	1,635

Q5 Prior to receiving this survey, did you know about the existence of Clackamas County's Natural Hazard Mitigation Plan (NHMP)?

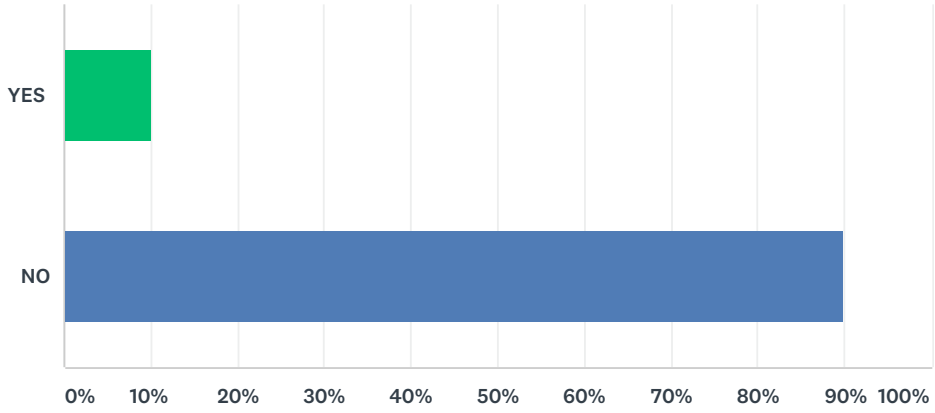
Answered: 1,622 Skipped: 118



ANSWER CHOICES	RESPONSES	
YES	14.36%	233
NO	85.64%	1,389
TOTAL		1,622

Q6 Prior to receiving this survey, were you aware that the Federal Emergency Management Agency (FEMA) requires Clackamas County to update the NHMP every five years in order to be eligible for federal pre- and post-disaster hazard mitigation funds?

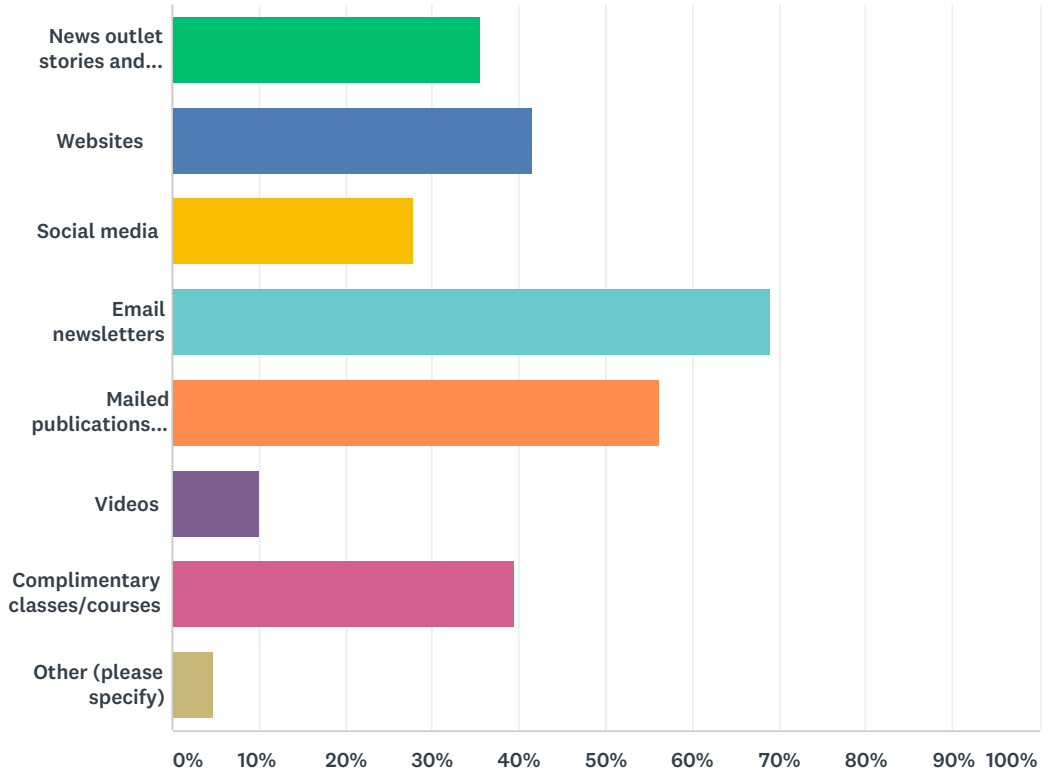
Answered: 1,624 Skipped: 116



ANSWER CHOICES	RESPONSES	
YES	9.98%	162
NO	90.02%	1,462
TOTAL		1,624

Q7 What are the most effective ways for you to receive information about how to make your household and home safer from natural disasters? Please check UP TO 3 of the boxes below.

Answered: 1,626 Skipped: 114



ANSWER CHOICES	RESPONSES	
News outlet stories and advertisements (newspapers, television, radio, online)	35.49%	577
Websites	41.70%	678
Social media	27.86%	453
Email newsletters	69.13%	1,124
Mailed publications (print newsletters, magazines)	56.21%	914
Videos	9.96%	162
Complimentary classes/courses	39.54%	643
Other (please specify)	4.86%	79
Total Respondents: 1,626		

#	OTHER (PLEASE SPECIFY)	DATE
1	News in the Clack County newsletter (quarterly?) is how we found out about the new alert system	12/1/2018 9:12 AM
2	Neighborhood groups	6/14/2018 9:36 AM
3	CONTINUE Disaster Services training with Red Cross	5/20/2018 4:03 PM

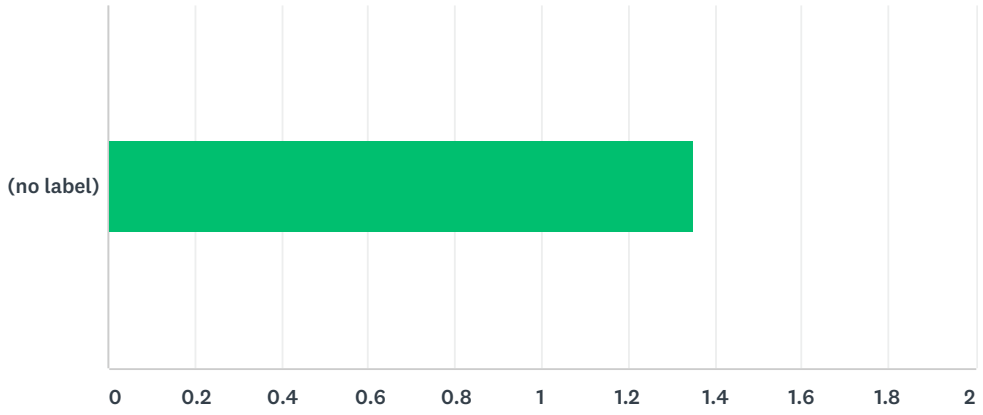
4	Next door for community level.	5/1/2018 2:43 PM
5	Text	2/22/2018 4:45 PM
6	NEXTDOOR SITE is a great tool for those of us that use it. I live alone so access to WL alerts is vital.	2/22/2018 9:05 AM
7	CARES	2/22/2018 3:42 AM
8	CERT training	2/21/2018 10:51 PM
9	PrepLO meetings	2/21/2018 7:28 PM
10	Mailing with property tax bill	2/21/2018 5:39 PM
11	More Presentations at normal community meetings	2/21/2018 3:41 PM
12	text	2/21/2018 3:40 PM
13	text message..	2/21/2018 3:10 PM
14	presentation at Neighborhood Association	2/21/2018 2:47 PM
15	Phone calls or visits from people willing to be the leaders in each neighborhood section	2/21/2018 2:34 PM
16	CERT Meetings	2/21/2018 2:08 PM
17	Neighborhood kids or Boy Scouts going door to door	2/21/2018 1:46 PM
18	Webinars with quizzes	2/21/2018 1:13 PM
19	neighborhood meetings	2/21/2018 12:52 PM
20	email	2/21/2018 12:46 PM
21	I'm new to this area. Would like to know all I can.	2/19/2018 11:09 PM
22	need more date/time choices for first aid class	2/19/2018 10:47 AM
23	Neighborhood meetings	2/18/2018 1:08 PM
24	Neighborhood association meetings	2/17/2018 11:29 PM
25	include with neighborhood watch	2/17/2018 10:16 AM
26	create neighborhood groups to do training and create block by block action plans	2/17/2018 9:02 AM
27	Educate	2/16/2018 4:04 PM
28	better support and publicizing CERT	2/16/2018 8:26 AM
29	Outreach through utilities (water, power, sewer, gas)	2/16/2018 5:51 AM
30	support the CERT program through insuring its volunteers and providing better support	2/15/2018 7:31 PM
31	County support for CERT	2/15/2018 6:20 PM
32	info in our retirement community	2/15/2018 4:52 PM
33	I DO NOT watch the news! My depression has improved since I stopped watching news. I am NOT on any form of social media. I rarely visit Next Door (dont remember why I signed up) SO I'm taking this opportunity to share my frustration about HOW I get informed. If they would deliver news without all the drama and reporting all the bike accidents, shootings ect. I would watch THE NEWS. BUT I CANT!!! My heart cant take the depressing information that I DO NOT NEED TO KNOW!!! .....I'm concerned about other senior citizens like me. I may not even check my email for weeks...I have NO reason to. My family calls if it's important. I have no work or any other forms of important email to worry about. Thinking that you will imform everyone over social media is a joke. Don't even plan on it! please!!! And the mailings only include The Clackamas news letter I receive.	2/15/2018 8:37 AM
34	I do not watch news or use social media not a computer person	2/15/2018 7:58 AM
35	Billboards	2/15/2018 2:17 AM
36	text disaster	2/14/2018 12:30 PM
37	presentation to CERT (Community Emergency Response Team)	2/14/2018 12:27 PM
38	text messages	2/14/2018 10:41 AM

39	classes/courses enhansed with 'webinar' remote attendance with edited recordings made available via links to appropriate gov't websites for wider distribution to those unable to attend	2/14/2018 10:39 AM
40	phone App or text / SMS alert system	2/14/2018 9:47 AM
41	someone speaking at a HOA meeting or other small gathering of community	2/14/2018 8:54 AM
42	Homeowners associations	2/14/2018 12:38 AM
43	more important to know what to do/where to go AFTER natural disaster occurs	2/13/2018 9:08 PM
44	Community educational forums,ie, earthquake,landslide,emergency preparedness,DOGAMI speakers, legislative representatives and possibly Senator or Congressman involved	2/13/2018 9:04 PM
45	Neighborhood meetings/presentations	2/13/2018 8:56 PM
46	Natural Disaster	2/13/2018 7:30 PM
47	notification through Nextdoor app. (am not on any other social media platform)	2/13/2018 7:24 PM
48	Independent and group hands on training	2/13/2018 7:07 PM
49	None needed	2/13/2018 6:57 PM
50	Farmers Market booth would be great!	2/13/2018 6:44 PM
51	Map Your Neighborhood get togethers with neighbors	2/13/2018 4:57 PM
52	Personal trainer	2/13/2018 4:53 PM
53	Automated phone call system	2/13/2018 4:39 PM
54	I am hard of hearing - personal connection is best for me	2/13/2018 4:15 PM
55	Neighborhood meetings - but we haven't gone.	2/13/2018 4:09 PM
56	Simple guidelines to post in home to follow in case of disaster.	2/13/2018 3:47 PM
57	Use local news paper as avenue to present news and information.	2/13/2018 3:34 PM
58	Please read all the following: Prepare videos for Utube to catch interest, then connect to a county website. Show history of floods and wildfires and the county responses. Make it very clear what areas are particularly vulnerable and what needs to be done about them. As to earthquakes, it will be an 8 or 9 and nothing can be done about that.	2/13/2018 3:32 PM
59	community meetings	2/13/2018 3:14 PM
60	Mail flyer	2/13/2018 3:10 PM
61	Next door	2/13/2018 2:46 PM
62	Am a CERT team member and promote the info to fellow residents.	2/13/2018 2:13 PM
63	Email alerts	2/13/2018 1:26 PM
64	Offer education at local churches	2/13/2018 1:23 PM
65	Text msg	2/13/2018 1:15 PM
66	TV program info and what provisions to stock.	2/13/2018 1:05 PM
67	Scout outreach	2/13/2018 1:01 PM
68	TV ads	2/13/2018 12:59 PM
69	store kiosks	2/13/2018 12:58 PM
70	Emergency Preparedness "Fairs"	2/13/2018 12:56 PM
71	Workplace and school presentations	2/13/2018 12:31 PM
72	Speak to CPOs and other groups, detail training and other resources, cert training, ham radio training	2/13/2018 12:26 PM
73	Neighborhood meetings	2/13/2018 12:18 PM
74	Nextdoor Network	2/13/2018 12:14 PM
75	Give info to neighborhood meetings	2/13/2018 12:14 PM

76	Help create neighborhood groups to help support each other in case of emergencies.	2/13/2018 12:05 PM
77	NextDoor.com	2/13/2018 12:00 PM
78	local volunteers - eg. CERT	2/13/2018 12:00 PM
79	Milwaukie NDAs (Hector Campbell)	2/13/2018 11:55 AM

Q8 How do you identify your gender?

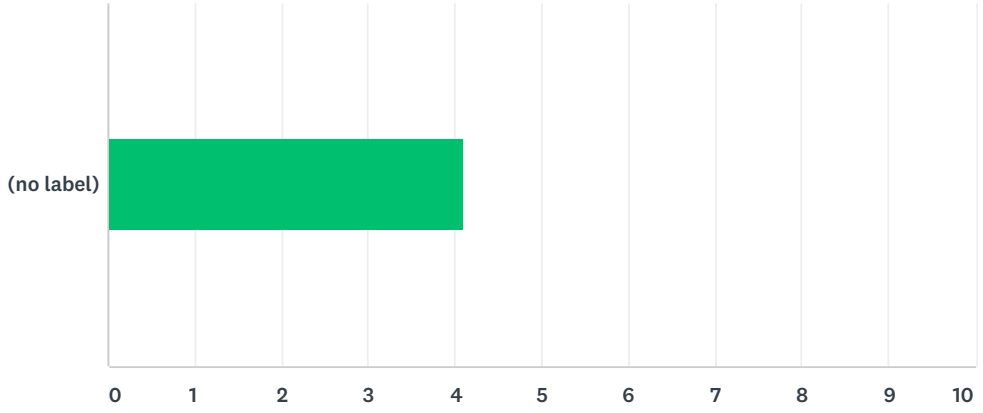
Answered: 1,584 Skipped: 156



	FEMALE	MALE	NEITHER FEMALE NOR MALE	PREFER NOT TO SAY	TOTAL	WEIGHTED AVERAGE
(no label)	69.51% 1,101	28.09% 445	0.32% 5	2.08% 33	1,584	1.35

Q9 What is your age?

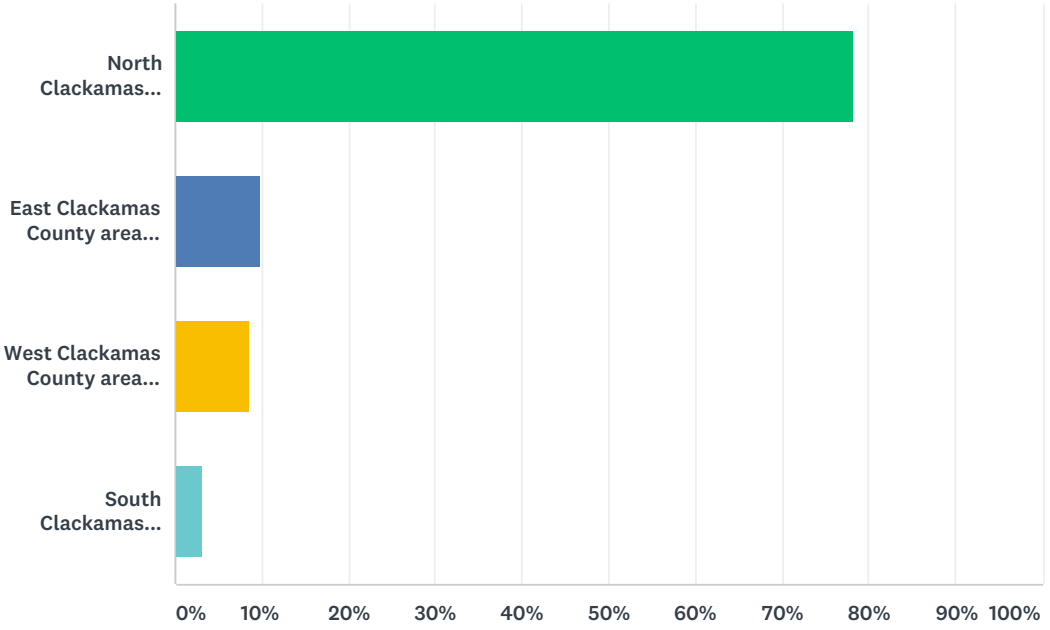
Answered: 1,595 Skipped: 145



	UNDER 18	18 - 29	30 - 49	50 - 64	65 OR OLDER	TOTAL	WEIGHTED AVERAGE
(no label)	0.19% 3	0.75% 12	25.27% 403	37.30% 595	36.49% 582	1,595	4.09

Q10 What area of Clackamas County do you live in?

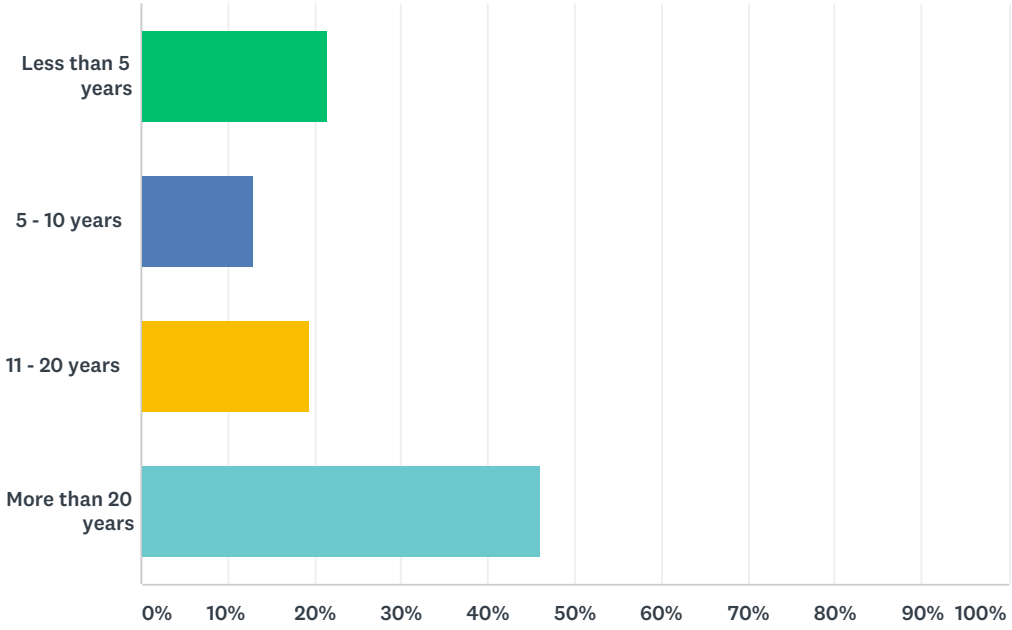
Answered: 1,615 Skipped: 125



ANSWER CHOICES	RESPONSES	
North Clackamas County area (Lake Oswego, West Linn, Happy Valley, Milwaukie, Gladstone, Oregon City)	78.33%	1,265
East Clackamas County area (Damascus, Sandy, Estacada, Mount Hood area)	9.91%	160
West Clackamas County area (Canby, Wilsonville)	8.54%	138
South Clackamas County area (Molalla, Mulino, Colton)	3.22%	52
TOTAL		1,615

Q11 How long have you lived in Clackamas County?

Answered: 1,613 Skipped: 127



ANSWER CHOICES	RESPONSES	
Less than 5 years	21.57%	348
5 - 10 years	12.96%	209
11 - 20 years	19.40%	313
More than 20 years	46.06%	743
TOTAL		1,613