

Volume II: Jurisdictional Addenda



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Clackamas Fire District #1 Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan



Photo Credit: Clackamas Fire District #1

March 2019

Volume II: Clackamas Fire District #1 Addendum



CLACKAMAS FIRE DISTRICT #1

Prepared for:

Clackamas Fire District #1

Prepared by:

University of Oregon
Institute for Policy Research and Engagement
Oregon Partnership for Disaster Resilience

Planning grant funding provided by:



FEMA

Federal Emergency Management Agency (FEMA)
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FEMA

September 25, 2019

The Honorable Jim Bernard
Chair, Clackamas County Commissioners
2020 Kaen Road Suite A
Oregon City, Oregon 97045

Dear Chairman Bernard:

On April 12, 2019, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan* as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance grants through April 11, 2024, through your state.

Clackamas County	City of Estacada	City of Lake Oswego
City of West Linn	City of Wilsonville	City of Johnson City
City of Oregon City	City of Happy Valley	City of Canby
Clackamas Fire District		

The updated list of approved jurisdictions includes the cities of Canby, Happy Valley, Oregon City, Johnson City, and the Clackamas Fire District which recently adopted the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan*. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Joseph Murray, State Hazard Mitigation Planner with Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities.

Sincerely,

Mark Carey, Director
Mitigation Division

Enclosure

JG

Clackamas Fire District #1



CLACKAMAS FIRE DISTRICT #1 RESOLUTION #19-05

A Resolution Adopting the Clackamas Fire District #1 Representation in the Updates to the Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan

Whereas, the Clackamas Fire District #1 recognizes the threat that natural hazards pose to people, property and infrastructure within our District; and

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

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

Whereas, the Clackamas Fire District #1 has fully participated in the FEMA prescribed mitigation planning process to prepare the *Clackamas County, Multi-Jurisdictional Natural Hazard Mitigation Plan*, which has established a comprehensive, coordinated planning process to eliminate or minimize these vulnerabilities; and

Whereas, the Clackamas Fire District #1 has identified natural hazard risks and prioritized a number of proposed actions and programs needed to mitigate the vulnerabilities of the Clackamas Fire District #1 to the impacts of future disasters within the *Clackamas County, Multi-Jurisdictional Natural Hazard Mitigation Plan*; and

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

Whereas, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *Clackamas Fire District #1 addendum* to the *Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan* and pre-approved it (dated, September 13, 2019) contingent upon this official adoption of the participating governments and entities;

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

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

Whereas, Clackamas Fire District #1 adopts the NHMP and directs the Fire Chief to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.

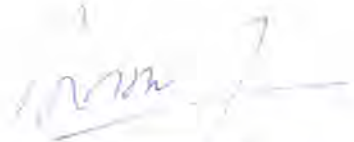
Now, therefore, be it resolved, that the Clackamas Fire District #1 adopts *the Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan* as an official plan; and

Be it further resolved, that the Clackamas Fire District #1 will submit this Adoption Resolution to the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the *Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan*.

Adopted this 16th day of September, 2019



President, Board of Directors



Secretary, Board of Directors

9/16/19

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Purpose

The Clackamas Fire District #1 (CFD, Fire District) addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP) was completed in 2019. This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation and Volume III (Appendices) which provide additional information. This addendum meets the following requirements:

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

Clackamas Fire District #1 adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on **September 16, 2019**. FEMA Region X approved the Clackamas County NHMP on **April 12, 2019** and the Fire District's addendum on **September 25, 2019**. With approval of this NHMP the Fire District is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **April 11, 2024**.

Mitigation Plan Mission

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

The Fire District concurs with the mission statement developed during the Clackamas County planning process (Volume I, Section 3):

Promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

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

The Fire District concurs with the goals developed during the Clackamas County planning process (Volume I, Section 3). All NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Below is a list of the NHMP goals:

GOAL #1: PROTECT LIFE AND PROPERTY

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

GOAL #2: ENHANCE NATURAL SYSTEMS

- Balance watershed planning, natural resource management, and land use planning with natural hazards mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

GOAL #3: AUGMENT EMERGENCY SERVICES

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, and business, and industry.
- Coordinate and integrate natural hazards mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL #4: ENCOURAGE PARTNERSHIPS FOR IMPLEMENTATION

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

GOAL #5: PROMOTE PUBLIC AWARENESS

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

NHMP Process, Participation and Adoption

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

This Clackamas Fire District #1 addendum was added to the Clackamas County NHMP in 2019. In addition to establishing a comprehensive community-level mitigation strategy, the Disaster Mitigation Act of 2000 (DMA2K), and the regulations contained in 44 CFR 201, require that jurisdictions maintain an approved NHMP to receive federal funds for mitigation projects. Local adoption, and federal approval of this NHMP ensures that the Fire District will remain eligible for pre- and post-disaster mitigation planning and project grants.

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM) to update Clackamas County's NHMP which included the development of the Clackamas Fire District #1 addendum. This project is funded through the Federal Emergency Management Agency's Pre-Disaster Mitigation (PDM) Competitive Grant Program EMS-2017-PC-0005 (PDMC-PL-10-OR-2016-001). Members of the Clackamas Fire District #1 NHMP Hazard Mitigation Advisory Committee (HMAC) also participated in the County NHMP update process (Volume III, Appendix B).

The Clackamas County NHMP and Clackamas Fire District #1 addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector and regional organizations. The Clackamas Fire District #1 HMAC guided the process of developing their NHMP addendum.

Convener

Clackamas Fire District #1's Emergency Manager served as the designated convener of the NHMP development and will take the lead in implementing, maintaining and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the Clackamas Fire District #1 HMAC met formally and informally, to discuss updates to their addendum (Volume III, Appendix B). This addendum reflects decisions made at the designated meetings and during subsequent work and communication between the Fire District's convener and OPDR.

The Clackamas Fire District #1 HMAC was comprised of the following representatives:

- Convener, Gregg Ramirez, Emergency Manager
- Fred Charlton – Fire Chief
- Doug Whiteley – Deputy Fire Chief (Business Services)
- Ryan Hari – Deputy Fire Chief (Operations)
- Stephanie Walker (Administrative Technician)

Public participation was achieved with the establishment of the HMAC, which was comprised of Fire District officials representing different divisions and members of the public. The HMAC served as the local review body for the NHMP's development. Community members were provided an opportunity for comment via the NHMP review process, and through a survey administered by Clackamas County (Volume III, Appendix G).

NHMP Implementation and Maintenance

The CFD Board of Directors will be responsible for adopting the Clackamas Fire District #1 addendum to the Clackamas County NHMP. This addendum designates the HMAC, and a convener to oversee the development, and implementation of action items. Because the Fire District addendum is part of the County's multi-jurisdictional NHMP, the Fire District will look for opportunities to partner with the County. The Fire District's HMAC will convene after re-adoption of the Clackamas Fire District #1 NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities and Fire District to report on NHMP implementation, and maintenance during their meetings. The CFD Emergency Manager will serve as the convener and will be responsible for assembling the HMAC. The HMAC will be responsible for:

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing, and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating, and training new HMAC members on the NHMP, and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement; and
- Documenting successes, and lessons learned during the year.

The convener will also remain active in the County's implementation, and maintenance process (Volume I, Section 4).

The Fire District will utilize the same action item prioritization process as the County (Volume I, Section 4).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the Fire District; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other Fire District plans and programs including their [Strategic Business Plan](#) and the [Clackamas County Community Wildfire Protection Plan](#) as well as the [Clackamas County NHMP](#), and the [State of Oregon NHMP](#).

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the Fire District. Plans and policies already in existence have support from district residents, businesses, and policy makers. Where possible, Clackamas Fire District #1 will implement the NHMP's recommended actions through existing plans and policies. Many land-use and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Future development without proper planning may result in worsening problems associated with natural hazards. In addition, Metro, the regional government for Clackamas, Multnomah, and Washington counties, determines many land use laws for the tri-county region and sets the urban growth boundary. The entire Portland Metro area is subject to tremendous growth pressures due to its desirable location and the restrictions on urban sprawl placed by urban growth boundary requirements.

Clackamas Fire District #1 currently has the following plans that relate to natural hazard mitigation: [Clackamas County Community Wildfire Protection Plan](#); [Clackamas Fire District #1 \(CFD#1\)](#) and [Strategic Business Plan](#). For a complete list visit the Fire Districts [website](#).

Governance Structure

Clackamas Fire District #1 is governed by a Board of Directors. The Board of Directors consists of five members elected to staggered four-year terms by voters within the CFD #1 Service Area (Figure CFD-1). The Board of Directors is responsible for identifying problems and opportunities within the Fire District and then addressing those issues through policy. The Board of Directors, in turn hire a fire chief, who serves as the administrative head of the Fire District.

The following divisions within the fire district have a role in natural hazards mitigation:

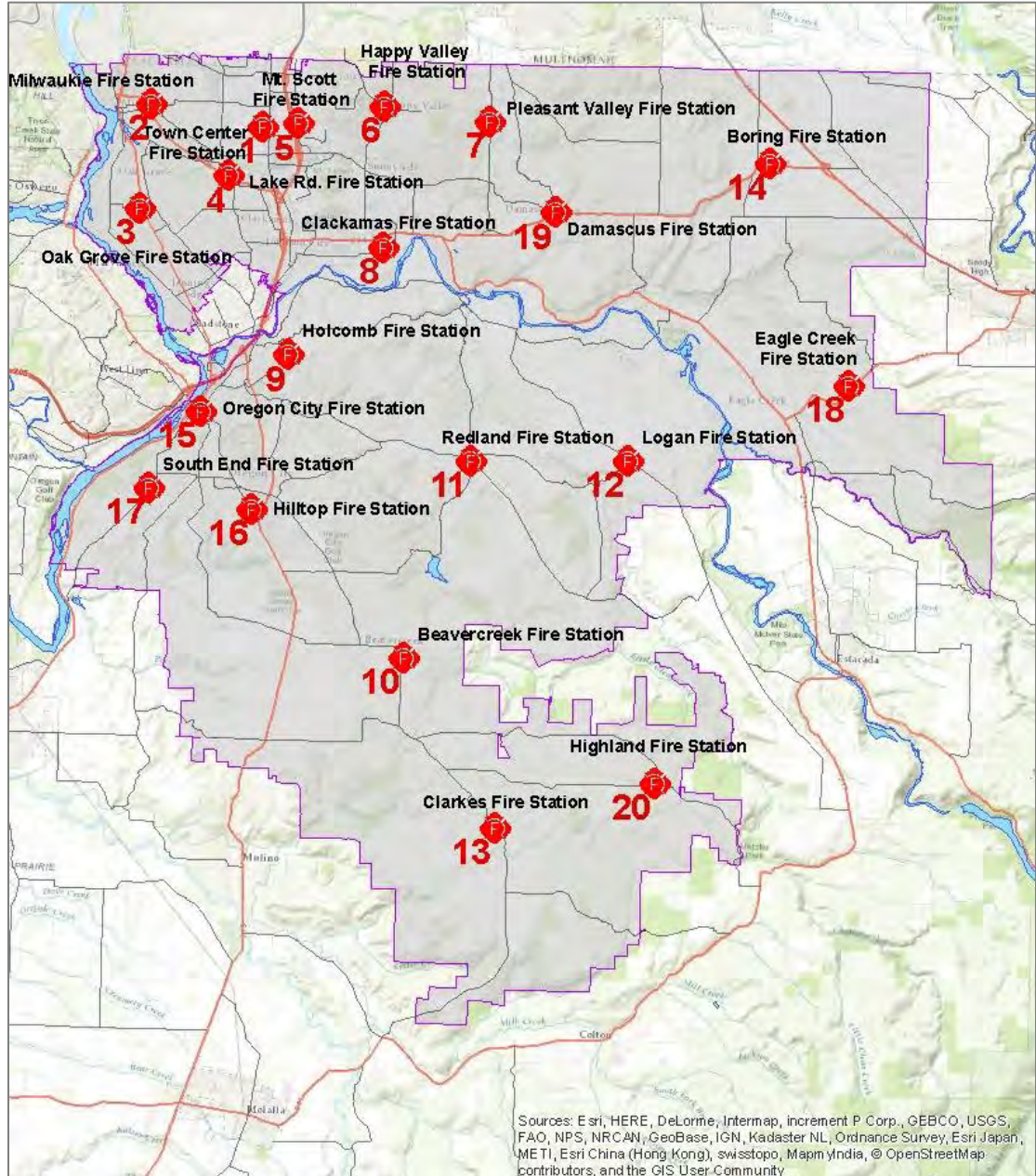
The **Emergency Services Division** includes departments responsible for emergency response, fire suppression, and related function. It includes highly skilled and cross trained firefighter/paramedics and firefighters (EMTs) that respond to medical emergency alarms. The division consists of 156 paramedics, 13 EMT Intermediates, and over 50 EMT Basics.

The **Fleet Division** is responsible for maintaining the fleet of fire and emergency apparatus and staff vehicles. The division also maintains and repairs apparatus and vehicles from the Canby and Gladstone fire departments through intergovernmental agreements.

The **Financial Services Division** is responsible for strategic financial planning, financial reporting, and accounting. Tasks of the division include financial forecasting and planning, budget development and administration, financial reporting, general accounting, payroll, and debt management.

The **Business Services Division** is comprised of support departments including Fire Prevention and the Fire Marshal's Office, Information Technology, Human Resources, Data Management, and Administration. The division provides administrative support to other divisions and provides public education and community involvement regarding fire prevention and medical aid.

Figure CFD-I Clackamas Fire District #1 Service Area Map



Source: Clackamas Fire District #1

Continued Public Participation

An open public involvement process is essential to the development of an effective NHMP. To develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunities for the public, neighboring communities, local, and regional agencies, as well as, private, and non-profit entities to comment on the NHMP during review.¹ Keeping the public informed of efforts to reduce its risk to future natural

¹ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

hazard events is important for successful NHMP implementation, and maintenance. As such, the Fire District is committed to involving the public in the NHMP review and update process (Volume I, Section 4). The Fire District posted the plan update for public comment before FEMA approval, and after approval will maintain the plan on the Fire District's website: <http://www.clackamasfire.com/>

NHMP Maintenance

The Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP) and Fire District addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the County NHMP update process, the Fire District will also review and update its addendum. The convener will be responsible for convening the HMAC to address the questions outlined below.

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

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

Mitigation Strategy

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

The Fire District's mitigation strategy (action items) were developed during the 2019 NHMP planning process. During this process, the HMAC assessed the Fire District's risk, identified potential issues, and developed a mitigation strategy (action items).

Priority Action Items

Table CFD-1 presents a list of mitigation actions. The HMAC decided to prioritize action items to reflect current conditions (risk assessment), needs, and capacity. High priority actions are shown in **bold** text with grey highlight. The Fire District will focus their attention, and resource availability, upon these achievable, high leverage, activities over the next five-years. Although this methodology provides a guide for the HMAC in terms of implementation, the HMAC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding

sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for detailed information for each action. Full text of the plan goals referenced in Table CFD-1 is located on page CFD-2.

Table CFD-I Clackamas Fire District #1 Action Items

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
MH#1	Develop new and continue to enhance education programs aimed at mitigating natural hazards and reducing risk.	Emergency Management	Business Services	Ongoing	✓		✓	✓	✓
EQ#1	Continue to conduct seismic evaluations and start projects implementing appropriate structural and non-structural mitigation strategies.	Facilities	Emergency Services	Long Term	✓			✓	✓
SW#1	Continue to ensure that all response vehicles have chains for driving on snow and ice.	Fleet Services	Business Services	Short Term			✓	✓	
SW#2	Continue to coordinate with the County and Cities to make stations a priority for plowing and ensure up-to-date knowledge of plowing routes.	Emergency Management	Business Services	Short Term	✓		✓	✓	✓
WF#1	Continue to coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan.	Fire Prevention	Business Services, Emergency Services	Ongoing	✓	✓	✓	✓	✓
WF#2	Continue to promote legal, safe, and responsible debris burning through public outreach and education.	Fire Prevention	Business Services	Short Term	✓	✓		✓	✓
WF#3	Continue to promote fire-resistant strategies for new and existing developments.	Fire Prevention	Business Services	Short Term	✓			✓	✓
WF#4	Continue to increase participation in land use reviews of residential structures in the Timber/Agriculture Zone.	Fire Prevention	Business Services	Long Term	✓			✓	✓

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
WF#5	Continue to conduct a Community Meeting to educate community on defensible space, and measures that can be taken to reduce structural ignitability. Consider creating Firewise/USA Communities here.	Fire Prevention	Business Services	Short Term	✓	✓		✓	✓
WF#6	Continue to obtain structural ignitability data by conducting structural triage assessment data collection (including GPS points) for homes in Communities at Risk.	Fire Prevention	Business Services	Ongoing	✓			✓	✓

Source: Clackamas Fire District #1 HMAC, 2018.

Note: Full text of the plan goals referenced in this table is located on page CFD-2.

Risk Assessment

This section of the NHMP addendum addresses 44 CFR 201.6(b)(2) - Risk Assessment. Assessing natural hazard risk has three phases:

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

The local level rationale for the identified mitigation strategies (action items) is presented herein, and within Volume I, Section 2, and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure CFD-2. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure CFD-2 Understanding Risk



Hazard Analysis

The Clackamas Fire District #1 HMA developed their hazard vulnerability assessment (HVA), using the County’s HVA as a reference. Changes from the County’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Clackamas Fire District #1, which are discussed throughout this addendum.

Table CFD-2 shows the HVA matrix for Clackamas Fire District #1 listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response and recovery. The method provides the jurisdiction with sense of hazard priorities but does not predict the occurrence of a hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake and a Crustal earthquake event such as from the Portland Fault) and one chronic hazard (winter storm) rank as the top hazard threats to the Fire District (Top Tier). The windstorm, flood, and wildfire hazards comprise the next highest ranked hazards (Middle Tier), while volcanic event, landslide, extreme heat, and drought comprise the lowest ranked hazards (Bottom Tier).

Table CFD-2 Hazard Analysis Matrix – Clackamas Fire District #1

Hazard	Maximum				Total Threat Score	Hazard Rank	Hazard Tiers
	History	Vulnerability	Threat	Probability			
Earthquake - Cascadia	4	45	100	49	198	#1	Top Tier
Earthquake - Crustal	6	50	100	21	177	#2	
Winter Storm	10	35	70	56	171	#3	
Windstorm	14	25	50	56	145	#4	Middle Tier
Flood	16	25	50	49	140	#5	
Wildfire	8	20	40	56	124	#6	
Volcanic Event	2	35	50	14	101	#7	Bottom Tier
Landslide	14	15	20	35	84	#8	
Extreme Heat	2	20	40	14	76	#9	
Drought	2	10	20	28	60	#10	

Source: Clackamas Fire District #1 HMAC, 2018.

Table CFD-3 categorizes the probability, and vulnerability scores from the hazard analysis for the Fire District and compares the results to the assessment completed by the Clackamas County HMAC. Variations between the Fire District and County are noted in **bold** text within the Fire District ratings.

Table CFD-3 Probability and Vulnerability Comparison

Hazard	CFD #1		Clackamas County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Low	High	Low
Earthquake - Cascadia	Moderate	High	Moderate	High
Earthquake - Crustal	Low	High	Low	High
Extreme Heat	Low	Moderate	Low	High
Flood	Moderate	Moderate	High	Moderate
Landslide	Moderate	Low	High	Low
Volcanic Event	Low	Moderate	Low	Moderate
Wildfire	High	Moderate	High	Moderate
Windstorm	High	Moderate	Moderate	Low
Winter Storm	High	Moderate	Moderate	Moderate

Source: Clackamas Fire District #1 HMAC, 2018.

Community Characteristics

Table CFD-4 and the following section provides information on Fire District specific demographics and assets. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation. Considering the Fire District specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation. Between 2010 and 2016 the service area grew by 12,567 people² (6%) and median household income remained stable.³ New development has complied with the standards of the [Oregon Building Code](#) per County and city development codes.

Transportation/Infrastructure

Transportation has played a major role in shaping the communities within the service area of the Fire District. Interstate 205 runs from the western edge through the Fire District and north; State Highway 99E (or McLoughlin Blvd.) runs along the western border of the Fire District; Highway 213 runs north to south through the central part of the Fire District; Highway 212/224 runs from Interstate 205 east towards the Fire Districts eastern boundary.

Today, mobility plays an important role in the area and the daily experience of its residents and businesses as they move from point A to point B. Motor vehicles represent the dominant mode of travel through, and within the Fire District. Most communities within the Fire District's service area are provided public transportation by Tri-Met which provides daily local bus services to numerous community transit centers. The Fire District's service area is also accessed by the Union Pacific Railroad main line and Amtrak, which travels northeast to southwest carrying both passengers and freight.

Economy

The Fire District is located within the greater Portland region, resulting in easy access to downtown Portland and surrounding communities. Fire District service area residents are mostly employed in professional and related occupations.⁴ In 2016, the average per capita income for residents is \$31,198.⁵ The top economic sectors are Educational Services, and Health Care and Social Assistance; Retail Trade; and Manufacturing.⁶

For additional information on the characteristics of the Fire District, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume II addenda for the cities of Happy Valley, Johnson City, Milwaukie, and Oregon City, and Volume III, Appendix C, *Community Profile*. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation.

² U.S. Census Bureau, 2006-2010 and 2012-2016 American Community Survey Estimates. Census data for the Fire District aggregated at the tract level – see description under Table CFD-4 for more information.

³ Social Explorer, Table T57, U.S. Census Bureau, 2006-2010 and 2012-2016 American Community Survey Estimates.

⁴ Social Explorer, Table B17008, U.S. Census Bureau, 2012-2016 American Community Survey Estimates.

⁵ Ibid. Table A14024.

⁶ Ibid. Table A17004.

Table CFD-4 Community Characteristics

Population Characteristics		
2010 Population	201,696	
2016 Population	214,263	
Race (non-Hispanic) and Ethnicity (Hispanic)		
White		82%
Black/ African American		1%
American Indian and Alaska Native		1%
Asian		5%
Native Hawaiian and Other Pacific Islander		< 1%
Some Other Race		< 1%
Two or More Races		3%
Hispanic or Latino		9%
Limited or No English Spoken		5%
Vulnerable Age Groups		
Less than 15 Years	8,743	4%
65 Years and Over	33,922	16%
Disability Status		
Total Population	27,068	13%
Children	2,147	5%
Seniors	11,810	35%
Income Characteristics		
Households by Income Category		
Less than \$15,000	6,670	8%
\$15,000-\$29,999	9,891	12%
\$30,000-\$44,999	10,516	13%
\$45,000-\$59,999	10,063	12%
\$60,000-\$74,999	9,405	12%
\$75,000-\$99,999	12,275	15%
\$100,000-\$199,999	18,659	23%
\$200,000 or more	3,735	5%
Median Household Income	\$64,749	
Poverty Rates		
Total Population	22,103	10%
Children	5,555	12%
Seniors	2,467	7%
Housing Cost Burden		
Owners with Mortgage	17,565	45%
Renters	12,816	49%

Source: U.S. Census Bureau, 2006-2010 and 2012-2016 American Community Survey Estimates. Census data for the Fire District aggregated at the tract level. Clackamas County Census tracts used for these estimates are: 208, 209, 210, 211, 212, 213, 214, 215, 216.01, 216.02, 217, 218.01, 218.02, 219, 220, 221.01, 221.03, 221.05, 221.07, 221.08, 222.01, 222.05, 222.06, 222.07, 222.08, 223.01, 223.02, 224, 225, 226.02, 226.03, 226.05, 226.06, 230.01, 230.02, 231, 232.01, 232.02, 233, 234.01, 235.

Housing Characteristics		
Housing Units		
Single-Family	60,831	71%
Multi-Family	18,009	21%
Mobile Homes	6,176	7%
Year Structure Built		
Pre-1970	24,042	30%
1970-1989	27,895	34%
1990 or later	29,277	36%
Housing Tenure and Vacancy		
Owner-occupied	55,225	65%
Renter-occupied	25,989	31%
Seasonal	228	< 1%
Vacant	3,689	4%

The Fire District’s service area is near the southern limits of the Portland metro-area. The Fire District serves the cities of Happy Valley, Johnson City, Milwaukie, and Oregon City and the unincorporated areas of Barton, Beavercreek, Boring, Carus, Carver, Central Point, Clackamas, Clarkes, Damascus, Eagle Creek, Highland, Hillsview, Holcomb, Kelso, Jennings Lodge, Oak Grove, Redland, South End, Sunnyside, and Westwood.

The Fire District has grown in land area over the years as it merged with to provided expanded service levels and to expand the scope of services with the economies of scale of modern fire agencies. As of 2019, the Fire District covers nearly 235 square miles with 21 fire stations in urban, suburban, and rural areas.

Temperatures range from monthly average lows in the mid-30°F range in the winter months (December/January coldest) to average highs in the mid-80°F range in the summer months (July/August hottest). The average annual precipitation ranges within the district but is typically in the 40 to 50-inch range with most precipitation falling between October and April.

Community Assets

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of Clackamas Fire District #1. It is important to note that the facilities identified as “critical” and “essential” are characterized differently than the structural code that identifies buildings as “essential” and “non-essential.” The structural code uses different language and criteria and therefore have completely different meanings than the buildings identified in this addendum. Considering the Fire District specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation.

Critical Facilities

Facilities that are critical to government response, and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include: 911 Centers, Emergency Operations Centers, Police, and Fire Stations, Public Works facilities, sewer, and water facilities, hospitals, bridges, roads, shelters, and more.

Table CFD-5 Critical Facilities in Clackamas Fire District #1

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Facilities									
Fire Stations									
Station 1 – Town Center									X
Station 2 – Milwaukie									X
Station 3 – Oak Grove									X
Station 4 – Lake Road				X					X
Station 5 – Mt Scott									X
Station 6 – Happy Valley					X				X
Station 7 – Pleasant Valley		X							X
Station 8 – Clackamas									X
Station 9 – Holcomb		X							X
Station 10 - Beavercreek									X
Station 11 – Redland					X				X
Station 12 – Logan									X
Station 13 – Clarkes		X					X		X
Station 14 – Boring									X
Station 15 – John Adams		X			X				X
Station 16 – Hilltop		X		X	X				X
Station 17 – South End									X
Station 18 – Eagle Creek		X			X		X		X
Station 19 - Damascus					X				X
Station 20 – Highland							X		X
Station 21 – Centennial Park									X

Essential Facilities

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public’s ability to recover from the emergency.

Table CFD-6 Essential Facilities in Clackamas Fire District #1

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Essential Facilities									
Fleet Logistics									
Training and Wellness (Office)									
Training and Wellness (Facility)									
Administrative Building									
IT Building									

Hazard Characteristics

Drought

The HMAC determined that the Fire District’s probability for drought is **moderate** and that their vulnerability to drought is **low**.

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent and probability of a potential event. Due to the climate of Clackamas County, past and present weather conditions have shown an increasing potential for drought.

Vulnerability Assessment

Due to insufficient data and resources, Clackamas Fire District #1 is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section. For specific information for communities within the Fire District’s service area see Volume I, Section 2 and the addenda for the cities of Happy Valley, Johnson City, Milwaukie, and Oregon City.

Mitigation Activities

The existing drought hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Earthquake (Cascadia Subduction Zone)

The HMAC determined that the Fire District's probability for a Cascadia Subduction Zone (CSZ) earthquake is **moderate** and that their vulnerability to a CSZ earthquake is **high**.

Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent and probability of a potential event. Generally, an event that affects the County is likely to affect Clackamas Fire District #1 as well. The causes and characteristics of an earthquake event are appropriately described within the Volume I, Section 2 as well as the location and extent of potential hazards. Previous occurrences are well documented within Volume I, Section 2 and the community impacts described by the County would generally be the same for Clackamas Fire District #1 as well.

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Portland Hills Fault Zone, and Gales Creek-Newberg-Mt. Angel Structural Zone (discussed in the crustal earthquake section).

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year. Scientists have found evidence that 11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D.⁷

Figure CFD-3 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the Fire District is expected to experience very strong shaking (orange), while areas near rivers and streams will experience severe (light red) to violent (dark red) shaking in a CSZ event.

Ground shaking can mix groundwater and soil, liquefying and weakening the ground that supports buildings and severing utility lines. This is a special problem in low lying areas adjacent to rivers where the water table is shallow and the soils are subject to liquefaction. For example, the fine-grained alluvial soils along the banks of the Willamette and Clackamas Rivers and area creeks are likely subject to this hazard.

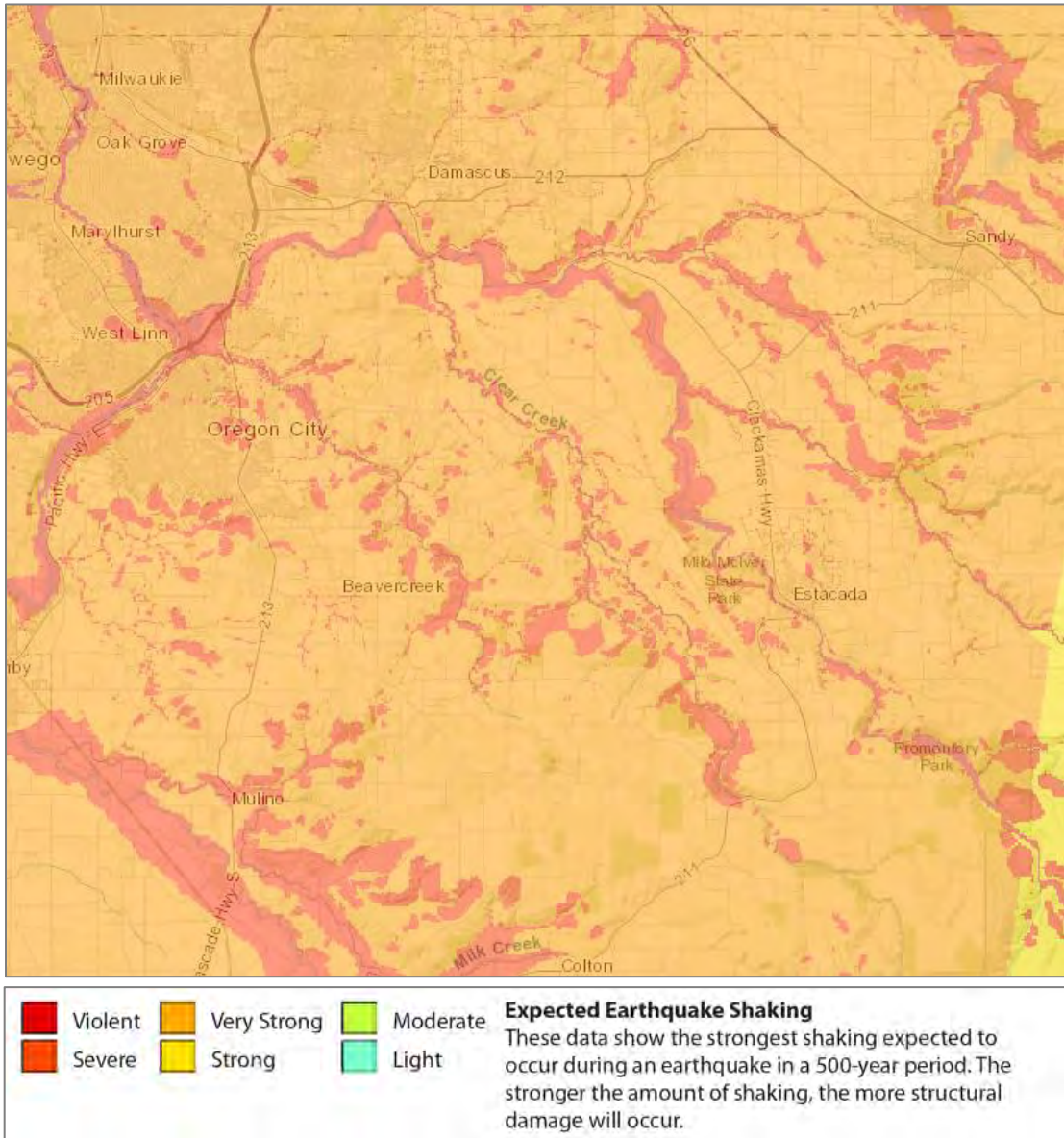
The Fire District's proximity to the Cascadia Subduction Zone, potential slope instability and the prevalence of certain soils subject to liquefaction and amplification combine to give the Fire District a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places the Fire District predominately within the "Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades). Within the Northwest Oregon region, damage and shaking is expected to be strong and widespread - an event will be disruptive to daily

⁷ The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. <http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf>

life and commerce and the main priority is expected to be restoring services to business and residents.

Older buildings and the sewer system in the Fire District are most vulnerable to damage. Earthquakes shift soil that could cause landslides. Transportation routes and economic areas within the Fire District can also be affected. Demand on resources such as Emergency Service (Fire and Ambulance) would also increase.

Figure CFD-3 Cascadia Subduction Zone Expected Shaking



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

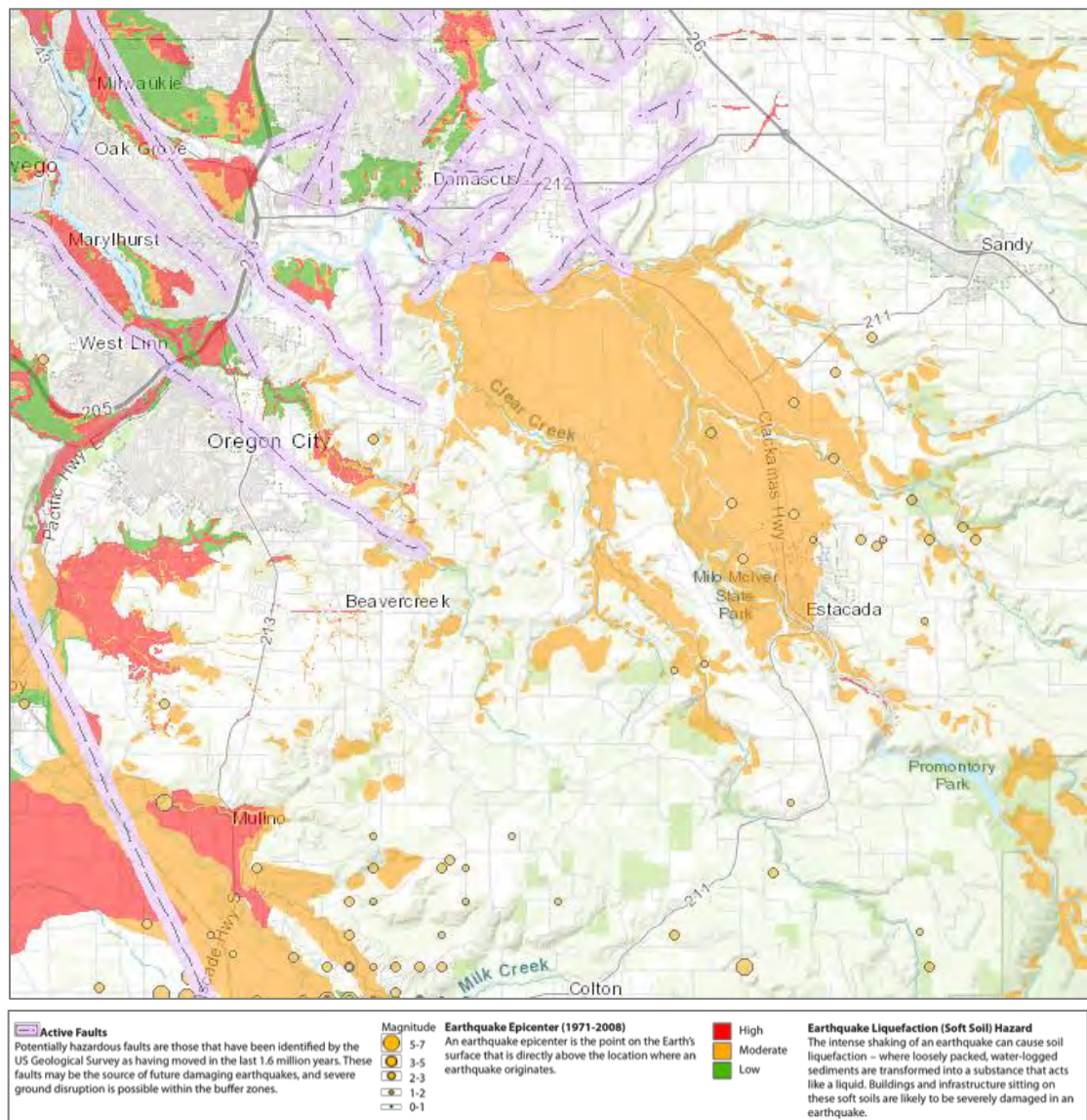
Note: To view detail click the link above to access Oregon HazVu.

Earthquake (Crustal)

The HMAc determined that the Fire District's probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**.

Volume I, Section 2 describes the causes and characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect the Fire District as well. Figure CFD-4 shows a generalized geologic map of the Fire District service area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows the areas of greatest concern within the service area as red and orange.

Figure CFD-4 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



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

Note: To view detail click the link above to access Oregon HazVu

There are several potential crustal faults and/or zones near, or within, the Fire District's service area that can generate high-magnitude earthquakes. These include the Gales Creek-Mt. Angel Structural Zone, Bolton Fault, Oatfield Fault, Canby-Molalla structural zones, Damascus-Tickle Creek fault zone, and Portland Hills Fault Zone (discussed in greater detail below). Historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and extends into the Fire District service area through Milwaukie and near Oregon City.

Vulnerability Assessment

Due to insufficient data and resources, Clackamas Fire District #1 is currently unable to perform a quantitative risk assessment for this hazard. However, in 2018 the Department of Geology and Mineral Industries (DOGAMI) completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)), findings from that report relevant to the Fire District's service area are provided in Volume I, Section 2 and within the addenda for the cities of Happy Valley, Johnson City, Milwaukie, and Oregon City.

Seismic building codes were implemented in Oregon in the 1970s, however, stricter standards did not take effect until 1991 and the early 2000s. As noted in the community profile, approximately 64% of residential buildings (primarily single-family residential) with the Fire District service area were built prior to 1990 (30% before 1970), which increases the service areas vulnerability to the earthquake hazard. Information on specific public buildings' (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table CFD-7; each "X" represents one building within that ranking category. Of the Fire District facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), none have a very high (100% chance) or a high (greater than 10% chance) collapse potential.

Table CFD-7 Rapid Visual Survey Scores

Facility	Location	Site ID*	Level of Collapse Potential			
			Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Station 1 – Town Center 11300 SE Fuller Rd (ca. 1983)	Milwaukie	Clac_fir09	X			
Station 2 – Milwaukie 3200 SE Harrison St (ca. 1993)	Milwaukie	Clac_fir26	X			
Station 3 – Oak Grove 2930 SE Oak Grove Blvd (ca. 1997)	Milwaukie	Clac_fir27	X			
Station 4 – Lake Road 6600 SE Lake Rd (ca. 1999)	Milwaukie	Clac_fir08	X			
Station 5 – Mt Scott 9339 SE Causey Ave (ca. 2003)	Happy Valley	None		<i>2007 RVS report did not include structural appendix for this facility.</i>		
Station 6 – Happy Valley 12901 SE King Rd (ca. 2000)	Happy Valley	Clac_fir13	X			
Station 7 – Pleasant Valley 10921 SE 172 nd (ca. 2004)	Happy Valley	None		<i>2007 RVS report did not include structural appendix for this facility.</i>		
Station 8 – Clackamas 16100 SE 130 th Ave (ca. 1985)	Happy Valley	Clac_fir11 Clac_fir12	X X			
Station 9 – Holcomb 300 Longview Way (ca. 1974)	Oregon City	Clac_fir29	X			
Station 10 - Beaver Creek 22310 S Beaver Creek Rd (ca. 2000)	County	Clac_fir14	X			
Station 11 – Redland 18265 S Redland Rd (ca. 2000)	County	Clac_fir25	X			
Station 12 – Logan 18081 S Harding Rd (ca. 1980)	County	Clac_fir24		Mitigated per 2013-2014 SRGP grant.		
Station 13 – Clarkes 25675 S Beaver Creek Rd (ca. 1955)	County	Clac_fir04		Mitigated per 2013-2014 SRGP grant.		
Station 14 – Boring 28655 SE Hwy 212 (ca. 1969)	County	Clac_fir22	X			
Station 15 – John Adams 624 7t St (ca. 1921)	Oregon City	Clac_fir35	X			

Facility	Location	Site ID*	Level of Collapse Potential			
			Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Station 16 – Hilltop 19340 Molalla Ave (ca. 2018)	Oregon City	Clac_fir36	Mitigated/rebuilt per 2013-2014 SRGP grant.			
Station 17 – South End 19001 South End Rd (ca. 2004)	Oregon City	Clac_fir51	X			
Station 18 – Eagle Creek 32200 SE Judd Rd (ca. 1999)	County	Clac_fir47	X			
Station 19 - Damascus 19750 SE Damascus Ln (ca. 2019)	County	None	<i>2007 RVS report did not include structural appendix for this facility.</i>			
Station 20 – Highland 22295 S Lower Highland (ca. 1960) – storage only	County	Clac_fir28	X			
Station 21 – Centennial Park 20100 SE Hwy 212 (ca. 1976)	County	Clac_fir46	X			

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

– Site ID is referenced on the [RVS Clackamas County Map](#)

Note 1: **Bold** indicates facilities that have been seismically retrofitted or rebuilt.

For a list of additional facilities and infrastructure vulnerable to this hazard see the Community Assets section. In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

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

Earthquake Regional Impact Analysis

In 2018 DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)). Their study focused on damage to buildings, and the people that occupy them, and to two key infrastructure sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and night time (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damaged varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone

scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood structures that fare worse in an earthquake. The Portland Hills fault scenario created greater damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios, however, the impact is considerably less than it is to the transportation routes. Additional, capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts. For specific information for communities within the Fire District's service area see Volume I, Section 2 and the addenda for the cities of Happy Valley, Johnson City, Milwaukie, and Oregon City.

Recommendations from the report included topics within Planning, Recovery, Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMPs mitigation strategies (Table CFD-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and the recommendations see: *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, [O-18-02](#)).

Mitigation Activities

Many buildings in Clackamas Fire District #1 have been seismically upgraded. A \$29 million general obligation bond was approved in 2015 and seismic retrofit grant awards per the [Seismic Rehabilitation Grant Program](#)⁸ were funded to retrofit Fire Station 12 (2013-2014 grant award, \$94,552), Fire Station 13 (2013-2014 grant award, \$71,582), and Fire Station #16 (2013-2014 grant award, \$483,062).

Please review Volume I, Section 2 for additional information on this hazard.

Flood

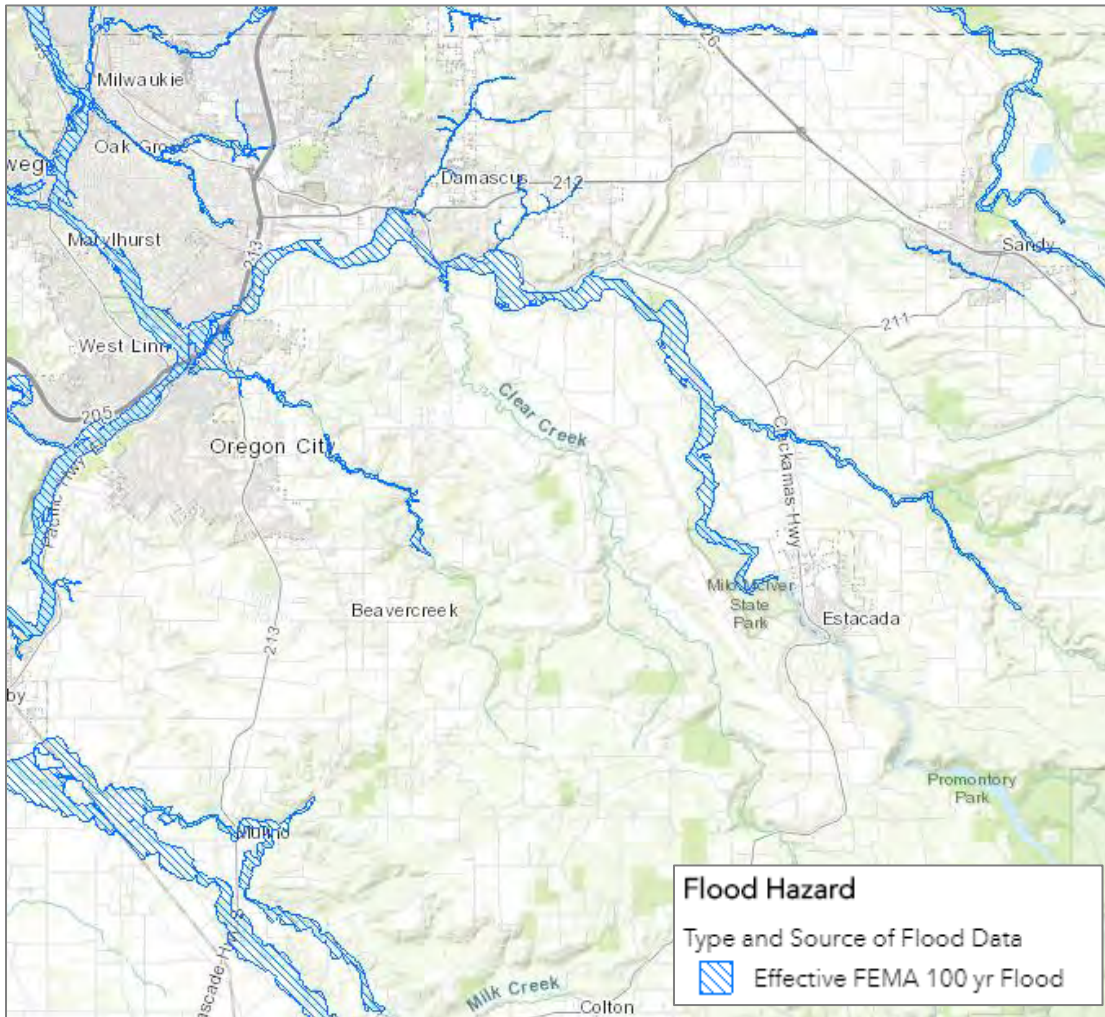
The HMAC determined that the Fire District's probability for flood is **moderate** and that their vulnerability to flood is **moderate**.

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent and probability of a potential event. Portions of Clackamas Fire District #1 have areas of floodplains (special flood hazard areas, SFHA). These include areas include

⁸ The Seismic Rehabilitation Grant Program (SRGP) is a state of Oregon competitive grant program that provides funding for the seismic rehabilitation of critical public buildings, particularly public schools and emergency services facilities.

along Willamette River, Clackamas River, and creeks within the service area (Figure CFD-5). Other portions of Clackamas Fire District #1, outside of the mapped floodplains, are also subject to flooding from local storm water drainage. Not all flood prone areas are subject to damage. Several valleys, such as the upper reaches of Abernethy Creek, are still in or near their natural state. Flooding of such areas causes no damage to human development and may help the riparian habitat.

Figure CFD-5 Special Flood Hazard Area



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

Note: To view detail click the link above to access Oregon HazVu

Vulnerability Assessment

Due to insufficient data and resources, Clackamas Fire District #1 is currently unable to perform a quantitative risk assessment for this hazard. Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage and economic loss from business interruption. It is important for the Fire District to be aware of flooding impacts and assess its level of risk.

The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners and their employees are significantly

impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of the Fire District outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage.

Most of the buildings affected by flooding are in the lowest parts of the Fire District's service area. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section. For specific information for communities within the Fire District's service area see Volume I, Section 2 and the addenda for the cities of Happy Valley, Johnson City, Milwaukie, and Oregon City.

National Flood Insurance Program (NFIP)

FEMA updated the Flood Insurance Study (FIS) and Flood Insurance Rate Maps (FIRMs) in 2018 (effective January 19, 2018). The Fire District is not a community which has authority to adopt and enforce floodplain management regulations for the areas within its jurisdiction. The cities of Happy Valley, Johnson City, Milwaukie, Oregon City and Clackamas County participate in the National Flood Insurance Program (NFIP).

There are no repetitive loss or severe repetitive loss properties owned or operated by the Fire District. For specific information for communities within the Fire District's service area see Volume I, Section 2 (Table 2.11 for more information) and the addenda for the cities of Happy Valley, Johnson City, Milwaukie, and Oregon City.

Mitigation Activities

The existing flood hazard mitigation activities are conducted at the city, county, regional, state, and federal levels and are described in the Clackamas County NHMP and city addenda.

Please review Volume I, Section 2 for additional information on this hazard.

Landslide

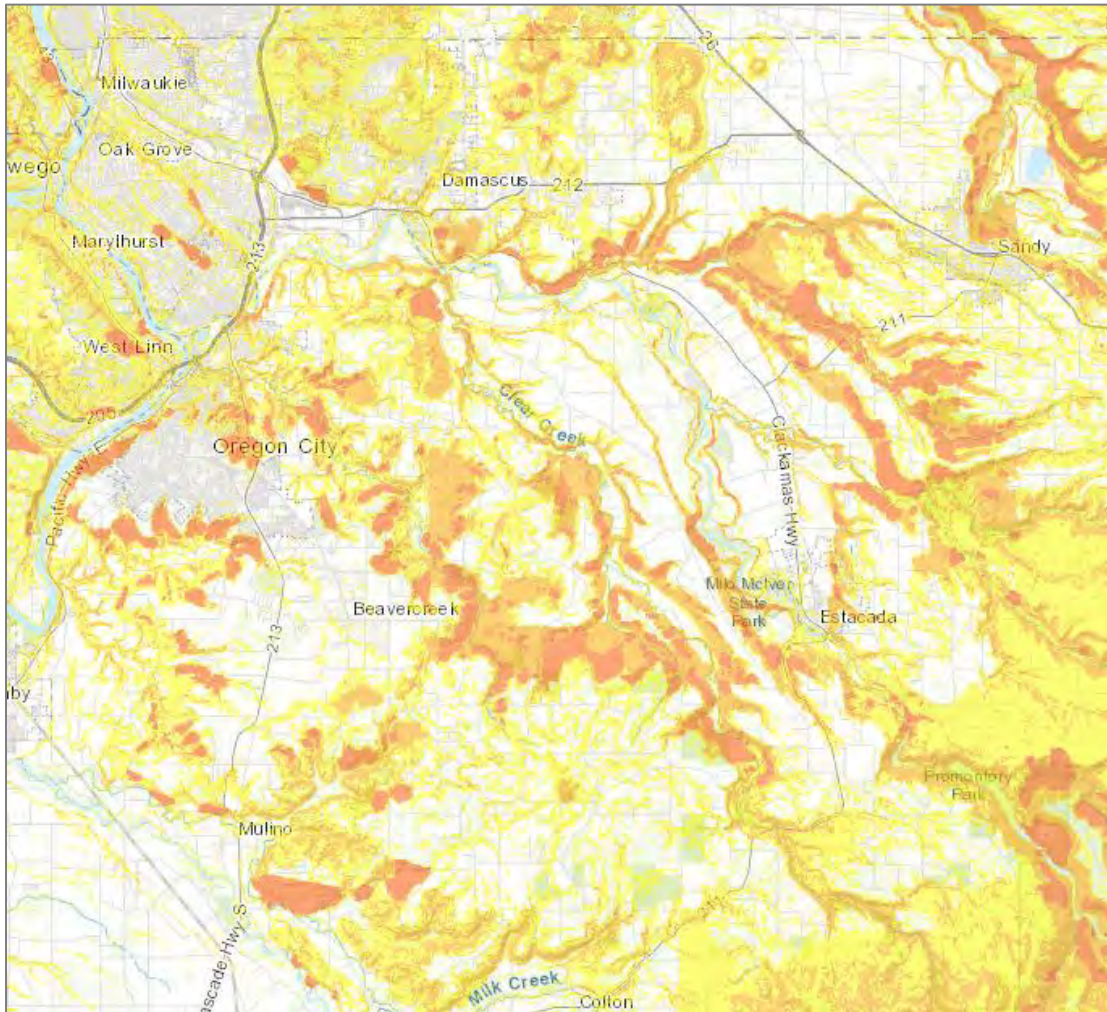
The HMAC determined that the Fire District's probability for landslide is **moderate** and that their vulnerability to landslide is **low**.

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent and probability of a potential event within the region.

Landslides destroy or damage anything on the sliding hillside or in the path of the slide. This includes buildings, houses and streets. Sometimes, a small amount of settlement occurs, giving the owner time to shore up or retrofit the building to prevent further damage. Many property owners in the Fire District's service area have built retaining walls and replaced slide prone soils with rock to help prevent landslides. However, if an entire hillside fails, the buildings may be destroyed and the streets washed out or covered in debris.

Landslide susceptibility exposure within the Fire District's service area is shown in Figure CFD-6. Most of the Fire District's service area demonstrates a low to moderate susceptibility to landslide exposure.

Figure CFD-6 Landslide Susceptibility Exposure



Low	Landsliding unlikely. Areas classified as Landslide Density = Low (less than 7%) and areas classified as Slopes Prone to Landsliding = Low.
Moderate	Landsliding possible. Areas classified as Landslide Density = Low to Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = Moderate OR areas classified as Landslide Density = Moderate (7%-17%) and areas classified as Slopes Prone to Landsliding = Low.
High	Landsliding likely. Areas classified as Landslide Density = High (greater than 17%) and areas classified as Slopes Prone to Landsliding = Low and Moderate OR areas classified as Landslide Density = Low and Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = High.
Very High	Existing landslides Landslide Density and Slopes Prone to Landsliding data were not considered in this category. Note: the quality of landslide inventory (existing landslides) mapping varies across the state.

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

Note: To view detail click the link above to access Oregon HazVu

Note that even if an area has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard and assets.

The most common type of landslides in Clackamas County are slides caused by erosion and flooding. Slides move in contact with the underlying surface, are generally slow moving and

can be deep. Rainfall-initiated landslides tend to be smaller; while earthquake induced landslides may be quite large. All soil types can be affected by natural landslide triggering conditions.

Vulnerability Assessment

Due to insufficient data and resources, Clackamas Fire District #1 is currently unable to perform a quantitative risk assessment for this hazard. However, DOGAMI completed a statewide landslide susceptibility assessment in 2016 ([O-16-02](#)), general findings from that report are provided above and within Figure CFD-6. For specific information for communities within the Fire District's service area see Volume I, Section 2 and the addenda for the cities of Happy Valley, Johnson City, Milwaukie, and Oregon City.

Potential landslide-related impacts are adequately described within Volume I, Section 2 and include infrastructural damages, economic impacts (due to isolation and/or arterial road closures), property damages and obstruction to evacuation routes. Rain-induced landslides and debris flows can potentially occur during any winter in Clackamas County and thoroughfares beyond City limits are susceptible to obstruction as well. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section.

Mitigation Activities

Clackamas Fire District #1 works to mitigate future landslide hazards to its fire stations and other critical facilities. Additional landslide hazard mitigation activities are conducted at the city, county, regional, state, and federal levels and are described in the Clackamas County NHMP and city addenda.

Please review Volume I, Section 2 for additional information on this hazard.

Severe Weather

Severe weather in can account for a variety of intense and potentially damaging weather events. These events include windstorms and winter storms. The following section describes the unique probability and vulnerability of each identified weather hazard. Other more abrupt or irregular events such as hail are also described in this section.

Extreme Heat

The HMAC determined that the Fire District's probability for extreme heat events is **low** and that their vulnerability is **moderate**.

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the Fire District as well.

A severe heat episode or "heat wave" occurs about every two to three years and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days we have temperatures greater than or equal to 90-degrees Fahrenheit and 100-degrees Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The Fire District has not experienced any life-threatening consequences from the few extreme heat events in the past, though with the changing climate expect to see more extreme heat events with potentially greater risk to the Fire District's service area population.

Please review Volume I, Section 2 for additional information on this hazard.

Windstorm

The HMAC determined that the Fire District's probability for windstorm is **high** and that their vulnerability to windstorm is **moderate**.

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent and probability of a potential event within the region. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding and very rarely, snow. Other severe weather events that may accompany windstorms, including thunderstorms, hail, lightning strikes and tornadoes are generally negligible for the Fire District.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages and storm-related debris. Additionally, transportation and economic disruptions result as well.

Damage from high winds generally has resulted in downed utility lines and trees usually limited to several localized areas. Electrical power can be out anywhere from a few hours to several days. Outdoor signs have also suffered damage. If the high winds are accompanied by rain (which they often are), blowing leaves and debris clog drainage-ways, which in turn causes localized urban flooding.

Please review Volume I, Section 2 for additional information on this hazard.

Winter Storm (Snow/Ice)

The HMAC determined that the Fire District's probability for winter storm is **high** and that their vulnerability to winter storm is **moderate**.

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter and early spring months. Severe winter storms affecting the Fire District's service area typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

Most winter storms typically do not cause significant damage, they are frequent and have the potential to impact economic activity. Road and rail closures due to winter weather are an uncommon occurrence, but can interrupt commuter and commercial traffic.

Vulnerability Assessment

Due to insufficient data and resources, Clackamas Fire District #1 is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Assets section. For specific information for communities

within the Fire District's service area see Volume I, Section 2 and the addenda for the cities of Happy Valley, Johnson City, Milwaukie, and Oregon City.

Mitigation Activities

Clackamas Fire District #1 has made progress to reduce the effects of storms. Most utilities leading to fire stations are underground, but in case of power outages the Fire District's critical facilities have back up power generation. Clackamas County Public Health operates heating and cooling centers for the region.

Additional severe weather hazard mitigation activities are conducted at the city, county, regional, state, and federal levels and are described in the Clackamas County NHMP and city addenda.

Please review Volume I, Section 2 for additional information on this hazard.

Volcanic Event

The HMAC determined that the Fire District's probability for a volcanic event is **low** and that their vulnerability to a volcanic event is **moderate**.

Volume I, Section 2 describes the characteristics of volcanic hazards, history, as well as the location, extent and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the Fire District service area as well. Clackamas Fire District #1 is unlikely to experience anything more than volcanic ash during a volcanic event.

Vulnerability Assessment

Due to insufficient data and resources, Clackamas Fire District #1 is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section.

Due to the Fire District's relative distance from volcanoes, its service area is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Depending on wind patterns and which volcano erupts, however, the service area may experience ashfall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the service area could experience a heavier coating of ash.

Mitigation Activities

The existing volcano hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Wildfire

The HMAC determined that the Fire District's probability for wildfire is **high** and that their vulnerability to wildfire is **moderate**.

The [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) was completed in May 2018. The CWPP is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard: <https://www.clackamas.us/dm/CWPP.html>. Information specific to Clackamas Fire District #1 is found in the following chapter: [Chapter 10.3: Clackamas Fire District #1](#).

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions. Weather, and urbanization conditions are primarily at cause for the hazard level. Clackamas Fire District #1 does not regularly experience wildfire within its urbanized service area, but the Fire District service area has abundant wooded areas, particularly in the south, southeast, and east that are a concern in the case of a wildfire event.

Clackamas County has two major physiographic regions: the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern Clackamas County. The Willamette River Valley, which includes the Fire District's service area, is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range has a relatively small population and is characterized by heavily forested slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to its dense forest land. Human caused fires are responsible for most fires in Clackamas County.

The forested hills within and surrounding the Fire District service area are interface areas. High and medium Priority Communities at Risk (CARs) within the Fire District service area include the following high priority areas: Forest Park/Leisure Woods, Diane Drive Shelly Road, Redland Road/Fishers Mill area/Logan, Clarkes/Beavercreek, Beaver Lake, Canemah Bluffs, Scouters Mountain, and Mount Talbert and the following medium priority areas: 3 Creeks and Holcomb.⁹

Most of the Fire District service area has less severe (moderate or less) wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions.¹⁰ However, conditions vary widely and with local topography, fuels, and local weather (including wind) conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts.

⁹ Clackamas County Community Wildfire Protection Plan, *Clackamas Fire District #1* (2018), Table 10.3-1.

¹⁰ [Oregon Wildfire Risk Explorer](#), date accessed May 10, 2019.

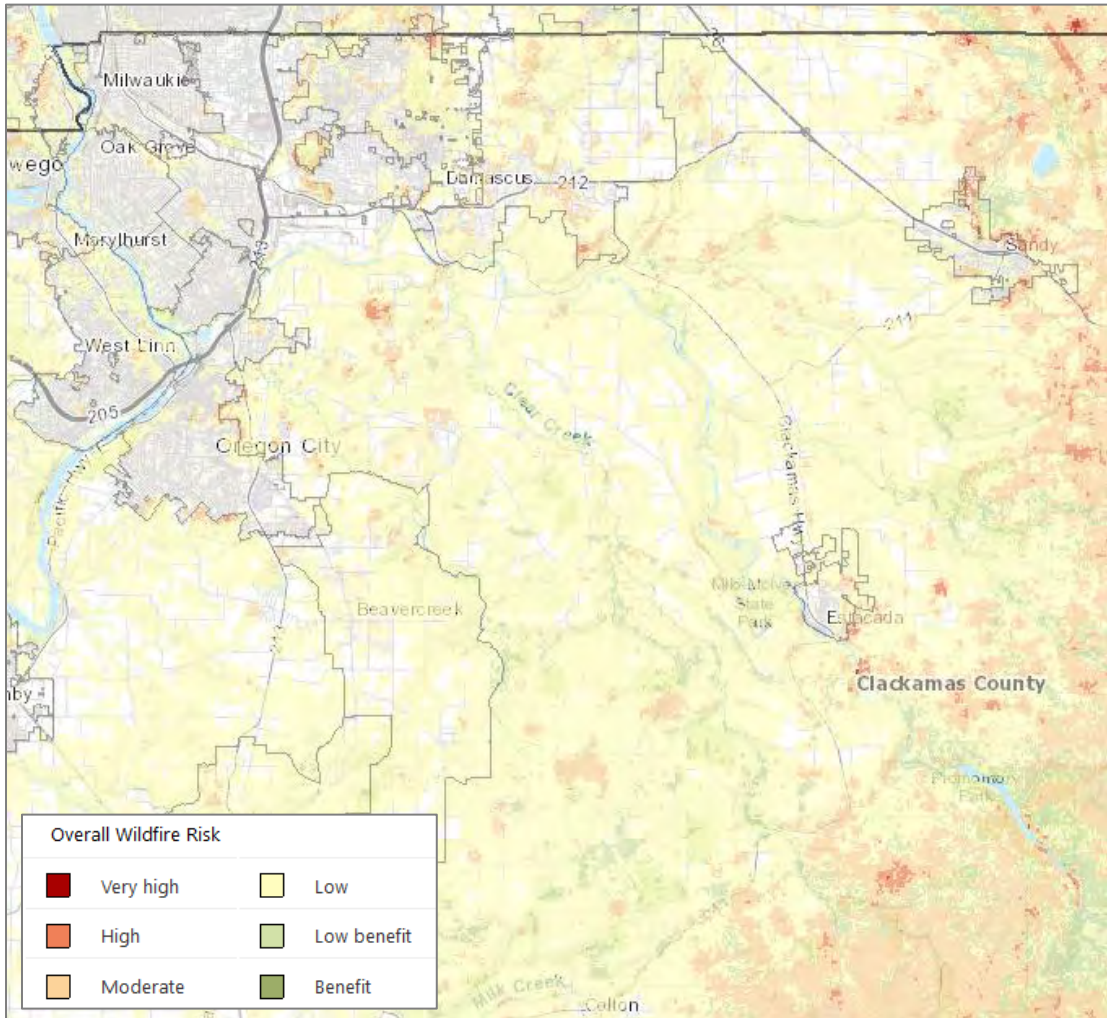
Vulnerability Assessment

Due to insufficient data and resources, Clackamas Fire District #1 is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section.

The potential community impacts, and vulnerabilities described in Volume I, Section 2 are generally accurate for the Fire District service area as well. Clackamas Fire District #1's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. Figure CFD-7 shows overall wildfire risk in the Fire District service area. The Fire District will update their wildfire risk assessment if the fire plan presents better data during future updates (an action item is included to participate in future updates to the CWPP). For specific information for communities within the Fire District's service area see Volume I, Section 2 and the addenda for the cities of Happy Valley, Johnson City, Milwaukie, and Oregon City.

Property can be damaged or destroyed with one fire as structures, vegetation, and other flammables easily merge to become unpredictable, and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

Figure CFD-7 Overall Wildfire Risk



Source: [Oregon Wildfire Risk Explorer](#), date accessed May 10, 2019.

Mitigation Activities

Clackamas Fire District #1 uses several mitigation tools to reduce the service area's risk to wildfires. Clackamas Fire District #1's offers numerous education opportunities including school programs, public presentations, media events, and safety fairs. They work with Clackamas County and Happy Valley, Johnson City, Milwaukie, and Oregon City to review pre-construction plans and develop fire codes. They promote the use of defensible space, fire-resistant building materials and roofing, and community preparedness. Additionally, the Fire District inspects buildings for fire code compliance, enforces open burning regulations, and offers juvenile fire setter counseling and follow-up.

Please review the [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\), Volume I, Section 2](#) for additional information on this hazard.

ATTACHMENT A: ACTION ITEM FORMS

ATTACHMENT A

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* - *Priority Action Item*

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 NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the County, participating cities, and special districts. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. The Fire District addresses legislative requirements through its capital improvements plan, mandated standards, and County and City building codes. To the extent possible, the Fire District 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 several sources, including participants in the planning process, noted deficiencies in local capability, or issues identified through the risk assessment. The rationale for proposed action items is based on the information documented in the addenda. The worksheet provides information on the activities that have occurred since the previous plan for each action item if applicable.

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 Fire District 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.

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:	
Develop new and continue to enhance education programs aimed at mitigating natural hazards and reducing risk.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Clackamas County CWPP			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Conducting public outreach campaigns raises awareness about natural hazards and helps illustrate what residents and businesses can do to reduce the impact of a natural disaster on their properties, thereby reducing the impact of natural hazards. • The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the county's actions to mitigate hazards. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Maintain hazard related information and public information materials and disseminate to public through existing resources (newsletter, website, social media, etc.); • Conduct public education as hazard seasons approach; • Target neighborhood associations to sponsor CERT teams; • Add emergency preparedness and response curriculum to school programs; • Partner with Clackamas County and other jurisdictions to develop public education flyers for all hazards; • Include hazard information on the Fire District website; and • Include insurance information in public outreach and education materials. 			
Coordinating Organization:		Emergency Management	
Internal Partners:		External Partners:	
Business Services		Clackamas County, Participating Cities, Community Organizations Active in Disaster (COAD), FEMA, DLCD, DOGAMI, Fire Co-op	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	Medium		

Earthquake #1*

Proposed Action Item:		Alignment with Plan Goals:	
Continue to conduct seismic evaluations and start projects implementing appropriate structural and non-structural mitigation strategies.		Protect Life and Property; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for earthquakes to cause damage can assist a community in mitigating its overall risk to earthquakes. • Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. • Refer to risk assessment, and DOGAMI's rapid visual assessment scores 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Obtain funding to perform seismic evaluations; • Conduct seismic evaluations on identified community assets (including shelters) for implementing appropriate structural and non-structural mitigation strategies; • Prioritize seismic upgrades based on criticality of need and population served; • Seismically retrofit critical government facilities to guarantee continuous operation during and after a natural disaster; • Partner with appropriate organizations to implement seismic upgrades; and • Create damage assessment procedures. 			
Coordinating Organization:		Facilities	
Internal Partners:		External Partners:	
Emergency Services		DOGAMI, Clackamas County, Participating Cities	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund, Seismic Rehabilitation Grant Program, Hazard Mitigation Assistance Grants		Moderate to High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	Medium		

* - High Priority Action Item

Severe Weather #1

Proposed Action Item:		Alignment with Plan Goals:	
Continue to ensure that all rigs have chains for driving on snow and ice.		Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Winter weather can create dangerous driving conditions for Responders. Appropriate traction devices will greatly enhance Responder safety and decrease response times. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Continue to make traction devices available for all Fire District response vehicles. Continue Fleet periodic review of current inventory. Emergency Manager will make Fleet and Logistics aware of anticipated weather conditions that might result in hazardous vehicle operation. 			
Coordinating Organization:		Fleet Services	
Internal Partners:		External Partners:	
Business Services			
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Capital Funds		Low	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	Medium		

Severe Weather #2*

Proposed Action Item:		Alignment with Plan Goals:	
Continue to coordinate with the County and Cities to make stations a priority for plowing and ensure up-to-date knowledge of plowing routes.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Clearing station driveways will improve Responder safety and decrease response times. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Emergency Manger will communicate with city and county public works departments prior to and in anticipation of snow events. 			
Coordinating Organization:		Emergency Management	
Internal Partners:		External Partners:	
Business Services		Clackamas County, Participating Cities	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	High		

Wildfire #1*

Proposed Action Item:		Alignment with Plan Goals:	
Continue to coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan .		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; 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:			
The wildfire mitigation action items provide direction on specific activities that organizations and residents in Clackamas Fire District #1's Service Area can take to reduce wildfire hazards. 2018 Status: CWPP updated in 2018.			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
Wildfire Risk Assessment (Ch. 4):			
<ol style="list-style-type: none"> Maintain and update the Fuels Reduction (FR) and Communities at Risk (CAR) maps and databases. Continue to track structure vulnerability data throughout the County through structural triage assessments. Update the Overall Wildfire Risk Assessment as new data becomes available. 			
Hazardous Fuels Reduction and Biomass Utilization (Ch. 5):			
<ol style="list-style-type: none"> Develop and maintain an inventory of potential and successful FR projects by meeting with parks and natural lands managers quarterly. Continue securing funding to implement projects/hire seasonal ODF staff. 			
Emergency Operations (Ch. 6):			
<ol style="list-style-type: none"> Develop and FDB Communications Works Group. Conduct a Conflagration Exercise. 			
Education and Community Outreach (Ch. 7):			
<ol style="list-style-type: none"> Develop Firewise toolkit for CAR's. Create incentives for fuels reduction. Update and distribute the Burn Permitting and Fire Restrictions Brochure. Continue to improve address signage throughout the County. 			
Structural Ignitability Policies and Programs (Ch. 8):			
<ol style="list-style-type: none"> Identify a DTD representative for the WFEP. Improve coordination with Rural Fire Agencies. Integrate WU into Plan Map and include a public outreach strategy. 			
Coordinating Organization:		Fire Prevention	
Internal Partners:		External Partners:	
Emergency Services, Business Services		Clackamas Fire Defense Board, Clackamas County, participating cities	
Potential Funding Sources:		Estimated cost:	Timeline:
ODF, operating budgets		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	High (CWPP identified priority actions listed above)		

* - High Priority Action Item

Wildfire #2*

Proposed Action Item:		Alignment with Plan Goals:	
Continue to promote legal, safe, and responsible debris burning through public outreach and education.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Clackamas County Community Wildfire Protection Plan (2018)			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Proper and safe debris burning will decrease fire danger to structures and wildlands. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Promote safe debris burning practices at public outreach events. Clackamas Fire posts safe debris burning guidelines on the Fire District Website. 			
Coordinating Organization:		Fire Prevention	
Internal Partners:		External Partners:	
Business Services		Clackamas County, participating cities, ODF, DEQ, Fire Co-op	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund		Low	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	Medium		

* - High Priority Action Item

Wildfire #3

Proposed Action Item:		Alignment with Plan Goals:	
Continue to promote fire-resistant strategies for new and existing developments.		Protect Life and Property; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Clackamas County Community Wildfire Protection Plan (2018)			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Clackamas Fire District #1 already encourages the use of non-combustible roofing materials. • Programs focus on fuel reduction and defensible space. • The local building codes are updated every 3 years in alignment with the State Building Code updates. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Require fuel breaks in site plans, describe the procedures for ongoing maintenance, and place information on the Fire District website for public view; • Review street designs that facilitate the movement of firefighting equipment; • Review roofing standards and develop recommendations for promoting non-combustible roofing; • Promote use of sprinkler systems in residential construction; and • Maintain awareness of potential growth into the wildland urban interface. 			
Coordinating Organization:		Fire Prevention	
Internal Partners:		External Partners:	
Business Services		Clackamas County, participating cities	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	Medium		

Wildfire #4

Proposed Action Item:		Alignment with Plan Goals:	
Continue to increase participation in land use reviews of residential structures in the Timber/Agriculture Zone.		Protect Life and Property; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Clackamas County Community Wildfire Protection Plan (2018)			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Land use reviews help ensure developing areas comply with existing wildfire protection best practices. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Continue to build on the strength of the current program. 			
Coordinating Organization:		Fire Prevention	
Internal Partners:		External Partners:	
Business Services		Clackamas County DTD, participating cities	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to moderate	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	Medium		

Wildfire #5

Proposed Action Item:		Alignment with Plan Goals:	
Continue to conduct a Community Meeting to educate community on defensible space, and measures that can be taken to reduce structural ignitability. Consider creating Firewise/USA Communities here.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Clackamas County CWPP (Local Communities at Risk Action Plan: Forest Park/Leisure Woods, Diane Drive, Shelly Road)			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Educating communities at risk regarding the creation of defensible spaces around their homes can improve the wildfire resilience of their home and community. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Clackamas Fire already supports the Firewise program. 			
Coordinating Organization:		Fire Prevention	
Internal Partners:		External Partners:	
Business Services		Clackamas County, participating cities	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to moderate	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	Medium		

Wildfire #6

Proposed Action Item:		Alignment with Plan Goals:	
Continue to obtain structural ignitability data by conducting structural triage assessment data collection (including GPS points) for homes in Communities at Risk.		Protect Life and Property; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Clackamas County CWPP (Local Communities at Risk Action Plan: All CAR's)			
2018 Status/Rationale for Proposed Action Item:			
Ideas for Implementation:			
Coordinating Organization:		Fire Prevention	
Internal Partners:		External Partners:	
Business Services		Clackamas County, participating cities	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	Medium		

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ATTACHMENT B: PUBLIC INVOLVEMENT SUMMARY

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

To provide the public information regarding the draft NHMP addendum, and provide an opportunity for comment, an announcement (see text below) was provided on the Fire District's website and social media pages including a method for the public to provide comment.

During the public review period (July 18-August 1) there were no comments provided.

Press Release





Clackamas Fire District #1 seeks additional public input on update to Natural Hazard Mitigation Plan

Clackamas Fire District #1 is in the process of developing our Natural Hazard Mitigation Plan (NHMP). This work is being performed in cooperation with the University of Oregon's Institute for Policy Research and Engagement - Oregon Partnership for Disaster Resilience and the Oregon Military Department's Office of Emergency Management utilizing funds obtained from the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation Grant Program. With re-adoption of the plan, Clackamas Fire District #1 will gain eligibility to apply for federal funding towards natural hazard mitigation projects. This local planning process includes a wide range of representatives from city, special district, county government, emergency management personnel, and outreach to members of the public in the form of an electronic survey.

Please feel free to provide your comments in the comment box that will be submitted to Clackamas Fire District #1's Emergency Manager, Gregg Ramirez.

If you have any questions regarding the Clackamas Fire District #1 NHMP addendum or the update process in general, please contact: Gregg Ramirez, Emergency Manager at (971) 250-1166 or gregg.ramirez@clackamasfire.com, or Michael Howard, Assistant Program Director for the Oregon Partnership for Disaster Resilience at (541) 346-8413 or mrhoward@uoregon.edu.

Your Comments: *

Name *

First Name

Last Name

Email *

example@example.com

Submit Your Comments

City of Canby Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan



Photo Credit: City of Canby

March 2019

Volume II: Canby Addendum



Prepared for:

City of Canby

Prepared by:

University of Oregon
Institute for Policy Research and Engagement
Oregon Partnership for Disaster Resilience

Planning grant funding provided by:



FEMA

Federal Emergency Management Agency (FEMA)
Pre-Disaster Mitigation Program
Grant: EMS-2017-PC-0005
Sub-grant Application Reference: PDMC-PL-10-OR-2016-001, and

Additional Support Provided by:



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FEMA

September 25, 2019

The Honorable Jim Bernard
Chair, Clackamas County Commissioners
2020 Kaen Road Suite A
Oregon City, Oregon 97045

Dear Chairman Bernard:

On April 12, 2019, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan* as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance grants through April 11, 2024, through your state.

Clackamas County	City of Estacada	City of Lake Oswego
City of West Linn	City of Wilsonville	City of Johnson City
City of Oregon City	City of Happy Valley	City of Canby
Clackamas Fire District		

The updated list of approved jurisdictions includes the cities of Canby, Happy Valley, Oregon City, Johnson City, and the Clackamas Fire District which recently adopted the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan*. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Joseph Murray, State Hazard Mitigation Planner with Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities.

Sincerely,

Mark Carey, Director
Mitigation Division

Enclosure

JG

RESOLUTION NO. 1327

**A RESOLUTION ADOPTING THE CITY OF CANBY ADDENDUM TO THE
CLACKAMAS COUNTY MULTI-JURSDICTIONAL NATURAL HAZARDS
MITIGATION PLAN**

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

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

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

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

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

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

Whereas, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *City of Canby addendum* to the *Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan* and pre-approved it (dated, August 29, 2019) contingent upon this official adoption of the participating governments and entities;

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

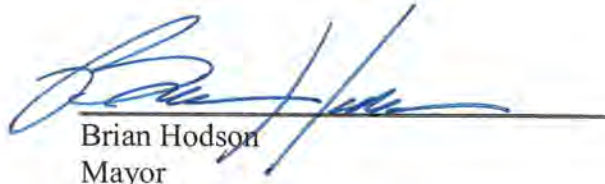
Whereas, the NHMP is in an on-going cycle of development and revision to improve its effectiveness; and

Whereas, City of Canby adopts the NHMP and directs the City Administrator and/or those persons designated by the City Administrator, to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.

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

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

Adopted this 18th day of September, 2019



Brian Hodson
Mayor

ATTEST:



Rick Robinson
City Recorder Pro-Tem

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Purpose

This is an update of the Canby addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation and Volume III (Appendices) which provide additional information. This addendum meets the following requirements:

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

Updates to Canby's addendum are further discussed throughout the NHMP and within Volume III, Appendix B, which provides an overview of alterations to the document that took place during the update process.

Canby adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on **September 18, 2019**. FEMA Region X approved the Clackamas County NHMP on **April 12, 2019** and the City's addendum on **September 25, 2019**. With approval of this NHMP the City is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **April 11, 2024**.

Mitigation Plan Mission

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

The City concurs with the mission statement developed during the Clackamas County planning process (Volume I, Section 3):

Promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

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

The City concurs with the goals developed during the Clackamas County planning process (Volume I, Section 3). All NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Below is a list of the NHMP goals:

GOAL #1: PROTECT LIFE AND PROPERTY

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

GOAL #2: ENHANCE NATURAL SYSTEMS

- Balance watershed planning, natural resource management, and land use planning with natural hazards mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

GOAL #3: AUGMENT EMERGENCY SERVICES

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, and business, and industry.
- Coordinate and integrate natural hazards mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL #4: ENCOURAGE PARTNERSHIPS FOR IMPLEMENTATION

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

GOAL #5: PROMOTE PUBLIC AWARENESS

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

NHMP Process, Participation and Adoption

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

Canby first developed an addendum to Clackamas County's Natural Hazards Mitigation Plan in 2003. This plan was updated in 2009, 2013, and in 2018. The last update of the Canby addendum to the Clackamas County NHMP was approved by FEMA on April 8, 2013.

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

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research, and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM), Clackamas County, and Canby to update their NHMP. This project is funded through the Federal Emergency Management Agency's (FEMA) Fiscal-Year 2016 (FY16) Pre-Disaster Mitigation (PDM) Competitive Grant Program EMS-2017-PC-0005 (PDMC-PL-10-OR-2016-001). Members of the Canby NHMP Hazard Mitigation Advisory Committee (HMAC) also participated in the County NHMP update process (Volume III, Appendix B).

The Clackamas County NHMP, and Canby addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. The Canby HMAC guided the process of developing the NHMP.

Convener

The Canby Public Works Director serves as the NHMP addendum convener. The convener of the NHMP will take the lead in implementing, maintaining and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the City of Canby HMAC met formally and informally, to discuss updates to their addendum (Volume III, Appendix B). The HMAC reviewed and revised the City's addendum, with focus on the NHMP's risk assessment and mitigation strategy (action items).

This addendum reflects decisions made at the designated meetings and during subsequent work and communication with Clackamas County Resilience Coordinator, and the OPDR. The changes are highlighted with more detail throughout this document and within Volume III, Appendix B. Other documented changes include a revision of the City's risk assessment and hazard identification sections, NHMP mission and goals, action items, and community profile.

The Canby HMAC was comprised of the following representatives:

- Convener, Jennifer Cline, Public Works Director (former)
- Rick Robinson, City Administrator

- Jerry Nelzen, Public Works Operations
- Amanda Zeiber, Technical Services
- Dave Conner, Wastewater Treatment
- Jorge Tro, Canby Police Department
- Todd Gary, Canby Fire
- Jim Stewart, Canby Utility

Public participation was achieved with the establishment of the HMAc, which was comprised of City officials representing different departments and sectors. The HMAc served as the local review body for the NHMP's development. Community members were provided an opportunity for comment via the NHMP review process, and through a survey administered by Clackamas County (Volume III, Appendix G).

NHMP Implementation and Maintenance

The City Council will be responsible for adopting the Canby addendum to the Clackamas County NHMP. This addendum designates a HMAc and a convener to oversee the development and implementation of action items. Because the City addendum is part of the County's multi-jurisdictional NHMP, the City will look for opportunities to partner with the County. The City's HMAc will convene after re-adoption of the Canby NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The City's Public Works Director will serve as the convener and will be responsible for assembling the HMAc. The HMAc will be responsible for:

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating and training new HMAc members on the NHMP and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement; and
- Documenting successes and lessons learned during the year.

The convener will also remain active in the County's implementation and maintenance process (Volume I, Section 4).

The City will utilize the same action item prioritization process as the County (Volume I, Section 4).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, and Building Codes, as well as the [Clackamas County NHMP](#), and the [State of Oregon NHMP](#).

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the city. Plans and policies already in existence have support from residents, businesses and policy makers. Where possible, Canby will implement the NHMP's recommended actions through existing plans and policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Canby's acknowledged comprehensive plan is the City of Canby Comprehensive Plan (1984, updated in January 2007). The City implements the plan through the Development Code.

Canby currently has the following plans, regulations, and projects that relate to natural hazard mitigation. For a complete list visit the City's [website](#):

- [Comprehensive Plan](#)
 - [Land Use Map \(May 2014\)](#)
 - [Additional Planning Documents](#)
- [Municipal Code](#)
 - Title 08: Health and Safety
 - Title 13: Public Services
 - Title 15: Buildings and Construction
 - [Chapter 15.12: Flood Hazard Protection](#)
 - Title 16: Planning and Zoning
 - [Chapter 16.40: Hazard Overlay Zone](#)
- [Capital Improvement Plan](#)
- [Transportation Systems Plan](#)
- [Stormwater Master Plan](#)
- [Water System Master Plan](#)
- [General City Maps](#)

Other plans:

- [Clackamas Community Wildfire Protection Plan](#)
 - [Canby Rural Fire Protection District #62](#)

Government Structure

The City of Canby has a council-mayor form of government. The City Council consists of seven members; a mayor and six councilors. The mayor presides over Council meetings. The mayor is elected to a two-year term, while City Council members are elected to four-year terms of office through a general election. The City Council is responsible for identifying problems and needs within the community and then addressing those problems through community goals and objectives.

The City of Canby currently has the following departments which have a role in natural hazard mitigation:

Administration Department is responsible for taking charge of the daily supervision of City affairs.

Development Services includes economic development, planning and building, and urban renewal.

The **Planning Department** regulates growth and development in the city of Canby by administering the city's Comprehensive Plan and Municipal Code related to zoning and land division. Tasks range from implementing existing zoning regulations to assisting City Council with land use and growth planning policy development. Planning is also responsible for providing safe, attractive, and well-maintained parks, facilities, trails, open spaces, and recreation programs. Building permits are issued by Clackamas County after City review.

The **Public Works Department** provides many of the basic urban services to the citizens of Canby including parks, streets (including street lighting), sewer, street trees, waste water treatment plant, building maintenance, and fleet services. Canby Utility (a city owned utility) provides water and electric for the City.

Police services are provided by the **Police Department**. Fire services are provided by **Canby Rural Fire Protection District #62**.

Continued Public Participation

An open public involvement process is essential to the development of an effective NHMP. To develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunity for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the NHMP during review.¹ Keeping the public informed of the City's efforts to reduce its risk to future natural hazard events is important for successful NHMP implementation and maintenance. The City is committed to involving the public in the NHMP review and update process (Volume I, Section 4). The City posted the plan update for public comment before FEMA approval, and after approval will maintain the plan on the City's website: <http://www.canbyoregon.gov>.

NHMP Maintenance

The Clackamas County NHMP and City addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the County NHMP update process, the City will also review and update its addendum (Volume I, Section 4). The convener will be responsible for convening the HMAc to address the questions outlined below.

- Are there new partners that should be brought to the table?
- Are there new local, regional, state or federal policies influencing natural hazards that should be addressed?
- Has the community successfully implemented any mitigation activities since the NHMP was last updated?
- Have new issues or problems related to hazards been identified in the community?
- Are the actions still appropriate given current resources?

¹ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

- Have there been any changes in development patterns that could influence the effects of hazards?
- Have there been any significant changes in the community's demographics that could influence the effects of hazards?
- Are there new studies or data available that would enhance the risk assessment?
- Has the community been affected by any disasters? Did the NHMP accurately address the impacts of this event?

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

Mitigation Strategy

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

The City's mitigation strategy (action items) were first developed during the 2003 NHMP planning process and revised during subsequent NHMP updates. During these processes, the HMAC assessed the City's risk, identified potential issues, and developed a mitigation strategy (action items).

During the 2018 update process the City re-evaluated their mitigation strategy (action items). During this process action items were updated, noting what accomplishments had been made and whether the actions were still relevant; any new action items were identified at this time (see Attachment A for more information on changes to action items).

Priority Action Items

Table CA-1 presents a list of mitigation actions. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity. High priority actions are shown in **bold** text with grey highlight. The City will focus their attention, and resource availability, upon these achievable, high leverage, activities over the next five-years. Although this methodology provides a guide for the HMAC in terms of implementation, the HMAC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for detailed information for each action. Full text of the plan goals referenced in Table CA-1 is located on page CA-2.

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Table CA-I Canby Action Items

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
MH #1	Update and revise the Canby Emergency Operations Plan.	Canby Fire District	City of Canby	Short Term	✓		✓	✓	
MH #2	Ensure there are adequate shelter facilities in hazard-free zones to serve Canby residents. Identify potential shelter sites and evaluate their relative structural risks/structural deficiencies. Seek funding for upgrades on shelter sites if needed.	Hazard Mitigation Advisory Committee (HMAC)	Public Works, Planning, Building	Ongoing	✓		✓	✓	
MH #3	Develop, enhance, and implement education programs designed to reduce the losses from natural hazards.	HMAC	Canby Fire District, Canby Utility, Administration	Ongoing	✓	✓	✓	✓	✓
MH #4	Integrate the goals and action items from the Canby Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	HMAC	Planning, Public Works	Ongoing	✓	✓	✓	✓	✓
MH #5	Identify, plan, and establish an alternate potable water source on the Willamette River.	Canby Utility	HMAC	Short Term	✓	✓		✓	✓
EQ #1	Conduct seismic evaluations and upgrades on identified critical and essential facilities and infrastructure for implementing appropriate structural and non-structural mitigation strategies.	HMAC	Administration, Planning, Public Works, Police, Canby Fire District, Canby Utility	Long Term	✓		✓	✓	

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
FL #1	Evaluate and upgrade surface water management infrastructure and identify appropriate mitigation strategies.	Public Works	Planning, Administration	Ongoing	✓	✓	✓	✓	
FL #2	Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.	Planning	Public Works	Ongoing	✓	✓		✓	✓
LS #1	Reduce the vulnerability of property owners in landslide-prone areas.	Planning	Public Works	Long Term	✓	✓		✓	✓
SW #1	Obtain funding to bury power lines subject to frequent failures to reduce power outages from the windstorm and severe winter storm hazard, where possible.	Canby Utility	Public Works	Ongoing	✓			✓	
WF #2	Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan.	Fire District	Public Works, Planning	Ongoing	✓	✓	✓	✓	✓

Source: City of Canby HMAC, 2018.

Note: Full text of the plan goals referenced in this table is located on page CA-2.

Risk Assessment

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

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

The local level rationale for the identified mitigation strategies (action items) is presented herein and within Volume I, Section 3 and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure CA-1. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure CA-1 Understanding Risk



Hazard Analysis

The Canby HMAC developed their hazard vulnerability assessment (HVA), using their previous HVA and the County’s HVA as a reference. Changes from their previous HVA and the County’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Canby, which are discussed throughout this addendum. For detailed information on the methodology see Volume I, Section 2.

Table CA-2 shows the HVA matrix for Canby listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response and recovery. The method provides the jurisdiction with sense of hazard priorities but does not predict the occurrence of a hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake and Crustal earthquake) and one chronic hazard (flood) rank as the top hazard threats to the City (Top Tier). Winter storm, windstorm, drought, and wildfire comprise the next highest ranked hazards (Middle Tier), while the extreme heat, volcanic event, and landslide hazards comprise the lowest ranked hazards (Bottom Tier).

Table CA-2 Hazard Analysis Matrix – Canby

Hazard	Maximum				Total Threat Score	Hazard Rank	Hazard Tiers
	History	Vulnerability	Threat	Probability			
Earthquake - Cascadia	4	45	100	49	198	#1	Top Tier
Flood	16	40	80	56	192	#2	
Earthquake - Crustal	6	50	100	21	177	#3	
Winter Storm	10	30	70	56	166	#4	Middle Tier
Windstorm	20	35	50	56	161	#5	
Drought	10	20	50	28	108	#6	
Wildfire	6	20	50	21	97	#7	
Extreme Heat Event	2	20	40	28	90	#8	Bottom Tier
Volcanic Event	2	15	50	7	74	#9	
Landslide	14	15	20	21	70	#10	

Source: Canby HMAc, 2018.

Table CA-3 categorizes the probability and vulnerability scores from the hazard analysis for the City and compares the results to the assessment completed by the Clackamas County HMAc. Variations between the City and County are noted in **bold** text within the city ratings.

Table CA-3 Probability and Vulnerability Comparison

Hazard	Canby		Clackamas County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Moderate	High	Low
Earthquake - Cascadia	Moderate	High	Moderate	High
Earthquake - Crustal	Low	High	Low	High
Extreme Heat	Moderate	Moderate	Low	High
Flood	High	High	High	Moderate
Landslide	Low	Low	High	Low
Volcanic Event	Low	Low	Low	Moderate
Wildfire	Low	Moderate	High	Moderate
Windstorm	High	Moderate	Moderate	Low
Winter Storm	High	Moderate	Moderate	Moderate

Source: Canby and Clackamas County HMAc, 2018.

Community Characteristics

Table CA-4 and the following section provides information on City specific demographics and assets. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation.

Considering the City specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation. Between 2010 and 2016 the City grew by 590 people (4%; as of 2018 the population was 16,800) and median household income decreased by about 2%.² Between 2018 and 2040 the population is forecast to grow by 53% to 25,748.³ New development has complied with the standards of the [Oregon Building Code](#) and the city's development code.

Transportation/Infrastructure

Canby is accessible by state highway 99E, running north to south on the city's west side. Congestion on 99E can result in the diversion of traffic onto City streets. Canby is also bisected by the Union Pacific Railroad main line, which separates the North side from the South; passenger service is provided by Amtrak. Congestion

The City's public transit is provided by the Canby Area Transit system, which provides shuttle transportation to scheduled route locations within Canby. The Canby Ferry, one of three ferries still in operation on the Willamette River, can transport nine vehicles per trip across the Willamette River. The availability and quality of pedestrian and bicycling facilities (sidewalks, bike lanes, and pathways) is inconsistent, generally newer neighborhoods have facilities. [Base Maps](#) are found on the city's website.

Economy

Canby is a relatively self-sufficient city that operates its own electric and water service (uncommon in Oregon). The business district includes a thriving downtown core as well as flourishing businesses along Highway 99E. The Canby area has a multitude of attractions tied to the bountiful nursery industry, which attract thousands of visitors annually. In Clackamas County, 75% of the nursery acreage is in the vicinity of Canby.

To a certain extent, Canby has been a "bedroom" community for Portland and Salem, though the City hopes to moderate this trend by increasing industrial development. The City is accessible by rail and highway and is located outside of the Portland Air Quality Maintenance area (AQMA). The 2007 Comprehensive Plan designated nearly a third of the total urbanizable area for future industrial development. The city has identified areas for commercial, office, or mixed use development in an updated Comprehensive Plan Map from 2014: [map](#). The two major industries for residents of Canby are educational services, and health care and social assistance (accounting for 22% of the market) and manufacturing (16%).⁴

² Portland State University, Population Research Center, "Annual Population Estimates", 2016 and Social Explorer, Table T57, U.S. Census Bureau, 2012-2016 and 2006-2010 American Community Survey Estimates.

³ Portland State University, Population Research Center, "Population Forecast Tables", 2017.

⁴ Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018 and Social Explorer, Table T57, U.S. Census Bureau, 2012-2016 and 2006-2010 American Community Survey Estimates.

Table CA-4 Community Characteristics

Population Characteristics		
2010 Population	15,830	
2016 Population [2018 Population]	16,420 [16,800]	
2040 Forecasted Population	25,748	
Race (non-Hispanic) and Ethnicity (Hispanic)		
White	75%	
Black/ African American	< 1%	
American Indian and Alaska Native	< 1%	
Asian	2%	
Native Hawaiian and Other Pacific Islander	0%	
Some Other Race	< 1%	
Two or More Races	3%	
Hispanic or Latino	20%	
Limited or No English Spoken	9%	
Vulnerable Age Groups		
Less than 15 Years	3,889	23%
65 Years and Over	2,528	15%
Disability Status		
Total Population	1,923	11%
Children	130	3%
Seniors	996	40%

Income Characteristics		
Households by Income Category		
Less than \$15,000	375	6%
\$15,000-\$29,999	850	14%
\$30,000-\$44,999	752	12%
\$45,000-\$59,999	1,061	17%
\$60,000-\$74,999	669	11%
\$75,000-\$99,999	995	16%
\$100,000-\$199,999	1,268	20%
\$200,000 or more	246	4%
Median Household Income	\$62,035	
Poverty Rates		
Total Population	2,682	16%
Children	741	16%
Seniors	114	5%
Housing Cost Burden		
Owners with Mortgage	1,210	29%
Renters	989	48%

Source: U.S. Census Bureau, 2012-2016 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018; Portland State University, Population Research Center, "Population Forecast Tables", 2017.

Housing Characteristics		
Housing Units		
Single-Family	4,565	71%
Multi-Family	1,315	21%
Mobile Homes	519	8%
Year Structure Built		
Pre-1970	993	16%
1970-1989	2,250	35%
1990 or later	3,162	49%
Housing Tenure and Vacancy		
Owner-occupied	4,164	65%
Renter-occupied	2,052	32%
Seasonal	48	1%
Vacant	189	3%

Canby has grown substantially since its incorporation in 1893 and has an area today of about 4 square miles. Canby lies in the heart of very productive agricultural lands.

Canby's climate is consistent with the Marine west coast climate zone, with warm summers and cool, wet winters. Canby receives most of its rainfall between October and May, and averages 45 inches of rain.⁵ Snowfall is rare but can occur annually.

The City of Canby is located on a relatively flat terrain and, with few exceptions, only gentle changes in the topography of less than 30 feet occur within the city limits and Urban Growth Boundary (UGB); between 140 to 170 feet above mean sea level. The southwest portion of the city drops abruptly at the Molalla River to an elevation of approximately 80 feet.

At the northern border of the UGB, the topography gradually slopes to the Willamette River, dropping from an elevation of approximately 130 feet to 100 feet at the city's wastewater treatment facility. To the east of Canby, the topography changes very little until beyond the urban growth boundary, where the ground has undulating gentle hills in the southeastern areas and steep rocky cliffs in the northeastern areas along the Willamette River.

⁵ ["Monthly Average for Canby, OR"](#) The Weather Channel Interactive, Inc. Retrieved April 11, 2019.

Community Assets -

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of Canby. The community assets identified below were identified by the City of Canby. The tables identify which hazards each asset may be exposed to, based upon both a GIS analysis as well as HMAC member knowledge. Additional information is needed to fully understand the extent of risk to each asset. It is important to note that the facilities identified as “critical” and “essential” are characterized differently than the structural code that identifies buildings as “essential” and “non-essential.” The structural code uses different language and criteria and therefore have completely different meanings than the buildings identified in this addendum.

Critical Facilities

These facilities are critical to government response, and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include: 911 Centers, Emergency Operations Centers, Police, and Fire Stations, Public Works facilities, sewer, and water facilities, hospitals, bridges, roads, shelters, and more.

Table CA-5 Critical Facilities in Canby

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Facilities									
4 Power Substations		X	X	X		X		X	X
Canby Area Transit (CAT)		X	X			X			X
Canby Utility Business Offices		X				X			X
City Hall Complex/Library		X				X			X
Public Works Building (EOC #3)	X	X	X	X		X	X	X	X
Telephone Central Station		X				X		X	X
Waste Water Treatment Facilities		X	X	X		X	X	X	X
Water Treatment Facilities – including reservoirs, intake structures and raw water pump houses	X	X	X	X	X	X	X	X	X
Fire/Police Stations									
Canby Police Department (EOC #2)	X	X		X	X	X			X
Fire Station #362 (EOC #1)	X	X	X			X			X
Fire Station #365 (South of Canby)	X	X	X			X	X	X	X

Critical Infrastructure:

Infrastructure that provides necessary services for emergency response include:

Table CA-6 Critical Infrastructure in Canby

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Infrastructure									
Bridges		X		X	X			X	X
Canby Disposal		X		X		X		X	X
Canby Ferry	X	X	X	X	X	X	X	X	X
Communication Towers		X					X	X	X
Gas Lines		X		X	X				
NW Natural Pipeline/Telephone Fiber		X		X	X				
Pacific Pride Storage Tanks		X							
Power Lines		X	X	X	X	X	X	X	X
Railroads		X		X	X	X	X	X	X
Telephone Lines		X		X	X	X	X	X	X
Transportation Networks		X	X	X	X	X	X	X	X
Wastewater Collection	X	X		X	X	X	X	X	X
Water Treatment, Storage and Distribution Lines	X	X	X	X	X	X	X	X	X

Cultural and Historic Assets

The cultural and historic heritage of a community is more than just tourist charm. For families that have lived in the city for generations and new resident alike, it is the unique places, stories, and annual events that make Canby an appealing place to live. The cultural and historic assets are both intangible benefits and obvious quality-of-life- enhancing amenities. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important.

Table CA-7 Cultural or Historic Assets in Canby

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Cultural or Historic Assets									
Canby Chapel		X				X		X	X
Canby Depot Museum		X				X		X	X
Canby Ferry	X	X	X	X	X	X	X	X	X
Cemeteries		X				X		X	X
Clackamas County Event Center	X	X	X			X	X	X	X

Essential Facilities

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public's ability to recover from the emergency. These facilities may include: City buildings such as the Public Services Building, the City Hall, and other public facilities such as schools.

Table CA-8 Essential Facilities in Canby

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Essential Facilities									
Schools									
Ackerman Elementary School		X				X		X	X
Baker Prairie School		X				X		X	X
Canby High School		X				X		X	X
Other Essential Facilities									
Canby Adult Center		X				X		X	X
Canby Christian Church		X				X		X	X
Clackamas County Event Center		X				X		X	X
Four Square Church		X			X	X	X	X	X
Medical Clinics		X				X		X	X
Old Canby Library Building		X				X		X	X
St. Patricks Church		X				X		X	X
Student Transportation		X				X			X
United Methodist Church		X				X		X	X

Environmental Assets:

Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic, and functional ecosystem services for the community.

Table CA-9 Environmental Assets in Canby

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Economic Assets/Population Centers									
Canby City Parks	X	X	X	X	X	X	X	X	X
Canby Utility Bottom Lands	X	X	X	X	X	X	X	X	X
Emerald Park	X	X	X	X	X	X	X	X	X
Molalla River State Park	X	X	X	X	X	X	X	X	X
Willow Creek	X	X	X	X		X	X	X	X

Vulnerable Populations:

Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, often experience the impacts of natural hazards and disasters more acutely. Populations that have special needs or require special consideration include:

Table CA-10 Vulnerable Populations in Canby

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Vulnerable Populations									
Adult Foster Homes		X	X			X	X	X	X
Canby Adult Center		X	X			X		X	X
Countryside Living – assisted living		X	X			X		X	X
Hope Village – senior living and rehab		X	X			X		X	X
Providence Health Center	X	X	X	X	X	X	X	X	X
Rackleff House – assisted living		X				X	X	X	X
Riverside RV Park	X	X	X	X	X	X	X	X	X
Village on the Lochs		X	X	X	X	X	X	X	X
Schools									
<i>Schools listed in Essential Facilities</i>	X	X	X	X	X	X	X	X	X

Hazardous Materials:

Facilities that, if damaged, could cause serious secondary impacts may also be considered “critical.” A hazardous material facility is one example of this type of critical facility. Those sites that store, manufacture, or use potentially hazardous materials include:

Table CA-11 Hazardous Materials in Canby

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Hazardous Materials									
American Steel		X							
BBC Steel		X					X		
Johnson Controls Inc.		X					X		
JV Northwest		X							
Pacific Pride Fuel Storage Tanks		X							
Railroad		X		X	X	X	X	X	X
SR Smith		X			X		X		
Wastewater Treatment Facility		X		X			X		
Water Treatment Facility	X	X	X	X		X	X	X	X
Wilco		X							

Economic Assets/Population Centers:

Economic assets include businesses that employ large numbers of people and provide an economic resource to the City. If damaged, the loss of these economic assets could significantly affect economic stability, and prosperity. Population Centers usually are aligned with economic centers and are a concern during evacuation/notification during a hazard event.

Table CA-12 Economic Assets/Population Centers in Canby

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Economic Assets/Population Centers									
All multi-family dwelling structures	X	X		X	X	X	X	X	X
<i>Churches listed in Essential Facilities</i>	X	X	X	X	X	X	X	X	X
Grocery Stores		X				X		X	X
Johnson Controls		X			X	X	X	X	X
Pioneer Industrial Park		X				X	X	X	X
Post Office		X	X	X		X		X	X
Potter Industries		X				X		X	X
<i>Schools listed in Essential Facilities</i>	X	X	X	X	X	X	X	X	X
Sprague Controls		X				X		X	X
SR Smith		X			X	X	X	X	X
Student Transportation		X				X		X	X
Willamette Plastics		X			X	X	X	X	X
Wilson Construction Office		X				X		X	X

Hazard Characteristics

Drought

The HMAP determined that the City's probability for drought is **moderate** and that their vulnerability to drought is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent and probability of a potential event. Due to the climate of Clackamas County, past and present weather conditions have shown an increasing potential for drought.

The City of Canby currently obtains its potable water from the Molalla River with an intake pump station capacity of 7.9 million gallons a day (mgd). The primary groundwater source is the Springs Gallery with a seasonally varied capacity up to 1.4 mgd, though low pH and

moderate nitrate concentrations limit the use of it as the primary source.⁶ The Canby Utility water system includes surface and groundwater sources, treatment facilities, 66 miles of piping, four storage reservoirs with total usable capacity of 5.5 million gallons, and three pump stations. The [Water System Master Plan](#) was last updated in 2010 to provide long-term guidance for the development of the City's water system, which is a supporting document for the Comprehensive Plan.

Vulnerability Assessment

Due to insufficient data and resources, Canby is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables CA-5 to CA-12.

Mitigation Activities

Canby Utility has a Water Supply Shortage Contingency Plan that details voluntary and non-voluntary actions to be taken in the vent of a water shortage. Additional drought hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Earthquake (Cascadia Subduction Zone)

The HMAC determined that the City's probability for a Cascadia Subduction Zone (CSZ) earthquake is **moderate** and that their vulnerability to a CSZ earthquake is **high**. *The probability rating decreased, and the vulnerability rating did not change, since the previous version of this NHMP addendum. Note: Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake and Crustal earthquake.*

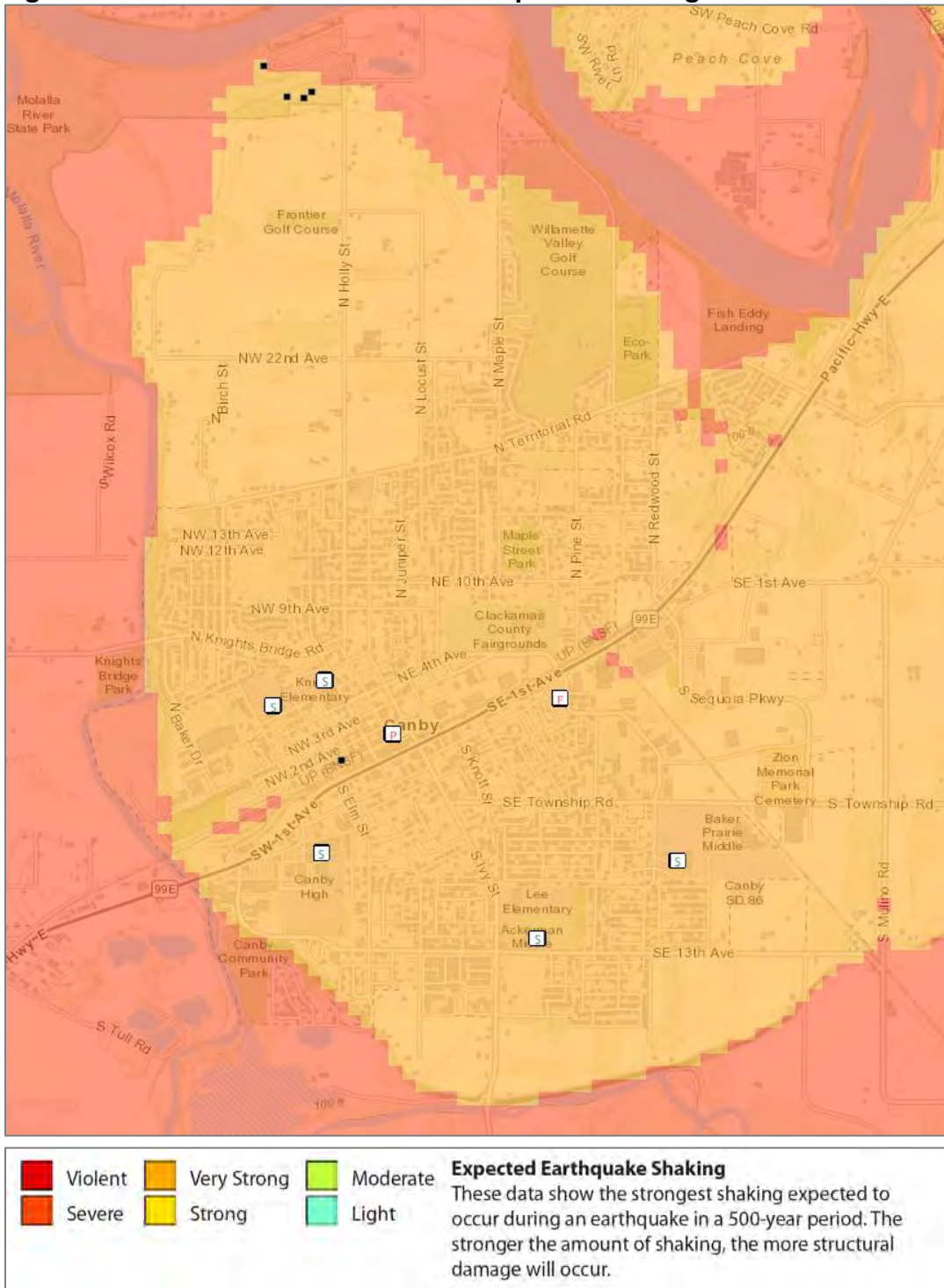
Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent and probability of a potential event. Generally, an event that affects the County is likely to affect Canby as well. The causes and characteristics of an earthquake event are appropriately described within the Volume I, Section 2 as well as the location and extent of potential hazards. Previous occurrences are well documented within Volume I, Section 2 and the community impacts described by the County would generally be the same for Canby as well.

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Portland Hills Fault Zone, and Gales Creek-Newberg-Mt. Angel Structural Zone (discussed in the crustal earthquake section).

Figure CA-2 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the city is expected to experience very strong shaking (orange), while areas near rivers and streams will experience severe (light red) to violent (dark red) shaking in a CSZ event.

⁶ [Water Service Information](#). Canby Utility. Visited April 18, 2019

Figure CA-2 Cascadia Subduction Zone Expected Shaking



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

Note: To view detail click the link above to access Oregon HazVu

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year. Scientists have found evidence that 11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D.⁷

The city's proximity to the Cascadia Subduction Zone, potential slope instability and the prevalence of certain soils subject to liquefaction and amplification combine to give the city a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places the city predominately within the "Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades). Within the Northwest Oregon region, damage and shaking is expected to be strong and widespread - an event will be disruptive to daily life and commerce and the main priority is expected to be restoring services to business and residents.

Earthquake (Crustal)

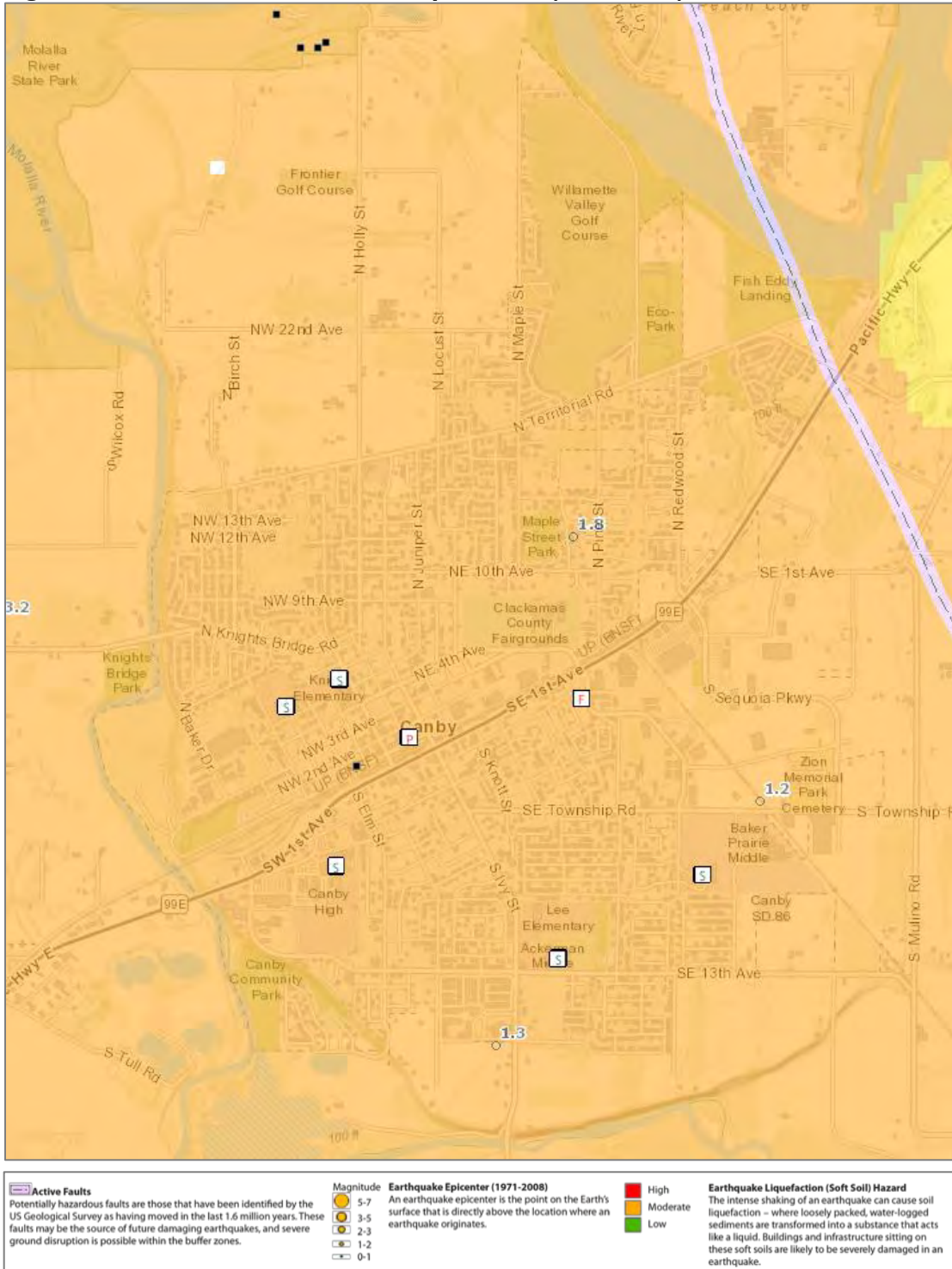
The HMAC determined that the City's probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**. *The probability rating decreased while the vulnerability did not change since the previous version of this NHMP addendum. Note: Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Crustal earthquake, and Cascadia Subduction Zone (CSZ) earthquake.*

Volume I, Section 2 describes the causes and characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Canby as well. Figure CA-3 shows a generalized geologic map of the Canby area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows the areas of greatest concern within the City limits as red and orange.

There are two potential crustal faults and/or zones near the City that can generate high-magnitude earthquakes. These include the Gales Creek-Mt. Angel Structural Zone and Portland Hills Fault Zone (discussed in greater detail below). Other faults include the Canby-Molalla fault (running through the city's east edge intersecting Highway 99E) and Oatfield fault (just to the east of the city on the eastern side of the Willamette River), and the Mt. Hood Fault in eastern Clackamas County. Historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

⁷ The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. <http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf>

Figure CA-3 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



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

Note: To view detail click the link above to access Oregon HazVu

Canby-Molalla Fault Zone

The Canby-Molalla Fault Zone is a series of NE-trending fault that vertically displace the Columbia River Basalt with discontinuous aeromagnetic anomalies that represent significant offset of Eocene basement and volcanic rocks. The fault zone extends for 31 miles from the vicinity of Tigard south through the towns of Canby and Molalla in northern Oregon.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and lies about 11 miles northeast of Canby.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

Vulnerability Assessment

Due to insufficient data and resources, Canby is currently unable to perform a quantitative risk assessment for this hazard. However, the City completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected. Additionally, in 2018 the Department of Geology and Mineral Industries (DOGAMI) completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)), findings from that report are provided at the end of the crustal earthquakes hazard section.

The city has overall moderate vulnerability to an earthquake, which includes the essential and critical facilities. Canby's infrastructure is particularly vulnerable to earthquake damage. All of the city's water facilities are all within the moderate hazard zone. Highway 99E crosses over the Molalla River and runs along the Willamette River, which are seismically vulnerable areas and might affect the ability of outside assistance in the case of an earthquake. During a major earthquake, emergency responders may have difficulty performing their duties because their buildings could be impacted by the event. The Canby Fire District 62 Station, and the Police Department's headquarters are in the moderate to high hazard zones. Areas near the Willamette and Molalla Rivers are likely comprised of softer soils prone to liquefaction. This can be very destructive to underground utilities such as water and sewer lines. Buildings and water lines can sink into the liquefied ground while sewer pipes, manholes and pump stations (assets partially filled with air) may float to the surface. After the earthquake, the liquefied soil will re-solidify, locking tilted buildings and broken pipe connections into place. In 2017, the Canby Fire District Station #62 was awarded a Seismic Rehabilitation Grant for \$233,256 and retrofitted their main fire station. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables CA-5 to CA-12.

Vulnerable populations such as children could be significantly impacted, as many schools lie in the moderate hazard zone. The data gathered from the statewide DOGAMI inventory should be used to prioritize school buildings in Canby for seismic hazard retrofitting.

Seismic building codes were implemented in Oregon in the 1970s, however, stricter standards did not take effect until 1991 and early 2000s. As noted in the community profile, approximately 51% of residential buildings were built prior to 1990, which increases the City’s vulnerability to the earthquake hazard. Information on specific public buildings’ (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table CA-13; each “X” represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), none have a very high (100% chance) or high (greater than 10% chance) collapse potential. *Note: one fire station has been rebuilt and the police department moved to a newly constructed location.*

Table CA-13 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Ackerman Center (350 SE 13 th Ave)	Clac_sch54	X			
Eccles Elementary (562 NW 5 th Ave)	Clac_sch55	X			
Knight Elementary (501 N Grant St)	Clac_sch53	X			
Lee Elementary (1110 S Ivy St)	-	Not assessed as part of the 2007 RVS			
Trost Elementary (800 S Redwood St)	Clac_sch76	X			
Baker Prairie Middle (1859 S Township Rd)	-	Not assessed as part of the 2007 RVS			
Canby High (721 SW 4 th Ave)	Clac_sch66	X			
Public Safety					
Canby Fire District Main Station 62 (221 S Pine St)	Clac_fir39	Seismic retrofit via 2015-17 SRGP			
Canby Fire District Station 65 (26815 S Hwy 170) (Outside City)	Clac_fir48	X			
Canby Police Department (1175 NW 3rd Ave)	-	Built at current site in 2012			

Source: [DOGAMI 2007. Open File Report O-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#) “*” – Site ID is referenced on the [RVS Clackamas County Map](#)

Note 1: Bold indicates facilities that have been seismically retrofitted or rebuilt.

Note 2: Private schools were not assessed by DOGAMI as part of O-07-02.

In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

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

Mitigation Activities

Canby has taken mitigation steps to reduce the city's vulnerability in earthquake events. Seismic retrofit grant awards per the [Seismic Rehabilitation Grant Program](#)⁸ have been used to retrofit Canby Fire District Station 62, (Phase Two of 2015-2017 grant award, \$233,256) and the Police Station was rebuilt on a new location (1175 NW 3rd Ave) in 2012. Additional mitigation activities completed by the City of Canby include:

- Seismic strengthening future projects including schools and other critical infrastructure located in the Long-Range Facilities Plan
- Seismically retrofitted: Canby Telcom control center and water reservoir.
- Compliance with SB 13, enacted in 2001, requiring local governments to develop seismic preparation procedures, inform their employees about the procedures, and conduct earthquake drills.
- The Canby School District has developed seismic preparation procedures and conducts drills in accordance with the Office of Emergency Management guidelines. These drills include "duck, cover and hold on" and familiarization with exit routes and methods of exiting the building during an earthquake.
- Adoption of a policy to require undergrounding of power lines in new subdivisions.
- Development Code restrictions regarding construction on steep slopes.

Earthquake Regional Impact Analysis

In 2018 DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)). Their study focused on damage to buildings, and the people that occupy them, and to two key infrastructure sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and night time (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damaged varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood structures that fare worse in an earthquake. The Portland Hills fault scenario created greater

⁸ The Seismic Rehabilitation Grant Program (SRGP) is a state of Oregon competitive grant program that provides funding for the seismic rehabilitation of critical public buildings, particularly public schools and emergency services facilities.

damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios, however, the impact is considerably less than it is to the transportation routes. Additional, capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts.

Table CA-14 shows the permanent resident population that are vulnerable to injury or death (casualty) and the buildings in the City that are susceptible to liquefaction and landslides, it does not predict that damage will occur in specific areas due to either liquefaction or landslide. More population and property are exposed to higher degrees of expected damage or casualty under the Portland Hills Fault “wet” scenario than in any other scenario.

Table CA-14 Expected damages and casualties for the CSZ fault and Portland Hills fault: earthquake, soil moisture, and event time scenarios

	Cascadia Subduction Zone (M9.0)		Portland Hills Fault (M6.8)	
	"Dry" Soil	"Wet" Saturated Soil	"Dry" Soil	"Wet" Saturated Soil
Number of Buildings	5,559	5,559	5,559	5,559
Building Value (\$ Million)	1,890	1,890	1,890	1,890
Building Repair Cost (\$ Million)	58	61	159	231
Building Loss Ratio	3%	3%	8%	12%
Debris (Thousands of Tons)	34	36	76	103
Long-Term Displaced Population	78	159	202	874
Total Casualties (Daytime)	38	40	109	172
Level 4 (Killed)	1	1	5	8
Total Casualties (Nighttime)	14	20	41	93
Level 4 (Killed)	0	0	1	2

Source: DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8, 12-9, 12-10, and 12-11.

Cascadia Subduction Zone Scenario

The City of Canby is expected to have a 3% building loss ratio with a repair cost of \$58 million under the CSZ “dry” scenario, and a 3% building loss ratio with a repair cost of \$61 million under the CSZ “wet” scenario.⁹ The city is expected to have around 38 daytime or 14 nighttime casualties during the CSZ “dry” scenario and 40 daytime or 20 nighttime casualties during the CSZ “wet” scenario. It is expected that there will be a long-term displaced population of around 78 for the CSZ “dry” scenario and 159 for the CSZ “wet” scenario.¹⁰

Portland Hills Fault Scenario

The City of Canby is expected to have a 8% building loss ratio with a repair cost of \$159 million under the CSZ “dry” scenario, and a 12% building loss ratio with a repair cost of \$231

⁹ DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8 and 12-9.

¹⁰ Ibid, Tables 12-8 and 12-9.

million under the CSZ “wet” scenario.¹¹ The long-term displaced population and casualties are greatly increased for all the Portland Hills Fault scenarios. The city is expected to have around 109 daytime or 41 nighttime casualties during the Portland Hills Fault “dry” scenario and 172 daytime or 93 nighttime casualties during the Portland Hills Fault “wet” scenario. It is expected that there will be a long-term displaced population of around 202 for the Portland Hills Fault “dry” scenario and 874 for the Portland Hills Fault “wet” scenario.¹²

Recommendations from the report included topics within Planning, Recovery, Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMPs mitigation strategies (Table CA-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and the recommendations see: *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, [O-18-02](#)).

Please review Volume I, Section 2 for additional information on this hazard.

Flood

The HMAC determined that the City’s probability for flood is **high** and that their vulnerability to flood is **high**. *The probability rating did not change while the vulnerability rating increased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent, and probability of a potential event. Figure CA-4 illustrates the flood hazard area for Canby.

Portions of Canby have areas of floodplain (located in the [Hazard Overlay Zone](#)). The Federal Emergency Management Agency (FEMA) regulatory floodplains for the Molalla and Willamette Rivers are depicted as relatively narrow areas on each side of the channels. On the Willamette River, the floodway is generally confined within high stream banks. On the Molalla River, the floodways cover a somewhat larger area that is usually located on the outside bank from Canby. Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage, and economic loss from business interruption. It is important for the City to be aware of flooding impacts and assess its level of risk.

The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners, and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of Canby outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage. City staff has identified sites where local drainage facilities are taxed during high flows,

¹¹ Ibid, Tables 12-10 and 12-11

¹² Ibid, Tables 12-10 and 12-11.

especially where open ditches enter culverts or go underground into storm sewers and works to mitigate the stormwater flood risks in these areas (see the City's [Stormwater Master Plan](#) for more information).

Figure CA-4 Special Flood Hazard Area



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)
Note: To view detail click the link above to access Oregon HazVu

The largest flooding event to affect Canby was the February 1996 flood. The high-water level meant tributaries could not drain into the Molalla and Willamette River, which led to

localized flooding on several backed-up creeks. Recently in December 2015, the Molalla River flooded low lying areas around Canby's South Pine Street.¹³

The extent of flooding hazards in Canby primarily depends on climate and precipitation levels. Additionally, withdrawals for irrigation and drinking water, as well as stream and wetland modifications or vegetation removal can influence water flow.

Vulnerability Assessment

Due to insufficient data and resources, Canby is currently unable to perform a quantitative risk assessment for this hazard. However, the City completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

Approximately 4% percent of the total land area in Canby is exposed to the flooding hazard, and in some areas this hazard presents potential life safety hazards. Multi-family housing structures, including Redwood Terrace Apartment Complex and Canby Grove, may be affected by flooding. Critical facilities exposed to the flood hazard include the water treatment facility main river intake structure, the wastewater treatment facility, backwash ponds, and the city's public works facility. In flooding events these facilities may be exposed to high waters and services can be interrupted.

Bridges and culverts are also vulnerable to flooding because debris and sediment can choke culverts and undermine bridges, causing surface water drainage problems. Canby relies on bridges for transportation and connection to other main highways. Canby could potentially be isolated if the bridges were to fail. Knights Bridge and Goods Bridge are particularly exposed. Roadways exposed include S. Ivy (Hwy 170) and SW/SE 1st Ave (Hwy 99E). Disruption to this infrastructure could result in transportation issues, power outages, sewage back-up, and affect overall community and environmental health.

Many older buildings will have difficulty sustaining pressure from flooding events and should be targeted for floodplain retrofitting. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables CA-5 to CA-12.

National Flood Insurance Program (NFIP)

FEMA's Flood Insurance Study (FIS), and Flood Insurance Rate Maps (FIRMs) are effective as of June 17, 2008. Table CA-15 shows that as of July 2018, Canby has 15 National Flood Insurance Program (NFIP) policies in force. Of those, 7 are for properties that were constructed before the initial FIRMs. The last Community Assistance Visit (CAV) for Canby was on November 19, 1993. Canby does not participate in the Community Rating System (CRS).

The table shows that all flood insurance policies are for residential structures, single-family homes. There has been a total of one paid claim for \$67,371. The City complies with the NFIP through enforcement of their flood damage prevention ordinance and their floodplain

¹³ [Wind, rain and floods fill up your Monday](#) (2015). Portland Tribune: Pamplin Media Group.

management program. The Community Repetitive Loss record for Canby identifies no Repetitive Loss (RL) Properties¹⁴ or Severe Repetitive Loss (SRL) Properties¹⁵.

Table CA-15 Flood Insurance Detail

	Clackamas County	Canby
Effective FIRM and FIS	6/17/2008	6/17/2008
Initial FIRM Date	-	6/17/2008
Total Policies	1,957	15
Pre-FIRM Policies	1,086	7
Policies by Building Type		
Single Family	1,761	15
2 to 4 Family	30	0
Other Residential	58	0
Non-Residential	9	0
Minus Rated A Zone	123	0
Insurance in Force	\$541,833,400	\$4,071,000
Total Paid Claims	590	1
Pre-FIRM Claims Paid	450	1
Substantial Damage Claims	83	0
Total Paid Amount	\$20,830,662	\$67,371
Repetitive Loss Structures	51	0
Severe Repetitive Loss Properties	4	0
CRS Class Rating	-	NP
Last Community Assistance Visit	-	11/19/1993

Source: Information compiled by Department of Land Conservation, and Development, July 2018.

Note: The portion of the cities of Portland and Tualatin that are within Clackamas County are not included in this table. NP = Not Participating

Mitigation Activities

Canby employs several mitigation strategies to reduce the city’s risk to flood events. The city development code includes policies and regulations for flood prone areas including: Surface Waters and Drainage (Chapter 8.12.090), Sewer Use (Chapter 13.16), Flood Hazard Protection (Chapter 15.12), Riparian Overlay Zone (Chapter 16.37), Wetlands Overlay Zone (Chapter 16.39), and Hazard Overlay Zone (Chapter 16.40). The City maintains a [Stormwater Master Plan](#).

¹⁴ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

¹⁵ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP, and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000, and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

Emerald Park is an area designated as open space along the Willamette River. The development of this park has enhanced the wetlands in the area, which will assist in flood water retention. Willow Creek Pump station was completely reconstructed in 2018. Larger capacity storage was installed along with a stand-alone backup generator. Willow Creek wetlands also assist in reducing flood waters by increasing the infiltration capacity of the soils in this area; this has become a public works project area focused on clearing the area weekly.

Please review Volume I, Section 2 for additional information on this hazard.

Landslide

The HMAC determined that the City's probability for landslide is **low** and that their vulnerability to landslide is **low**. *The probability rating decreased, and the vulnerability rating did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Although catastrophic landslides have not occurred in Canby, steep slopes do exist along the banks of the Molalla River, and extends south from 6th Street up to the northern city limits. Highway 99E, north of Canby, is especially vulnerable to landslide with multiple incidents of rock slides shutting down lanes in 2007, 2010, and 2015. As example, on January 7, 2009 two slides occurred in private yards after an intense winter storm. About three feet of earth fell 30 to 50 feet from the back yard of a home on North Baker Drive. Another home on Alder Creek Lane in Knights Bridge Estates lost approximately 10 feet of its back yard.

Landslide susceptibility exposure for Canby is shown in Figure CA-5. Most of Canby demonstrates a low to moderate landslide susceptibility exposure. Approximately 2% of Canby has very high or high, and approximately 9% moderate, landslide susceptibility exposure.¹⁶ However, most of the areas that are identified to exhibit dangerous potential rapidly moving landslides are vacant and often preserved in wooded and dedicated open space. *Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard, and assets.*

Vulnerability Assessment

Due to insufficient data and resources, Canby is currently unable to perform a quantitative risk assessment for this hazard. However, DOGAMI completed a statewide landslide susceptibility assessment in 2016 ([O-16-02](#)), general findings from that report are provided above and within Figure CA-5. Additionally, the City completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

¹⁶ DOGAMI. [Open-File Report, O-16-02](#), *Landslide Susceptibility Overview Map of Oregon* (2016)

Figure CA-5 Landslide Susceptibility Exposure



Low	Landsliding unlikely. Areas classified as Landslide Density = Low (less than 7%) and areas classified as Slopes Prone to Landsliding = Low.
Moderate	Landsliding possible. Areas classified as Landslide Density = Low to Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = Moderate OR areas classified as Landslide Density = Moderate (7%-17%) and areas classified as Slopes Prone to Landsliding = Low.
High	Landsliding likely. Areas classified as Landslide Density = High (greater than 17%) and areas classified as Slopes Prone to Landsliding = Low and Moderate OR areas classified as Landslide Density = Low and Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = High.
Very High	Existing landslides Landslide Density and Slopes Prone to Landsliding data were not considered in this category. Note: the quality of landslide inventory (existing landslides) mapping varies across the state.

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

Note: To view detail click the link above to access Oregon HazVu

Two critical facilities are exposed to the landslide hazard —Canby Utility’s main river intake, Springs Gallery, and pump houses as well as the Police Department (EOC #2). The critical infrastructure is especially exposed to the landslide hazard. In addition, economic centers, cultural or historic assets, environmental assets, and hazardous material sites are exposed to the landslide hazard. Hazardous materials sites would also suffer damage, resulting in threats to environmental and human health, while disrupting the availability of gasoline for vehicle transport and furthering economic loss because such sites are also sources of employment. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables CA-5 to CA-12.

This exposure means that large scale and simultaneous landslides triggered by an earthquake could substantially disrupt City operations buildings, police, fire stations and key pieces of infrastructure (bridges, sewage pump stations, water reservoirs) that would hinder the ability of the City to respond to emergency situations created by such an event.

As a result, it will be important for the City to pursue opportunities for retrofitting and mitigating important structures and infrastructure, such that said facilities can withstand and survive landslides, particularly simultaneous landslides generated by an earthquake. Business continuity planning shall also be an important factor, given the number of economic centers and employment facilities that are threatened by the landslide hazard.

Potential landslide-related impacts are adequately described within Volume I, Section 2, and include infrastructure damages, economic impacts (due to isolation, and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides, and debris flows can potentially occur during any winter, and thoroughfares beyond City limits are susceptible to obstruction as well.

The most common type of landslides are slides caused by erosion. Slides move in contact with the underlying surface, are generally slow moving, and can be deep. Rainfall-initiated landslides tend to be smaller; while earthquake induced landslides may be quite large. All soil types can be affected by natural landslide triggering conditions.

Mitigation Activities

Canby works to mitigate future landslide hazards. The city development code includes several policies and regulations to protect slopes including the Flood Hazard Protection (Chapter 15.12), Erosion Control (Chapter 15.20), Hazard Overlay Zone (Chapter 16.40), and Building Height, Subdivision Design Standards (Chapter 16.64). The City has identified steep slopes that may be susceptible to the landslide hazards. In 2007 Canby Public Works abandoned a storm line that had gone over a hill on North Baker Drive. This storm line was rerouted out of the hazard zone to reduce the possibilities of future damage due to landslides.

Please review Volume I, Section 2 for additional information on this hazard.

Severe Weather

Severe weather can account for a variety of intense, and potentially damaging hazard events. These events include extreme heat, windstorms, and winter storms. The following section describes the unique probability, and vulnerability of each identified weather hazard.

Extreme Heat

The HMAC determined that the City's probability for extreme heat events is **moderate** and that their vulnerability is **moderate**. *The probability rating and the vulnerability rating did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the City as well.

A severe heat episode or "heat wave" occurs about every two to three years, and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days with temperatures greater than or equal to 90-degrees, or 100-degrees, Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit, and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The City of Canby has not experienced any life-threatening consequences from the few historical extreme heat events, although changes in climate indicate that the area should expect to see more extreme heat events.

Please review Volume I, Section 2 for additional information on this hazard.

Windstorm

The HMAC determined that the City's probability for windstorm is **high** and that their vulnerability to windstorm is **moderate**. *The probability and vulnerability ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent, and probability of a potential event within the region. Because windstorms typically occur during winter months, they are sometimes accompanied by flooding and winter storms (ice, freezing rain, and very rarely, snow). Other severe weather events that may accompany windstorms, including thunderstorms, hail, lightning strikes, and tornadoes are generally negligible for Canby. In July 2016, two funnel clouds were spotted due to a low-pressure system and no damage was reported. While five miles east of Canby, a tornado touched down at Aurora State Airport in October of 2017.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation, and economic disruptions result as well.

Damage from high winds generally has resulted in downed utility lines, and trees usually limited to several localized areas. Electrical power can be out anywhere from a few hours to several days. Outdoor signs have also suffered damage. If the high winds are accompanied by rain (which they often are), blowing leaves, and debris clog drainage-ways, which in turn may cause localized urban flooding.

Please review Volume I, Section 2 for additional information on this hazard.

Winter Storm (Snow/Ice)

The HMAC determined that the City's probability for winter storm is **high** and that their vulnerability to winter storm is **moderate**. *The probability and vulnerability ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent, and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the City typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

Most winter storms typically do not cause significant damage, they are frequent, and have the potential to impact economic activity. Road closures due to winter weather are an uncommon occurrence but can interrupt commuter and commercial traffic.

Vulnerability Assessment

Due to insufficient data and resources, Canby is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. However, the City completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

The areas of the City that are often most at risk to severe storms are residential areas on steeper slopes, where roads may be icy and, thus, difficult to climb and descend. Road corridors leading to residential areas with fuller tree canopies are susceptible to downed tree limbs, and those areas that are above 500 feet in elevation are particularly vulnerable. However, some weather systems are characterized by a temperature inversion, where the valley floor is colder than the nearby hills. Consequently, severe storms affect the entire city.

The major risk to property results from exposed utilities, especially power lines and water pipes that are damaged by wind, broken tree limbs and cold temperatures. Businesses also suffer economic losses when they must close as the result of the inclement weather and/or the loss of power, which, in turn, disrupts the local supply chain of goods and services. Periods of extended ice coverage hinder emergency response services and limit the mobility of residents, which could result in serious life safety issues.

Residents and businesses that are in areas that exhibit the severe storm hazard face some risk of damage from severe storms. Severe weather events are expected to impact nearly all City residents.

Telcom Central Station and City Hall Complex are critical facilities located adjacent to vulnerable power lines. Canby Utility, Public Works, and Canby Telephone would be strained during a severe storm event as they work to clear roads and repair or replace power distribution and/or transmission lines and maintain telephone lines for communication.

Additionally, the area along 99E from South Elm to South Ivy St. is particularly vulnerable to damaged power lines from fallen tree limbs.

All schools and one adult community center that are considered essential facilities are also exposed to the severe weather hazards. In addition, critical infrastructure, economic centers, cultural or historic assets, environmental assets, and hazardous material sites are exposed to the severe weather hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Assets section and Tables CA-5 to CA-12.

The exposure of these facilities and infrastructure means that severe weather events could substantially disrupt the operations of City government buildings and fire stations, impairing key City functions, while hindering the ability of emergency response personnel to respond to emergency situations that are created by a severe storm event.

All these facilities depend upon utility lines, roads and bridges to operate and perform their respective important functions within the City. Exposed utility and power lines are particularly vulnerable to damage from severe winter storms by wind, ice and snow. More hardened infrastructure, like bridges and roads, can sustain a severe winter storm, but during the event, they are often hazardous to traverse because of icy, windy and snowy conditions.

Consequently, severe weather (wind or winter storm) could substantially disrupt numerous key resources and facilities within the City through impediments to the transportation system and damage to the power grid. Among other things, these transportation problems and power failures disrupt business operations and educational facilities, resulting in economic losses and halting educational opportunities.

Power to Hazardous material sites could also be disrupted. The sites themselves could be damaged or rendered inaccessible. In turn, these conditions could pose threats to the natural environment of the City and the health of its population, while disrupting the availability of gasoline for vehicle transport and furthering economic losses.

As a result, it will be important for the City to pursue opportunities for undergrounding utilities and retrofitting utility lines so that they may withstand cold weather conditions without freezing and bursting. Adhering to current building codes for weatherization of structures, as well as current engineering and fire codes that pertain to the steepness of new roads, are also key factors for the City to consider. Business continuity planning shall also be an important factor, given the number of economic centers and employment facilities that are threatened by the severe storm hazard.

Mitigation Activities

Mitigating severe weather can be difficult because storms affect all areas of the city, but Canby has made progress to reduce the effects of storms. Canby has a tree inventory and street tree regulation through the Development code's Tree Regulations section (Chapter 12). Canby Utility undergrounds all new facilities so they are not susceptible to fallen branches and ice buildup. Canby also has a designated snow plow and sanding routes to help expedite snow removal.

Please review Volume I, Section 2 for additional information on this hazard.

Volcanic Event

The HMAC determined that the City's probability for a volcanic event is **low** and that their vulnerability to a volcanic event is **low**. *The probability rating and the vulnerability rating decreased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of volcanic hazards, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the western portion of the County is likely to affect Canby as well. Several volcanoes are located near Canby, the closest of which are Mount Hood, Mount Adams, Mount Saint Helens, Mount Rainier, and the Three Sisters.

Vulnerability Assessment

Due to insufficient data and resources, Canby is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables CA-5 to CA-12.

Due to Canby's relative distance from volcanoes, the city is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Depending on wind patterns and which volcano erupts, however, the city may experience ashfall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city could experience a heavier coating of ash.

Mitigation Activities

The existing volcano hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Wildfire

The HMAC determined that the City's probability for wildfire is **low**, and that their vulnerability to wildfire is **moderate**. *The probability rating decreased, and the vulnerability rating did not change, since the previous version of this NHMP addendum.*

The [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) was completed in May 2018. The CWPP is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard: <https://www.clackamas.us/dm/CWPP.html>. Information specific to Canby is found in the following chapter: [Chapter 10.2: Canby Rural Fire Protection District #62](#).

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions. Weather, and urbanization conditions are primarily at cause for the hazard level. Canby has not experienced a catastrophic wildfire within City limits.

Clackamas County has two major physiographic regions: the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern

Clackamas County. The Willamette River Valley, which includes Canby, is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range has a relatively small population and is characterized by heavily forested slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to its dense forest land. Human caused fires are responsible for most fires in Clackamas County.

The City is characterized by lush parks, neighborhoods surrounded by mature trees and under story vegetation and development intermingled with the natural landscape. One area of wildland-urban interface is the northeast portion of Canby. A heavily wooded area borders the north and south boundaries of the sewage treatment facility and Public Works Building (EOC #3). Most of the woodlands are surrounded by urban development that are a concern in the case of a wildfire event. Figure CA-6 shows overall wildfire risk in Canby. The forested hills within, and surrounding Canby are interface areas including the following High Priority Communities at Risk (CARs): Adkins Circle, Dutch Vista/Madrona, Public Works Infrastructure, Sundowner, and the following Medium Priority CARs: N Side Molalla River Bluff, Molalla River State Park, and South End.¹⁷

Most of the city has less severe (moderate or less) wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions, except in a small wooded area near the Willamette River on North Holly Street that has the probability of four to eight feet expected flame lengths.¹⁸ However, conditions vary widely and with local topography, fuels, and local weather (including wind) conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts.

Vulnerability Assessment

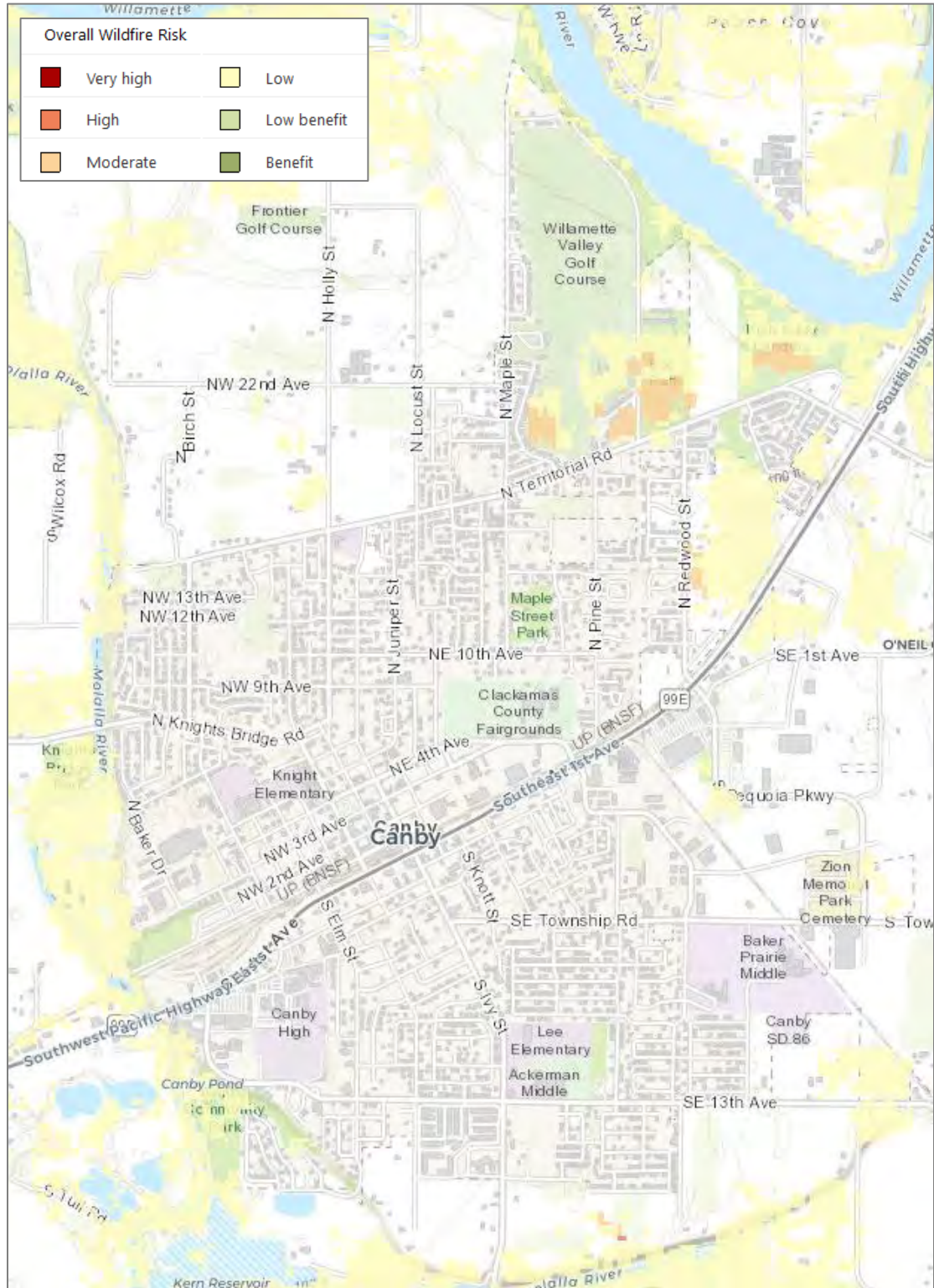
Due to insufficient data and resources, Canby is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. However, the City completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

Residences and businesses that border occluded woodlands with slopes greater than 25% are at the greatest risk of loss or damage from wildfires. A great deal of infrastructure is exposed to the wildfire hazard, including Canby's primary water source, water treatment facilities, and Public Works Building (EOC#3). This could affect the efficiency of fire protection professionals during a large-scale wildfire. Vegetation along roadways is also highly dangerous, as negligent motorists provide ignition sources by tossing cigarette butts out car windows. A variety of historic landmarks are also included in the high wildfire zones.

¹⁷ Clackamas County Community Wildfire Protection Plan, *Canby Rural Fire Protection District #62* (2018), Table 10.13-1.

¹⁸ [Oregon Wildfire Risk Explorer](#), date accessed April 26, 2019.

Figure CA-6 Overall Wildfire Risk



Source: [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables CA-5 to CA-12.

The potential community impacts, and vulnerabilities described in Volume I, Section 2 are generally accurate for the City as well. Canby's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. The City will update the City's wildfire risk assessment if the fire plan presents better data during future updates.

Property can be damaged or destroyed with one fire as structures, vegetation, and other flammables easily merge to become unpredictable, and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

Mitigation Activities

The City and Canby Fire District use several mitigation tools to reduce the city's risk to wildfires. Canby Fire District provides emergency fire suppression, medical response and rescue services to the cities of Canby and Barlow and other rural areas around those cities under an intergovernmental agreement related to voter-approved annexation to the district. Canby Fire District has 50 members who consist of 18 career, 30 volunteer, and 2 administrative personnel. Mutual aid agreements with neighboring jurisdictions are also in place. Water supply and storage capacity in Canby conforms with recommended fire flow requirements.

The Canby Fire District provides outreach and education to the community on wildfire mitigation via news releases, posters, signage, website messages, and visits to schools, civic organizations and neighborhood associations.

Please review the [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) and Volume I, Section 2 for additional information on this hazard.

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ATTACHMENT A: ACTION ITEM FORMS

ATTACHMENT A

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* - Priority Action Items

Note: The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity.

Summary of Action Changes

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

Previous NHMP Actions: Completed

Flood Action #3 (2012): “Identify mitigation strategies to address flooding issues in the bottom lands” is considered complete. The water wash ponds were elevated above the flood line. The water intake structures are elevated out of the 100-year floodplain. Canby Utility continues to address flooding issues as they arise.

See 2018 status identified in each action for activities that have been completed since the previous plan.

Previous NHMP Actions: Removed

Multi-Hazard Action #5 (2012): “Improve the hazard assessment in the Canby Natural Hazard Mitigation Plan” was removed from the list since it was determined by the steering committee that this is a duplication of the purpose of the NHMP’s implementation and maintenance and five-year update requirements.

Multi-Hazard Action #6 (2012): “Identify and pursue funding opportunities to develop and implement hazard mitigation activities” was removed from the list since it was determined by the steering committee that this is a duplication of the purpose of the NHMP’s implementation and maintenance requirements.

Note: 2012 Action MH #7 was renumbered to 2019 Action MH #5.

New NHMP Actions (2019):

- Wildfire Action #2

See action item forms below for detail.

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 NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the County, participating cities, and special districts. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. The City 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, the City 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 several 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 HMAP but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and/or resources toward completion of the action items.

Internal partner organizations are departments within the City 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.

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:	
Update and revise the Canby Emergency Operations Plan.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Canby Emergency Operations Plan; Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The EOP was last updated in February 2012. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Assign appropriate city staff to lead the EOP update process; and Work with the contractor hired by the State of Oregon to update the EOP 			
Coordinating Organization:	Canby Fire District		
Internal Partners:		External Partners:	
City of Canby			
Potential Funding Sources:		Estimated cost:	Timeline:
General fund, operating budgets		Low	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High Priority		

* - High Priority Action Item

Multi-Hazard #2*

Proposed Action Item:		Alignment with Plan Goals:	
Ensure there are adequate shelter facilities in hazard-free zones to serve Canby residents. Identify potential shelter sites and evaluate their relative structural risks/structural deficiencies. Seek funding for upgrades on shelter sites if needed.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The 2009 update included evaluating the structural integrity of shelters and seeking funding for upgrades. The city maintains an active inventory of all shelters. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Identify and contact non-Red Cross potential shelter sites to ensure they are structurally suitable under disaster scenarios; Obtain funding to enhance the resilience of emergency shelter sites; and Contact Red Cross shelter sites to renew and maintain agreements annually. 			
Coordinating Organization:		Hazard Mitigation Advisory Committee	
Internal Partners:		External Partners:	
Public Works, Planning, Building		Red Cross	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High Priority		

* - High Priority Action Item

Multi-Hazard #3*

Proposed Action Item:		Alignment with Plan Goals:	
Develop, enhance, and implement education programs designed to reduce the losses from natural hazards.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The county fair (Canby Fairgrounds) includes a "Safety Street" where police, fire, the forestry department, and other service organizations provide information on safety, preparedness, mitigation tips, etc. Canby Fire District educates youth on fire prevention and safety in schools and have "Fireman Troy" and "Hotshot the Cougar" mascots to assist in educating. The Fire District website provides information on fire prevention and mitigation. Canby Utility promotes vegetation management in their newsletters. The City of Canby puts out notices in their newsletters on preparedness for bad weather and tips on reducing damages. Canby School District educates students on earthquakes and practices earthquake drills. Canby Utility works with the Molalla River Alliance in river protection activities. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Gather hazard-related information and public information materials, and disseminate to public through local publications; Identify property owners in hazard zones, and conduct a target mailing to disseminate hazard information; Publicize hazard information as the seasons for the hazards approach. These include earthquake awareness month in April, wildfire prevention in summer, and flood and severe storm information in winter; Hold a community meeting with the neighbors along the steep slopes of the Molalla River, and in identified landslide areas. Provide them with the proper contacts and resources for dealing with erosion control and slope stabilization on their property. Educate them on mitigation practices they can employ to better protect their property. 			
Coordinating Organization:		Hazard Mitigation Advisory Committee	
Internal Partners:		External Partners:	
Canby Fire District, Canby Utility, Administration		FEMA, OEM, Canby School District, Molalla River Alliance	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, operating budgets		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High Priority		

* - High Priority Action Item

Multi-Hazard #4*

Proposed Action Item:		Alignment with Plan Goals:	
Integrate the goals and action items from the Canby Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan; Development Code; Zoning Ordinance; Natural Hazards Mitigation Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The development code was last updated in 2013 (amended 2015, 2016, 2018). • The Comprehensive Plan was last updated in 2015. • The Stormwater Master Plan was last updated in 2013. • The city utilizes the latest Oregon Building Code. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Use the mitigation plan to help the city's Comprehensive Land Use Plan meet 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 city's mitigation plan into current capital improvement plans to ensure that development does not encroach on known hazard areas; • Partner with other organizations and agencies with similar goals to promote building codes that are more disaster resistant at the state level; and • Incorporate the Canby Mitigation Plan into deed restrictions and conditions of approval where appropriate. 			
Coordinating Organization:		Hazard Mitigation Advisory Committee	
Internal Partners:		External Partners:	
Planning, Public Works		DOGAMI, DLCD, FEMA	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High Priority		

* - High Priority Action Item

Multi-Hazard #5

Proposed Action Item:		Alignment with Plan Goals:	
Identify, plan, and establish an alternate potable water source on the Willamette River.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Development Code, Zoning Ordinance, Water System Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The City of Canby potable water source is primarily reliant on Molalla River flows. As part of a long term plan, Canby Utility is working to establish a water treatment facility reliant on the Willamette River. As Canby continues to grow, additional potable water may be needed to meet the needs of the community. Groundwater in the area does not appear to be a viable alternative. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Coordinating efforts between other surrounding cities who can also benefit. Strategy work and early planning stages for determining a location for the transmission line and intake system. Utilize the website to post information regarding drought. 			
Coordinating Organization:		Canby Utility	
Internal Partners:		External Partners:	
Public Works, Hazard Mitigation Advisory Committee		Other cities/agencies	
Potential Funding Sources:		Estimated cost:	Timeline:
General fund		Moderate	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium Priority		

Earthquake #1

Proposed Action Item:		Alignment with Plan Goals:	
Conduct seismic evaluations and upgrades on identified critical and essential facilities and infrastructure for implementing appropriate structural and non-structural mitigation strategies.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Capital Improvement Plan; Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for earthquakes to cause damage can assist a community in mitigating its overall risk to earthquakes. Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. City buildings, fire stations, police station and schools were seismically evaluated. The Canby Telcom control center was earthquake retrofitted. The Police Department and the 13th Ave. Reservoir were completed in 2012. Canby Fire District Station #62 retrofit per SRGP grant. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Obtain funding to perform seismic evaluations; Conduct seismic evaluations on identified community assets (including shelters) for implementing appropriate structural and non-structural mitigation strategies; Prioritize seismic upgrades based on criticality of need and population served; Seismically retrofit critical government facilities to guarantee continuous operation during and after a natural disaster; Coordinate with agencies responsible for maintaining the bridges surrounding Canby to upgrade them to meet current seismic code; Partner with appropriate organizations to implement seismic upgrades; and Create damage assessment procedures. 			
Coordinating Organization:		Hazard Mitigation Advisory Committee	
Internal Partners:		External Partners:	
Administration, Planning, Public Works, Police, Canby Fire District, Canby Utility		DOGAMI, School District	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund, Seismic Rehabilitation Grant Program, Hazard Mitigation Assistance Grants, Utility Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium Priority		

Flood #1

Proposed Action Item:		Alignment with Plan Goals:	
Evaluate and upgrade surface water management infrastructure and identify appropriate mitigation strategies.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Surface Water Master Plan, Zoning Code, FEMA FIRMs, Comprehensive Plan, Capital Improvement Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The storm water master plan was updated in 2013. The city received a grant for developing new subdivision design standards for surface water, and another grant to address the flooding problem near the library. The city of Canby has received money to upgrade the storm system to reduce floods. They are currently working to upgrade the system by putting in new streets and pervious pavement. The city continues to mitigate floods by removing beaver dam debris. The city has a full-time vacuum sweeper, so the catch basins don't have to be cleaned as often. The storm system on Baker has been updated. The Stormwater CIP is currently being reviewed and updated – expected complete 2019-20. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Develop storm water grate management system to keep grates open and clear of debris; and Implement the actions stated in the storm water master plan to address areas of known flooding. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Planning, Administration		Clackamas County Water Environment Services, METRO, Department of Environmental Quality, Department of Land Conservation and Development, Department of State Lands	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Environmental Fund, City Stormwater Fund		Moderate to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium Priority		

Flood #2*

Proposed Action Item:		Alignment with Plan Goals:	
Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Flood Ordinance; Zoning Code, FEMA FIRMs, Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will help reduce the level of flood damage to new and existing buildings in communities while providing homeowners, renters and business owners additional flood insurance protection. The NFIP provides communities with federally backed flood insurance to homeowners, renters, and business owners, if communities develop and enforce adequate floodplain management ordinances. The benefits of adopting NFIP standards for communities are a reduced level of flood damage in the community and stronger buildings that can withstand floods. The city complies with the NFIP through enforcement of their flood hazard protection ordinance (Ord. 1279, 20008). Flood mitigation projects are routinely completed as part of their storm water master plan CIP (see FL #1 for more detail). 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Actively participate with DLCD and FEMA during Community Assistance Visits. Assess the floodplain ordinances to ensure they reflect current flood hazards and situations and meet NFIP requirements. Coordinate with the county to ensure that floodplain ordinances and NFIP regulations are maintained and enforced. Consider participating in the National Flood Insurance Program's Community Rating System (CRS). CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works		Department of Land Conservation and Development; Association of State Floodplain Managers	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	High Priority		

* - High Priority Action Item

Landslide #1

Proposed Action Item:		Alignment with Plan Goals:	
Reduce the vulnerability of property owners in landslide-prone areas.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan; Development Code			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Ongoing – no improvements to report. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Conduct a study to identify appropriate mitigation strategies for problem areas including buildings and infrastructure in the bluff area; Develop public information to emphasize economic risk when building on potential or historical landslide areas; Update the landslide hazard map when LIDAR data becomes available; and Review the planning and building codes and make updates or changes to the safe harbor code, if necessary. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works		Clackamas County Water Environment Services, Department of Environmental Quality	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Environmental Fund, System Development Charge Funds		Moderate	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium Priority		

Severe Weather #1

Proposed Action Item:		Alignment with Plan Goals:	
Obtain funding to bury power lines subject to frequent failures to reduce power outages from the windstorm and severe winter storm hazard, where possible.		Protect Life and Property; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Comprehensive Plan; Development Code			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to cause power outages can assist a community in mitigating its overall risk to wind and winter storms. Canby Utility placed utilities underground on 1st Avenue and SE 2nd street and all new development is underground. About 70% of utilities are located underground. A new substation on Knights Boulevard was built to assist with switching to have enough power transformation if the substation on 99E goes down. Part of a 5-year system study and update plan has been completed. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Partner with PGE to continue hazardous tree inventory and mitigation programs; Ensure there are back up underground lines to major businesses & employers; and Continue regular tree trimming practices. 			
Coordinating Organization:		Canby Utility	
Internal Partners:		External Partners:	
Public Works		PGE	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium Priority		

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; Enhance Natural Systems; Augment Emergency Services; 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:			
The wildfire mitigation action items provide direction on specific activities that organizations and residents in Canby can take to reduce wildfire hazards. 2018 Status: Ongoing. CCWPP updated in 2018.			
Ideas for Implementation: CCWPP Identified Focus Areas and Priority Actions			
Wildfire Risk Assessment (Ch. 4):			
<ol style="list-style-type: none"> 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):			
<ol style="list-style-type: none"> 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):			
<ol style="list-style-type: none"> 1. Develop and FDB Communications Works Group. 2. Conduct a Conflagration Exercise. 			
Education and Community Outreach (Ch. 7):			
<ol style="list-style-type: none"> 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):			
<ul style="list-style-type: none"> • Identify a DTD representative for the WFEP. • Improve coordination with Rural Fire Agencies. • Integrate WU into Plan Map and include a public outreach strategy. 			
Coordinating Organization:		Canby Fire District	
Internal Partners:		External Partners:	
Public Works, Planning		Clackamas Fire Defense Board, ODF, U.S. Forest Service, public land management agencies	
Potential Funding Sources:		Estimated cost:	Timeline:
ODF, operating budgets, FEMA HMA		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	High Priority (<i>CCWPP identified priority actions listed above</i>)		

* - High Priority Action Item

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ATTACHMENT B: PUBLIC INVOLVEMENT SUMMARY

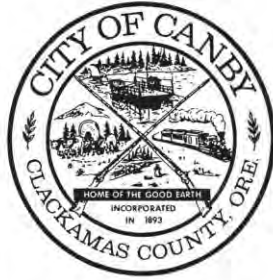
Members of the HMAC provided edits and updates to the NHMP prior to the public review period as reflected in the final document.

To provide the public information regarding the draft NHMP addendum, and provide an opportunity for comment, an announcement (see text below) was announced in the Canby Herald newspaper on June 26 and July 3 and on the city's [website](#) and an email contact was provided for public comment.

During the public review period there were no comments provided.



Press Release



Clackamas County Pre-Disaster Mitigation Planning PRESS RELEASE

**Canby seeks additional public input on
update to Natural Hazard Mitigation Plan**

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

A natural hazard mitigation plan provides communities with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities, and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

An electronic version of the updated draft Canby NHMP addendum will be available for formal public comment beginning June 19, 2019. To view the draft please visit: www.canbyoregon.gov

If you have any questions regarding the Canby NHMP addendum or the update process in general, please contact: Rick Robinson, City Administrator at (503) 266.0745 or robinsonr@canbyoregon.gov; or Michael Howard, Assistant Program Director for the Oregon Partnership for Disaster Resilience at (541) 346-8413 or mrhoward@uoregon.edu.

City of Estacada Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan



March 2019

Volume II: Estacada Addendum



Prepared for:

City of Estacada

Prepared by:

University of Oregon
Institute for Policy Research and Engagement
Oregon Partnership for Disaster Resilience

Planning grant funding provided by:



FEMA

Federal Emergency Management Agency (FEMA)
Pre-Disaster Mitigation Program
Grant: EMS-2017-PC-0005
Sub-grant Application Reference: PDMC-PL-10-OR-2016-001, and

Additional Support Provided by:



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FEMA

June 18, 2019

The Honorable Jim Bernard
Chair, Clackamas County Commissioners
2020 Kaen Road Suite A
Oregon City, Oregon 97045

Dear Chairman Bernard:

On April 12, 2019, the United States Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10 approved the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan* as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance (HMA) grants through April 11, 2024, through your state.

Clackamas County

| City of Estacada

| City of Lake Oswego

The updated list of approved jurisdictions includes the cities of Estacada and Lake Oswego which recently adopted the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan*. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Joseph Murray, State Hazard Mitigation Planner with Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities.

Sincerely,

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

Mark Carey, Director
Mitigation Division

Enclosure

JG:vl

RESOLUTION 2019 – 013

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

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

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

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

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

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

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

Whereas, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *City of Estacada addendum* to the *Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan* and pre-approved it (dated, April 25, 2019) contingent upon this official adoption of the participating governments and entities;

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


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

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


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

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

Adopted this 13th day of May, 2019


Sean Drinkwine, Mayor

ATTEST:


Sadie Main, City Recorder

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Purpose

This is an update of the Estacada addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation and Volume III (Appendices) which provide additional information. This addendum meets the following requirements:

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

Updates to Estacada's addendum are further discussed throughout the NHMP and within Volume III, Appendix B, which provides an overview of alterations to the document that took place during the update process.

Estacada adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on **May 13, 2019**. FEMA Region X approved the Clackamas County NHMP on April 12, 2019 and the City's addendum on **June 18, 2019**. With approval of this NHMP the City is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **April 11, 2024**.

Mitigation Plan Mission

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

The City concurs with the mission statement developed during the Clackamas County planning process (Volume I, Section 3):

Promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

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

The City concurs with the goals developed during the Clackamas County planning process (Volume I, Section 3). All NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Below is a list of the NHMP goals:

GOAL #1: PROTECT LIFE AND PROPERTY

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

GOAL #2: ENHANCE NATURAL SYSTEMS

- Balance watershed planning, natural resource management, and land use planning with natural hazards mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

GOAL #3: AUGMENT EMERGENCY SERVICES

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, and business, and industry.
- Coordinate and integrate natural hazards mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL #4: ENCOURAGE PARTNERSHIPS FOR IMPLEMENTATION

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

GOAL #5: PROMOTE PUBLIC AWARENESS

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

NHMP Process, Participation and Adoption

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

Estacada first developed an addendum to Clackamas County's Natural Hazards Mitigation Plan in 2009. This plan was updated in 2013 and in 2018. The last update of the Estacada addendum to the Clackamas County NHMP was approved by FEMA on April 8, 2013.

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

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research, and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM), Clackamas County, and Estacada to update their NHMP. This project is funded through the Federal Emergency Management Agency's (FEMA) Fiscal-Year 2016 (FY16) Pre-Disaster Mitigation (PDM) Competitive Grant Program EMS-2017-PC-0005 (PDMC-PL-10-OR-2016-001). Members of the Estacada NHMP Hazard Mitigation Advisory Committee (HMAC) also participated in the County NHMP update process (Volume III, Appendix B).

The Clackamas County NHMP, and Estacada addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. The Estacada HMAC guided the process of developing the NHMP.

Convener

The Estacada City Manager or designee serves as the NHMP addendum convener. The convener of the NHMP will take the lead in implementing, maintaining and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the City of Estacada HMAC met formally and informally, to discuss updates to their addendum (Volume III, Appendix B). The HMAC reviewed and revised the City's addendum, with focus on the NHMP's risk assessment and mitigation strategy (action items).

This addendum reflects decisions made at the designated meetings and during subsequent work and communication with Clackamas County Resilience Coordinator, and the OPDR. The changes are highlighted with more detail throughout this document and within Volume III, Appendix B. Other documented changes include a revision of the City's risk assessment and hazard identification sections, NHMP mission and goals, action items, and community profile.

The Estacada HMAC was comprised of the following representatives:

- Convener, Denise Carey, Estacada City Manager
- Scott Crosby, Reliance Connects

- Jason Crowe, City of Estacada Fire – Division Chief of Emergency Services
- Tom Seal, City of Estacada Public Works Director
- Melanie Wagner, Estacada City Manager Assistant

Public participation was achieved with the establishment of the HMAC, which was comprised of City officials representing different departments and sectors and members of the public. The HMAC served as the local review body for the NHMP's development. Community members were provided an opportunity for comment via the NHMP review process and through a survey administered by Clackamas County (Volume III, Appendix G).

NHMP Implementation and Maintenance

The City Council will be responsible for adopting the Estacada addendum to the Clackamas County NHMP. This addendum designates a HMAC and a convener to oversee the development and implementation of action items. Because the City addendum is part of the County's multi-jurisdictional NHMP, the City will look for opportunities to partner with the County. The City's HMAC will convene after re-adoption of the Estacada NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The City's City Manager or designee will serve as the convener and will be responsible for assembling the HMAC. The HMAC will be responsible for:

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating and training new HMAC members on the NHMP and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement; and
- Documenting successes and lessons learned during the year.

The convener will also remain active in the County's implementation and maintenance process (Volume I, Section 4).

The City will utilize the same action item prioritization process as the County (Volume I, Section 4).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, and Building Codes, as well as the [Clackamas County NHMP](#), and the [State of Oregon NHMP](#).

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the city. Plans and policies already in existence have support from residents, businesses and policy makers. Where possible,

Estacada will implement the NHMP's recommended actions through existing plans and policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Future development without proper planning may result in worsening problems associated with natural hazards. Metro, the regional government for Clackamas, Multnomah, and Washington counties, determines many land use laws for the tri-county region and sets the urban growth boundary. The entire Portland Metro area is subject to tremendous growth pressures due to its desirable location and the restrictions on urban sprawl placed by urban growth boundary requirements.

Estacada's acknowledged comprehensive plan is the City of Estacada Comprehensive Plan (1980, last amended December 2018). The Oregon Land Conservation and Development Commission acknowledged the plan following periodic review in 1993. The City implements the plan through adopted ordinances.

Estacada currently has the following plans, regulations, and projects that relate to natural hazard mitigation. For a complete list visit the City's [website](#):

- [Comprehensive Plan](#)
- Building Code, [2017 Oregon State Building Code](#) based on 2015 International Residential Code (IRC) and 2012 International Building Code
- [Estacada Municipal Code](#)
 - [Title 2.36.030 Emergency Management](#)
 - [Title 8.12.030 Weeds and noxious growth](#)
 - [Title 8.12.040 Trees](#)
 - [Title 13.12.060 Private disposal systems](#)
 - [Title 15.04.030 Adoptions of codes](#)
 - [Title 15.04.050 Application to existing buildings and building service equipment](#)
 - [Title 16.68 Natural Hazard Areas](#)
 - [Title 16.120.020 Procedure for land partitioning](#)
- Downtown Urban Renewal Plan
- [Parks Master Plan](#)
- [Street Tree Master Plan](#)
- [Transportation System Plan](#)
- [Active Transportation Plan](#)
- [Stormwater Master Plan](#)
- [Wastewater Facilities Plan](#)
- [Water System Master Plan](#)

Other plans:

- [Clackamas County Community Wildfire Protection Plan](#)
 - [Estacada Rural Fire District #69](#)

Government Structure

The City of Estacada has a council-manager form of government. The City Council consists of a mayor and six councilors. The mayor presides over Council meetings and is a voting member of the council with no veto authority. Through a general election, the mayor is elected for a two-year term with City Council members being elected to four-year terms of office. The City Council is responsible for identifying problems and needs within the community and then addressing those problems through community goals and objectives.¹

The Planning Commission is responsible for residential building and planning and monitoring future development. They make recommendations to City Council for changes to the Planning and Land Development Ordinance, Historic District Zones, the Comprehensive Plan and the Zoning Map.

The City of Estacada provides a variety of services to promote the safety and welfare of its residents. Public services that support the demands of a growing community include Building and Development, Economic Development, Finance, Planning and Zoning, Public Safety, and Public Works.

Building and Development: The Department manages development projects and all new construction permits within the city.

Economic Development: The Department works on supporting current businesses and attracting new businesses to strengthen the city.

Finance: The Department ensures the fiscal integrity of the financial operations of the city and its responsible growth.

Planning and Zoning: Responsible for guiding the City's growth by updating and enforcing all applicable land use regulations and development standards. The Department helps the Council produce the strategic vision of the city.

Public Safety: Consists of the Estacada Municipal Court, Clackamas County Sheriff's Office, and Estacada Rural Fire District #69 who provide services to enhance the health and safety of Estacada residents.

Public Works: Responsible for maintaining streets, streetlights, Water, sewer, and stormwater systems and manages the Willamette Water Treatment² and wastewater Treatment Plants.

Continued Public Participation

An open public involvement process is essential to the development of an effective NHMP. In order to develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunity for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the NHMP during review.³ Keeping the public informed of the City's efforts to reduce its risk to

¹ City of Estacada. (2018). City of Estacada Charter of 2006. <https://tinyurl.com/ybyluz73>

² City of Estacada. (2003). Source Water Assessment Summary Brochure. PWS# 4100279. <https://tinyurl.com/yd37toxf>

³ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

future natural hazard events is important for successful NHMP implementation and maintenance. The City is committed to involving the public in the NHMP review and update process (Volume I, Section 4). The City posted the plan update for public comment before FEMA approval, and after approval will maintain the plan on the City's website: <https://www.cityofestacada.org/>.

NHMP Maintenance

The Clackamas County NHMP and City addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the County NHMP update process, the City will also review and update its addendum (Volume I, Section 4). The convener will be responsible for convening the HMAC to address the questions outlined below.

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

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

Mitigation Strategy

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

The City's mitigation strategy (action items) were first developed during the 2009 NHMP planning process and revised during subsequent NHMP updates. During these processes, the HMAC assessed the City's risk, identified potential issues, and developed a mitigation strategy (action items).

During the 2018 update process the City re-evaluated their mitigation strategy (action items). During this process action items were updated, noting what accomplishments had been made and whether the actions were still relevant; any new action items were identified at this time (see Volume III, Appendix B for more information on changes to action items).

Priority Action Items

Table EA-1 presents a list of mitigation actions. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity. High priority actions are shown in **bold** text with grey highlight. The City will focus their attention, and resource availability, upon these achievable, high leverage, activities over the next five-years. Although this methodology provides a guide for the HMAC in terms of implementation, the HMAC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for detailed information for each action. Full text of the plan goals referenced in Table EA-1 is located on page EA-2

Table EA-I Estacada Action Items

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
MH #1	Develop and maintain public education programs to inform the public about methods for mitigating the impacts of natural hazards.	City Manager's Office	HMAC	Ongoing	✓		✓	✓	✓
MH #2	Integrate the goals and action items from the Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	City Manager's Office	City Council, Planning Commission	Ongoing	✓	✓	✓	✓	✓
EQ #1	Conduct seismic evaluations and upgrades on all critical city facilities and implement appropriate structural and non-structural mitigation strategies.	City Manager's Office	Public Works	Long Term	✓		✓	✓	✓
FL #1	Increase capacity of culverts by identifying and proposing mitigation actions for culverts that are prone to flooding within the City.	City Manager's Office	HMAC, Public Works	Ongoing	✓	✓		✓	
FL #2	Implement the projects detailed in the Stormwater Master Plan.	Public Works	City Manager's Office	Ongoing	✓	✓	✓	✓	
SW #1	Reduce negative effects from severe windstorm and severe winter storm events.	City Manager's Office	Public Works	Ongoing	✓	✓	✓	✓	✓
SW #2	Encourage facilities to become certified Red Cross shelter sites and maintain a list of disaster shelters located throughout Estacada.	City Manager's Office	Estacada Rural Fire District #69	Ongoing	✓		✓	✓	✓
WF #1	Review, promote, and implement action items identified in the 2017 Clackamas County Community Wildfire Protection Plan.	Estacada Rural Fire District #69	City Manager's Office, Public Works	Ongoing	✓	✓	✓	✓	✓

Source: City of Estacada HMAC, 2018.

Note: Full text of the plan goals referenced in this table is located on page EA-2.

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Risk Assessment

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

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

The local level rationale for the identified mitigation strategies (action items) is presented herein and within Volume I, Section 3 and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure EA-2. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure EA-2 Understanding Risk



Hazard Analysis

The Estacada HMAC developed their hazard vulnerability assessment (HVA), using their previous HVA and the County’s HVA as a reference. Changes from their previous HVA and the County’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Estacada, which are discussed throughout this addendum.

Table EA-2 shows the HVA matrix for Estacada listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response and recovery. The method provides the jurisdiction with sense of hazard priorities but does not predict the occurrence of a hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake and Crustal earthquake) and one chronic hazards (winter storm) rank as the top hazard threats to the City (Top Tier). Windstorm, drought, and flood comprise the next highest ranked hazards (Middle Tier), while the landslide, wildfire, volcanic event, and extreme heat hazards comprise the lowest ranked hazards (Bottom Tier).

Table EA-2 Hazard Analysis Matrix – Estacada

Hazard	Maximum				Total Threat Score	Hazard Rank	Hazard Tiers
	History	Vulnerability	Threat	Probability			
Earthquake - Cascadia	4	45	100	49	198	#1	Top Tier
Earthquake - Crustal	6	50	100	21	177	#2	
Winter Storm	10	30	70	56	166	#3	
Windstorm	14	30	50	56	150	#4	Middle Tier
Drought	10	30	50	56	146	#5	
Flood	16	30	30	56	132	#6	
Landslide	14	15	20	63	112	#7	Bottom Tier
Wildfire	6	15	70	21	112	#7	
Volcanic Event	2	35	50	14	101	#9	
Extreme Heat	2	20	40	28	90	#10	

Source: Estacada HMAc, 2018.

Table EA-3 categorizes the probability and vulnerability scores from the hazard analysis for the City and compares the results to the assessment completed by the Clackamas County HMAc. Variations between the City and County are noted in **bold** text within the city ratings.

Table EA-3 Probability and Vulnerability Comparison

Hazard	Estacada		Clackamas County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	High	Moderate	High	Low
Earthquake - Cascadia	Moderate	High	Moderate	High
Earthquake - Crustal	Low	High	Low	High
Extreme Heat Event	Moderate	Moderate	Low	High
Flood - Riverine	High	Moderate	High	Moderate
Landslide	High	Low	High	Low
Volcanic Event	Low	Moderate	Low	Moderate
Wildfire	Low	Low	High	Moderate
Windstorm	High	Moderate	Moderate	Low
Winter Storm	High	Moderate	Moderate	Moderate

Source: Estacada and Clackamas County HMAc, 2018.

Community Characteristics

Table EA-4 and the following section provides information on City specific demographics and assets. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation.

Considering the City specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation. Between 2010 and 2016 the City grew by 425 people (16%; as of 2018 the population was 3,400) and median household income increased by about 33%.⁴ Between 2018 and 2040 the population is forecast to grow by 74% to 5,930.⁵ New development has complied with the standards of the [Oregon Building Code](#) and the city's development code.

Transportation/Infrastructure

Estacada is located at the intersection of Highway 224 (Clackamas Highway) and Highway 211, east of the Clackamas River. The downtown central business district is a relatively dense grid of mostly compact and walkable streets located north of the Highway 211/224 intersection. The major collectors in central Estacada such as SW 2nd Avenue, Broadway Street, and Main Street have full sidewalks on both sides of the street along most segments. There are collectors outside of the central district that have missing links of sidewalks, but connectivity and pedestrian linkages are relatively good especially near schools. There is also a multi-use path that travels along the Clackamas River near SW Lake Shore Drive and terminates at Timber Park.⁶

Estacada is most commonly accessed from the Portland Metro area by car via Interstate 205. The City has public transit to Portland by TriMet transit system via Main Street, North 6th Street, Eagle Creek Road, and the Clackamas Highway stops. The SAM Estacada service provides direct service to Sandy. Estacada has a small airport called the Valley View Airport within its city limits. There are no active rail facilities within the City of Estacada.

Economy

The city's residents work in a variety of industries, with "office and administrative support occupations" (18% of workforce) and "construction, extraction, and maintenance occupations" (16% of workforce) accounting for the top two occupations.⁷

Estacada has an economic advantage due to its location at the edge of Mt Hood National Forest and its proximity to Portland. Businesses benefit from low property costs, moderate local government fees, ample utilities, and increased residential and tourist traffic. Estacada has over 100 acres of State Certified industrial land, commercial land located on Highway 224, and retail and office space located downtown. Estacada's available commercial and industrial properties have fiber on site or are fiber ready. The City is home to a robust cluster of metal fabrication companies and growing businesses such as Fearless Brewing Company and Northwest Technologies.⁸

⁴ Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018 and Social Explorer, Table T57, U.S. Census Bureau, 2012-2016 and 2006-2010 American Community Survey Estimates.

⁵ Portland State University, Population Research Center, "Population Forecast Tables", 2017.

⁶ Estacada Transportation System Plan. City of Estacada (2007).

⁷ Social Explorer, Table 50, U.S. Census Bureau, 2012-2016 American Community Survey Estimates

⁸ City of Estacada. *Economic Development*. <https://www.cityofestacada.org/biz/page/why-estacada>. Accessed November 25, 2018.

Table EA-4 Community Characteristics

Population Characteristics		
2010 Population	2,730	
2016 Population [2018 Population]	3,155	[3,400]
2040 Forecasted Population*	5,930	
Race (non-Hispanic) and Ethnicity (Hispanic)		
White	95%	
Black/ African American	< 1%	
American Indian and Alaska Native	< 1%	
Asian	< 1%	
Native Hawaiian and Other Pacific Islander	< 1%	
Some Other Race	< 1%	
Two or More Races	4%	
Hispanic or Latino	9%	
Limited or No English Spoken	2%	
Vulnerable Age Groups		
Less than 15 Years	694	23%
65 Years and Over	430	14%
Disability Status		
Total Population	363	12%
Children	11	1%
Seniors	225	52%

Income Characteristics		
Households by Income Category		
Less than \$15,000	221	19%
\$15,000-\$29,999	172	15%
\$30,000-\$44,999	136	12%
\$45,000-\$59,999	177	15%
\$60,000-\$74,999	87	7%
\$75,000-\$99,999	170	14%
\$100,000-\$199,999	218	19%
\$200,000 or more	-	-
Median Household Income	\$50,757	
Poverty Rates		
Total Population	700	23%
Children	177	23%
Seniors	90	21%
Housing Cost Burden		
Owners with Mortgage	212	30%
Renters	239	50%

Source: U.S. Census Bureau, 2012-2016 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018; Portland State University, Population Research Center, "Population Forecast Tables", 2017.

Housing Characteristics		
Housing Units		
Single-Family	919	69%
Multi-Family	322	24%
Mobile Homes	96	7%
Year Structure Built		
Pre-1970	333	25%
1970-1989	407	30%
1990 or later	597	45%
Housing Tenure and Vacancy		
Owner-occupied	699	52%
Renter-occupied	482	36%
Seasonal	0	0%
Vacant	156	12%

Estacada has grown since its incorporation in 1905 and has an area today of 2.06 square miles. It is in the western region of Clackamas County, located about 30 miles southeast of the City of Portland. The City is within the Willamette River Basin.

The city is on the Clackamas Highway (OR 224 and OR 211) at 468 feet above sea level. Because of its location Estacada's climate is consistent with the marine west coast climate zone, with warm summers and cool, wet winters. Estacada receives most of its rainfall between October and May, and averages 58 inches of rain, and around two (2) inches of snow, per year.⁹

According to the [Comprehensive Plan](#), land has been designated for public, industrial, commercial, airport, and residential use. There is a wetland overlay located near the Clackamas River that is designed to protect open spaces, wetlands, and riparian corridors along this area which is identified on inventory maps prepared by the U.S. Department of the Interior, Fish and Wildlife Service.¹⁰

⁹ "[Monthly Average for Estacada, OR](#)" The Weather Channel Interactive, Inc. Retrieved November 25, 2018.

¹⁰ Estacada, Oregon. Development Code. [§16.56](#)

Community Assets

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of Estacada. The community assets identified below were identified by the City of Estacada. The tables identify which hazards each asset may be exposed to, based upon both a GIS analysis as well as HMAC member knowledge. Additional information is needed to fully understand the extent of risk to each asset. It is important to note that the facilities identified as “critical” and “essential” are characterized differently than the structural code that identifies buildings as “essential” and “non-essential.” The structural code uses different language and criteria and therefore have completely different meanings than the buildings identified in this addendum.

Critical Facilities

Facilities that are critical to government response, and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include: 911 Centers, Emergency Operations Centers, Police, and Fire Stations, Public Works facilities, sewer, and water facilities, hospitals, bridges, roads, shelters, and more.

Table EA-5 Critical Facilities in Estacada

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Facilities									
City Hall		X							
Clackamas County Sheriff's Office		X							
Communications Center					X				
Fire Stations									
Estacada RFPD #69 Administration Building/EOC (retrofitted)									
Main Fire Station #110									
Medical									
Adventist Clinic		X						X	
Wade Creek Clinic				X				X	

Hazardous Materials:

Facilities that, if damaged, could cause serious secondary impacts may also be considered “critical.” A hazardous material facility is one example of this type of critical facility. Those sites that store, manufacture, or use potentially hazardous materials include the city’s: industrial campus, public works, wastewater treatment plant, and water treatment plant. Note: both treatment plants are vulnerable to earthquake and the water treatment plant is also vulnerable to landslide.

Critical Infrastructure:

Infrastructure that provides necessary services for emergency response include:

Table EA-6 Critical Infrastructure in Estacada

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Infrastructure									
Arterials (*designates infrastructure maintained by another jurisdiction)									
Broadway Street									
NW and NE 6th Avenue				X					
Main Street									
OR-211*									
OR-224*					X			X	X
River Mill Rd.									
SW 2 nd Avenue									
Bridges									
OR-211 Bridge*		X							
OR-224 Bridge over Eagle Creek*		X							
Bridge on 6th Ave		X		X					
Other Critical Infrastructure									
Box culvert on North Broadway									
Box culvert on Wade Street									
Clackamas River Dams*		X							
Culvert on Cemetery Road									
PGE substation		X							
Wastewater pump stations		X							
Wastewater treatment plant		X							
Water treatment plant		X			X				
Water treatment, storage, and distribution lines		X							

Essential Facilities

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public’s ability to recover from the emergency. These facilities may include: City buildings such as the Public Works Building, the City Hall, and other public facilities such as schools.

Table EA-7 Essential Facilities in Estacada

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Essential Facilities									
Library				X					
Schools									
Building (formerly Eagle Creek Elementary)		X					X		
Clackamas River Elementary									
Estacada High School		X							
Estacada Middle School		X							
River Mill Elementary		X							
Other Essential Facilities									
Forest Service Office							X		

Cultural and Historic Assets

The cultural and historic heritage of a community is more than just tourist charm. For families that have lived in the city for generations and new resident alike, it is the unique places, stories, and annual events that make Estacada an appealing place to live. The cultural and historic assets are both intangible benefits and obvious quality-of-life-enhancing amenities. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important.

- | | |
|--------------------------------|----------------------------|
| Arthur Smadbeck House | Frank Frank Store |
| August Stubbe House | Lichthoen Gustave H. House |
| Baby Guard Station | Mae B. and C.F. Howe House |
| Beary Bartholomew Feed & Grain | O.R. Jacobs House |
| Elimore Williams House | R.G. Marchbank Store |
| Ella C. Stephens House | St. Aloysius Church |
| Estacada Bridge | W.A. Cunningham House |
| Estacada City Hall | W.T. & Cora Kaake House |
| Estacada Lodge | William H.H. Wade House |
| Estacada St. Bank | |

Environmental Assets:

Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic, and functional ecosystem services for the community include:

Table EA-8 Environmental Assets in Estacada

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Environmental Assets									
Campanella City Park									
Clackamas River	X								
Timber Park									
Wade Creek				X					
Wade Creek Park				X					

Economic Assets/Population Centers:

Economic assets include businesses that employ large numbers of people and provide an economic resource to the city of Estacada. If damaged, the loss of these economic assets could significantly affect economic stability, and prosperity. Population Centers usually are aligned with economic centers, and are a concern during evacuation/notification during a hazard event include:

Eagle Foundry

Faraday – Westside Hydro

Harvest Market

Industrial Parks on Park Avenue and Veterans Way

Reliance Connect Phone Company

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. Populations that have special needs or require special consideration include:

300 Main Retirement

Adult Care Facilities

Altramar II

Clackamas River Elementary Day Care

Day Care Facilities

Golden Years

Hillway Apartments (for disabled)

Mobile Home Parks

Other Facilities

Other School Facilities

Red Barn Co-Op Preschool

Schools (see list under essential facilities)

Senior Community Center

Summer Day Care at River Mill Elementary

Whispering Pines

Hazard Characteristics

Drought

The HMAC determined that the City's probability for drought is **high** and that their vulnerability to drought is **low**. *The probability rating increased, and the vulnerability rating decreased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent, and probability of a potential event. Due to the climate of Clackamas County, past and present weather conditions have shown an increasing potential for drought.

The City of Estacada has their water intake on the Clackamas River, located in the Lower Clackamas and Middle Clackamas River Watershed in the Clackamas Sub-Basin of the Willamette Basin. The drinking water protection area for Estacada totals 673 square miles both upstream and downstream from the two intakes.¹¹ The water treatment facilities are located both inside and outside city limits with a capacity of two million gallons per day. Estacada will be adding two new water reservoirs over the next few years to improve the city's capacity for increasing water demands and drought conditions. The city is in the planning phases for increasing its wastewater plant capacity. Preventive and corrective maintenance is routinely performed at these facilities for safe and cost-effective operations.

Vulnerability Assessment

Due to insufficient data and resources, Estacada is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables EA-5 through EA-8.

Mitigation Activities

The existing drought hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Earthquake (Cascadia Subduction Zone)

The HMAC determined that the City's probability for a Cascadia Subduction Zone (CSZ) earthquake is **moderate** and that their vulnerability to a CSZ earthquake is **high**. *These ratings did not change since the previous version of this NHMP addendum. Note: Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake and Crustal earthquake.*

Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent and probability of a potential event. Generally, an event that affects the County is likely to affect Estacada as well. The causes and characteristics of an earthquake

¹¹ Department of Environmental Quality. [Source Water Assessment Summary Brochure](#), City of Estacada PWS#4100279.

event are appropriately described within the Volume I, Section 2 as well as the location and extent of potential hazards. Previous occurrences are well documented within Volume I, Section 2 and the community impacts described by the County would generally be the same for Estacada as well.

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Portland Hills Fault Zone, and Gales Creek-Newberg-Mt. Angel Structural Zone (discussed in the crustal earthquake section).

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year. Scientists have found evidence that 11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D.¹²

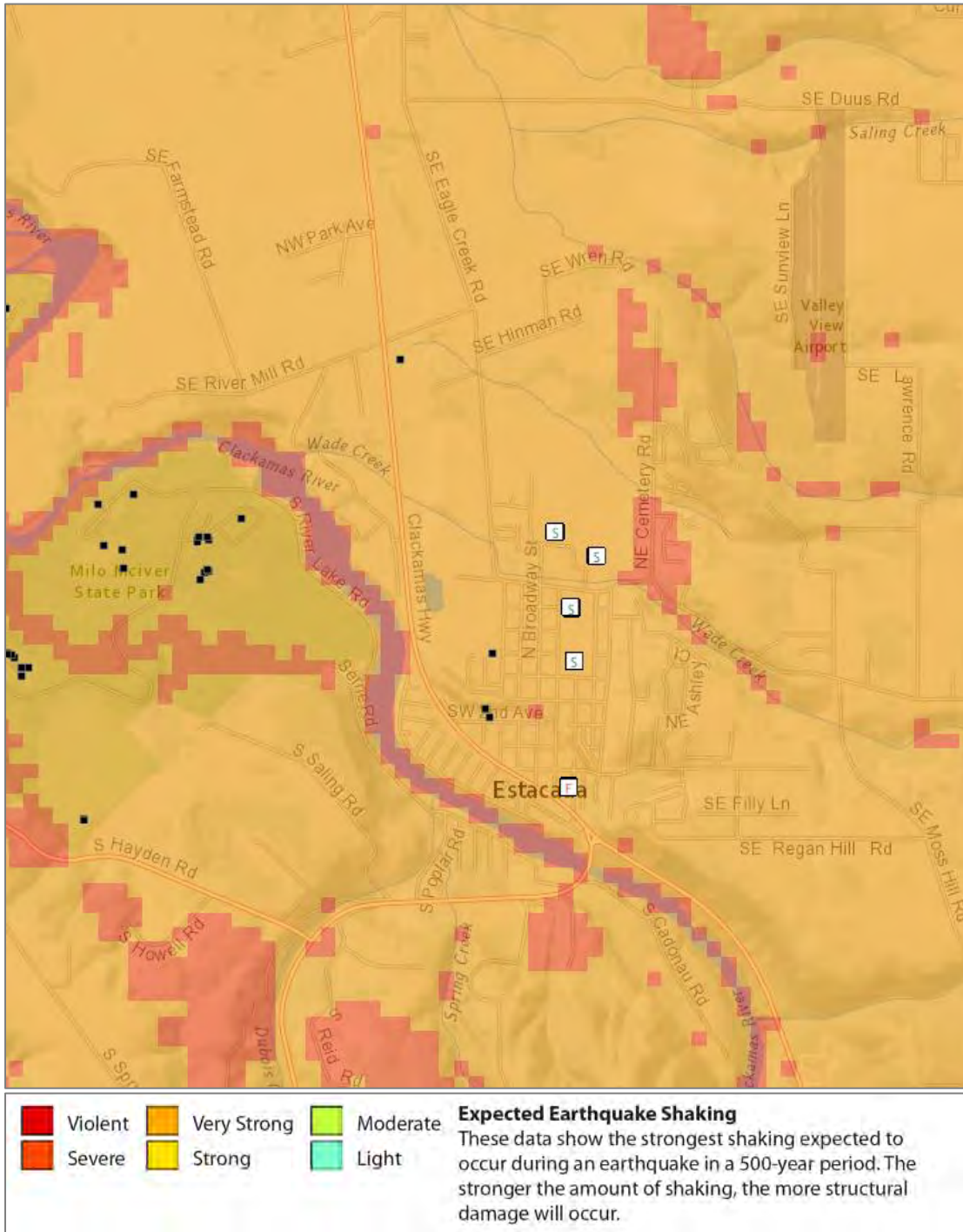
The city's proximity to the Cascadia Subduction Zone, potential slope instability and the prevalence of certain soils subject to liquefaction and amplification combine to give the city a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places the city predominately within the "Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades). Within the Northwest Oregon region, damage and shaking is expected to be strong and widespread - an event will be disruptive to daily life and commerce and the main priority is expected to be restoring services to business and residents.

Figure EA-1 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the city is expected to experience very strong shaking (orange), while areas near rivers and streams will experience severe (light red) to violent (dark red) shaking in a CSZ event.

Community assets located in the center of the city include Estacada High School, which is located near a high impact area. The Wade Creek Bridge is located in the high impact zone and might make access to that area difficult. Another high impact area is on the Clackamas River which has a mostly residential area next to it and the Clackamas Highway. Highway 211 bridge is in a high impact area, which might result in difficulties in accessing that side of the river, which is outside city limits.

¹² The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. <http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf>

Figure EA-I Cascadia Subduction Zone Expected Shaking



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

Note: To view detail click the link above to access Oregon HazVu.

Earthquake (Crustal)

The HMAC determined that the City's probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**. *The probability rating decreased, and the vulnerability rating did not change since the previous version of this NHMP addendum. Note: Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Crustal earthquake, and Cascadia Subduction Zone (CSZ) earthquake.*

Volume I, Section 2 describes the causes and characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Estacada as well. Figure EA-2 shows a generalized geologic map of the Estacada area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows the areas of greatest concern within the City limits as red and orange.

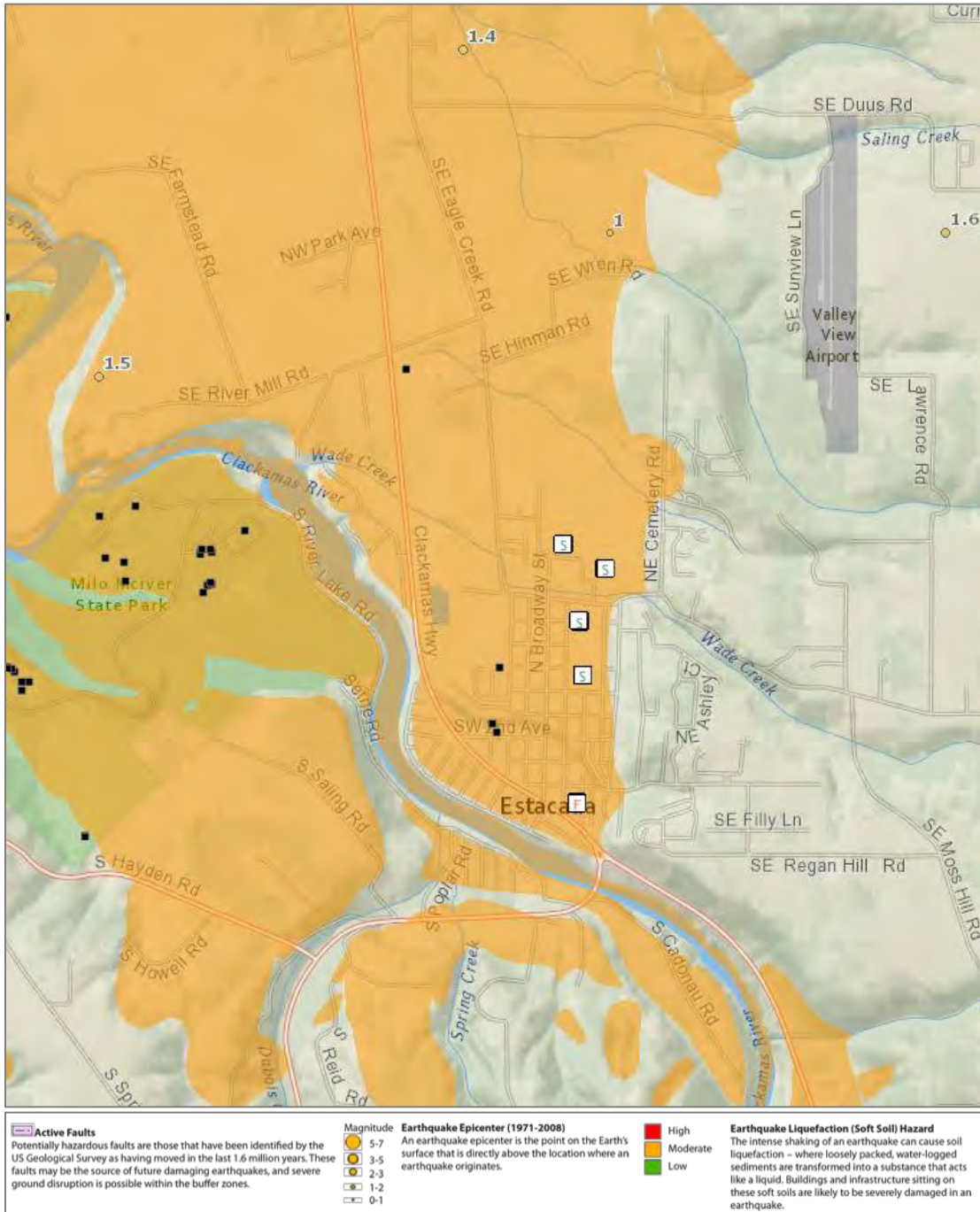
There are no crustal faults located within or adjacent to the City limits, though there are several potential crustal faults and/or zones west of the City. The Portland Hills Fault Zone is one of those potential crustal faults that is discussed in greater detail below.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and lies about 10 miles west of Estacada.

Figure EA-2 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



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

Note: To view detail click the link above to access Oregon HazVu

Vulnerability Assessment

Due to insufficient data and resources, Estacada is currently unable to perform a quantitative risk assessment for this hazard. However, in 2018 the Department of Geology and Mineral Industries (DOGAMI) completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)), findings from that report are provided at the end of the crustal earthquakes hazard section.

Earthquake Regional Impact Analysis

In 2018 DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)). Their study focused on damage to buildings, and the people that occupy them, and to two key infrastructure sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and night time (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damaged varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood structures that fare worse in an earthquake. The Portland Hills fault scenario created greater damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios, however, the impact is considerably less than it is to the transportation routes. Additional, capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts.

Table EA-9 shows the permanent resident population that are vulnerable to injury or death (casualty) and the buildings in the City that are susceptible to liquefaction and landslides, it does not predict that damage will occur in specific areas due to either liquefaction or landslide. More population and property are exposed to higher degrees of expected damage or casualty under the Portland Hills Fault “wet” scenario than in any other scenario.

Table EA-9 Expected damages and casualties for the CSZ fault and Portland Hills fault: earthquake, soil moisture, and event time scenarios

	Cascadia Subduction Zone (M9.0)		Portland Hills Fault (M6.8)	
	"Dry" Soil	"Wet" Saturated Soil	"Dry" Soil	"Wet" Saturated Soil
Number of Buildings	1,309	1,309	1,309	1,309
Building Value (\$ Million)	448	448	448	448
Building Repair Cost (\$ Million)	23	27	42	74
Building Loss Ratio	5%	6%	9%	17%
Debris (Thousands of Tons)	17	18	27	39
Long-Term Displaced Population	12	27	25	197
Total Casualties (Daytime)	29	33	55	105
Level 4 (Killed)	2	2	3	7
Total Casualties (Nighttime)	3	5	6	21
Level 4 (Killed)	0	0	0	1

Source: DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8, 12-9, 12-10, and 12-11.

Cascadia Subduction Zone Scenario

The City of Estacada is expected to have a 5% building loss ratio with a repair cost of \$23 million under the CSZ “dry” scenario, and a 6% building loss ratio with a repair cost of \$27 million under the CSZ “wet” scenario.¹³ The city is expected to have around 29 daytime or 3 nighttime casualties during the CSZ “dry” scenario and 33 daytime or 5 nighttime casualties during the CSZ “wet” scenario. It is expected that there will be a long-term displaced population of around 12 for the CSZ “dry” scenario and 27 for the CSZ “wet” scenario.¹⁴

Portland Hills Fault Scenario

The City of Estacada is expected to have a 9% building loss ratio with a repair cost of \$42 million under the CSZ “dry” scenario, and a 17% building loss ratio with a repair cost of \$74 million under the CSZ “wet” scenario.¹⁵ The long-term displaced population and casualties are greatly increased for all the Portland Hills Fault scenarios. The city is expected to have around 55 daytime or 6 nighttime casualties during the Portland Hills Fault “dry” scenario and 105 daytime or 21 nighttime casualties during the Portland Hills Fault “wet” scenario. It is expected that there will be a long-term displaced population of around 25 for the Portland Hills Fault “dry” scenario and 197 for the Portland Hills Fault “wet” scenario.¹⁶

Recommendations from the report included topics within Planning, Recovery, and Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMPs mitigation strategies (Table EA-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and the recommendations see: *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, [O-18-02](#)).

DOGAMI Rapid Visual Survey (2007)

Seismic building codes were implemented in Oregon in the 1970s, however, stricter standards did not take effect until 1991 and early 2000s. As noted in the community profile, approximately 55% of residential buildings were built prior to 1990, which increases the City’s vulnerability to the earthquake hazard. Information on specific public buildings’ (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table EA-10 **Error! Reference source not found.**; each “X” represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS) all have low collapse potential. *Note: Estacada Middle School and the main fire station have been retrofitted.*

For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables EA-5 through EA-8. In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

¹³ DOGAMI, *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, O-18-02), Tables 12-8 and 12-9.

¹⁴ Ibid, Tables 12-8 and 12-9.

¹⁵ Ibid, Tables 12-10 and 12-11

¹⁶ Ibid, Tables 12-10 and 12-11.

Table EA-10 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Clackamas River Elementary (301 NE 2nd Ave)	Clac_sch59	X			
River Mill Elementary (850 N Broadway St)	Clac_sch60	X			
Estacada Middle (500 NE Main St)	Clac_sch61	Seismic retrofit via 2015-17 SRGP			
Estacada High (355 NE 6th Ave)	Clac_sch62	X			
Public Safety					
Estacada RFD Station 110 (261 SE 5th Ave)	Clac_fir19	Seismic retrofit via 2015-17 SRGP			
Estacada RFD Administration Office/EOC (445 SE Currin St)		Not assessed as part of the 2007 RVS			

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#) "*" – Site ID is referenced on the [RVS Clackamas County Map](#)

Note: Bold indicates facilities that have been seismically retrofitted or rebuilt.

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

Mitigation Activities

Estacada has taken some mitigation steps to reduce the city’s vulnerability in earthquake events. Seismic retrofit grant awards per the [Seismic Rehabilitation Grant Program](#)¹⁷ have been used to retrofit Estacada Middle School (2016-2017 grant award, \$1,065,500) and the Estacada Rural Fire District’s Main Fire Station (2016-2017 grant award, \$702,794). City Hall would not be able to be occupied after a large earthquake event, and neither would the sewer treatment plant control building. While the water treatment plant building would likely sustain less damage, there would be a substantial amount of damage to operations.

Please review Volume I, Section 2 for additional information on this hazard.

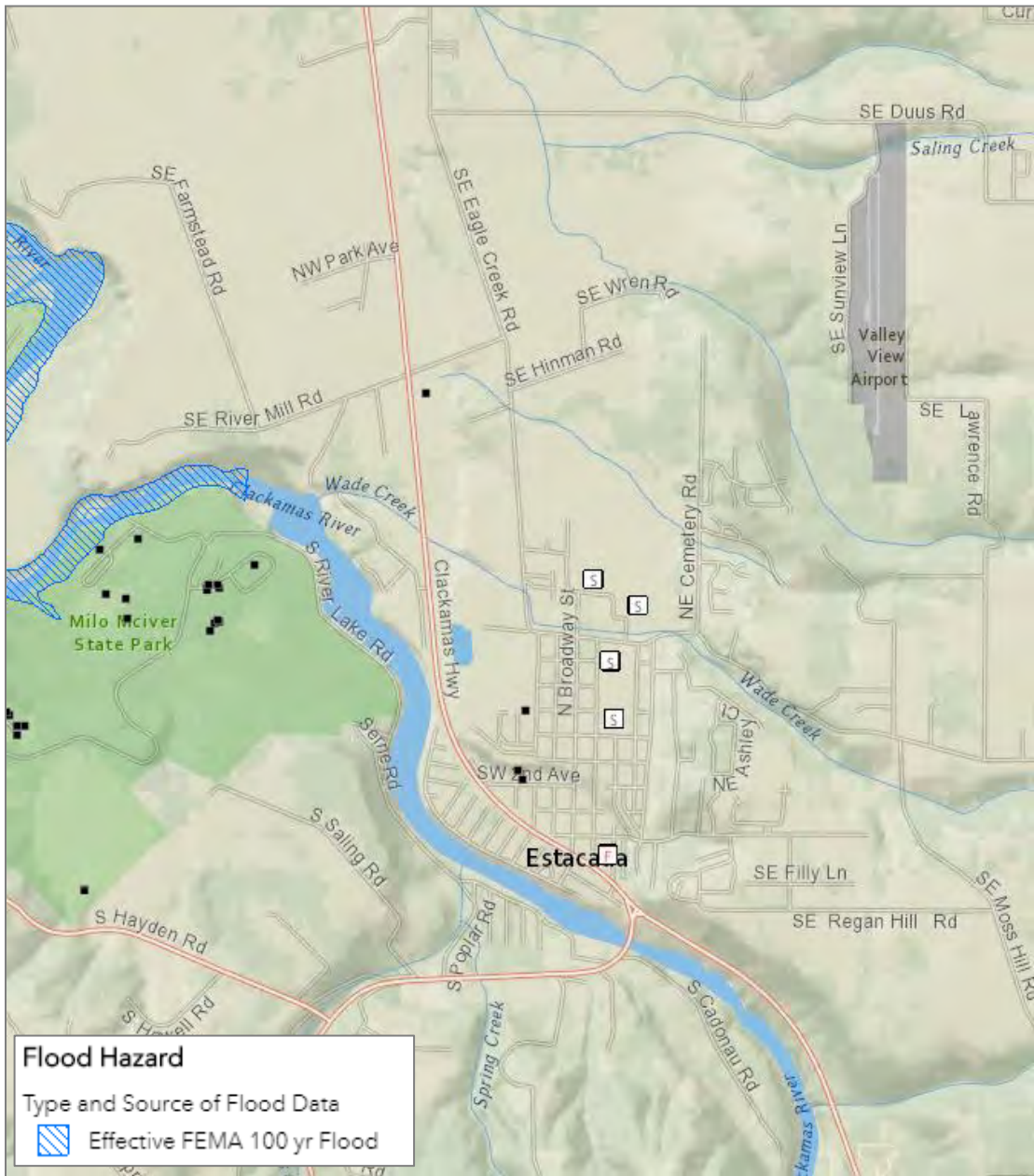
¹⁷ The Seismic Rehabilitation Grant Program (SRGP) is a state of Oregon competitive grant program that provides funding for the seismic rehabilitation of critical public buildings, particularly public schools and emergency services facilities.

Flood

The HMAC determined that the City’s probability for flood is **high** and that their vulnerability to flood is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent, and probability of a potential event. Figure EA-3 illustrates the flood hazard area for Estacada.

Figure EA-3 Special Flood Hazard Area



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)
Note: To view detail click the link above to access Oregon HazVu

Portions of Estacada are prone to flooding, however, there are no mapped flood hazard areas within the City. Wade Creek is the only riverine flooding potential. The geographic location of the flooding hazard was determined using the designated FEMA 100-year floodplain data.

Vulnerability Assessment

Due to insufficient data and resources, Estacada is currently unable to perform a quantitative risk assessment for this hazard.

While Estacada is not as vulnerable to riverine flooding, it is still vulnerable to flooding caused by excess water from storms. Floods from either rivers or storms can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage, and economic loss from business interruption. It is important for the City to be aware of flooding impacts and assess its level of risk.

The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners, and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of Estacada outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage. Currin Creek watershed (Basin 20) located in the north-northeast portion of the city and the Wade Creek watershed (Basin 40) the main stream flowing through the city have both had flooding issues due to insufficient culvert sizes.

In 2009, Estacada had flooding from Wade Creek that lead to over a foot of water into the library that had recently been built. There were mitigation measures completed to make sure that would not happen again. Estacada is working on improving their flood resilience. The city is in the third planning phase of increasing the Wade Creek Park flooding mitigation, which includes the pond area that has been flooded before.

The extent of flooding hazards in Estacada primarily depends on climate and precipitation levels. Additionally, withdrawals for irrigation and drinking water, as well as stream and wetland modifications or vegetation removal can influence water flow. In the past flooding has occurred along the Currin Creek and Wade Creek. These have typically been caused by insufficient sized culverts. Some culverts have been replaced or retrofitted with expanded capacity, such as piping installed from SE 4th and Shafford Streets to Highway 211/224 to eliminate creek bank flooding.

National Flood Insurance Program (NFIP)

FEMA's Flood Insurance Study (FIS), and Flood Insurance Rate Maps (FIRMs) are effective as of June 17, 2008; there are no special flood hazard areas within the City. Table EA-11 shows that as of July 2018, Estacada has two (2) National Flood Insurance Program (NFIP) policies in force. Of those, none (0) are for properties that were constructed before the initial FIRMs. There have been no Community Assistance Visits (CAV) for Estacada. Estacada does not participate in the Community Rating System (CRS). The table shows that the two (2) flood insurance policies are for single family residential structures. There have been zero (0) paid

claims. The City complies with the NFIP through enforcement of their flood damage prevention ordinance and their floodplain management program.

Table EA-II Flood Insurance Detail

	Clackamas County	Estacada
Effective FIRM and FIS	6/17/2008	6/17/2008
Initial FIRM Date	-	6/17/2008
Total Policies	1,957	2
Pre-FIRM Policies	1,086	0
Policies by Building Type		
Single Family	1,761	2
2 to 4 Family	30	0
Other Residential	58	0
Non-Residential	9	0
Minus Rated A Zone	123	0
Insurance in Force	\$541,833,400	\$490,000
Total Paid Claims	590	0
Pre-FIRM Claims Paid	450	0
Substantial Damage Claims	83	0
Total Paid Amount	\$20,830,662	-
Repetitive Loss Structures	51	0
Severe Repetitive Loss Properties	4	0
CRS Class Rating	-	NP
Last Community Assistance Visit	-	-

Source: Information compiled by Department of Land Conservation, and Development, July 2018.

Note: The portion of the cities of Portland and Tualatin that are within Clackamas County are not included in this table.

NP = Not Participating

The Community Repetitive Loss record for Estacada identifies no Repetitive Loss Properties¹⁸ or Severe Repetitive Loss Properties¹⁹.

Mitigation Activities

Estacada employs several mitigation strategies to reduce the city's risk to flood events. The city development code includes policies and regulations for flood prone areas from mostly storm events. The storm water system provides for the transport of surface water to minimize or reduce the potential of neighborhood flooding. Maintenance activities include repair and cleaning of the public storm water piping system, culverts, manholes, catch

¹⁸ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

¹⁹ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP, and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000, and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

basins, and open channel ditches. Street sweeping and drainage ditch cleaning occurs regularly, and catch basins are cleaned twice a year.

For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables EA-5 through EA-8.

Please review Volume I, Section 2 for additional information on this hazard.

Landslide

The HMAC determined that the City's probability for landslide is **high** and that their vulnerability to landslide is **low**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Estacada has had a few landslides over the years due to the steepest slopes located near and along the Clackamas River. In 1996 a landslide lead to a house slide and debris onto Highway 224 and in 2005 about 20 yards worth of material slid but no damage was sustained.

Landslide susceptibility exposure for Estacada is shown in Figure EA-4. Most of Estacada demonstrates a low to moderate landslide susceptibility exposure. Approximately 26% of Estacada has very high or high, and approximately 15% moderate, landslide susceptibility exposure.²⁰

Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard, and assets.

Vulnerability Assessment

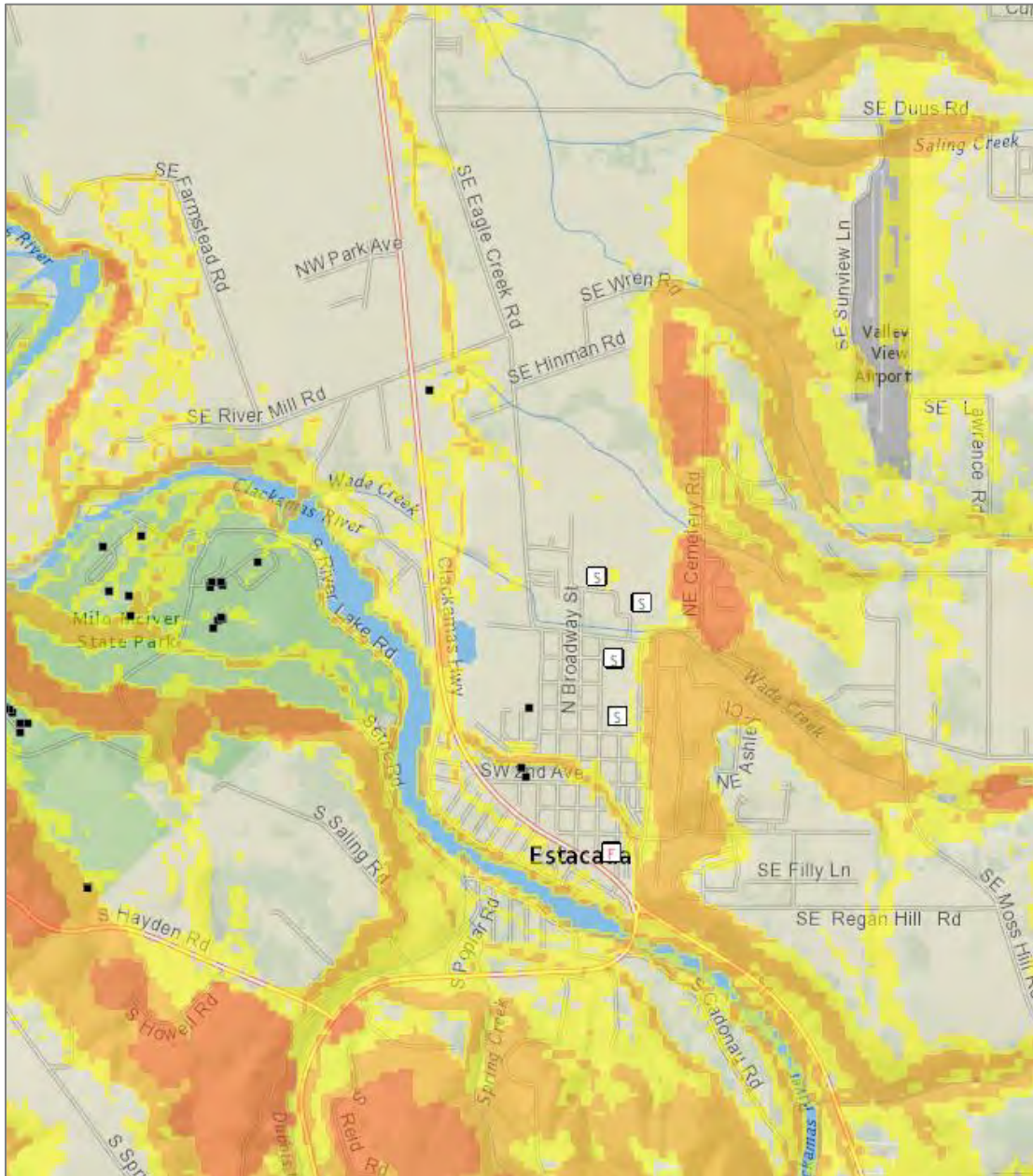
Due to insufficient data and resources, Estacada is currently unable to perform a quantitative risk assessment for this hazard. However, DOGAMI completed a statewide landslide susceptibility assessment in 2016 ([O-16-02](#)), general findings from that report are provided above and within Figure EA-4.

Potential landslide-related impacts are adequately described within Volume I, Section 2, and include infrastructure damages, economic impacts (due to isolation, and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides, and debris flows can potentially occur during any winter, and thoroughfares beyond City limits are susceptible to obstruction as well. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables EA-5 through EA-8.

The most common type of landslides are slides caused by erosion. Slides move in contact with the underlying surface, are generally slow moving, and can be deep. Rainfall-initiated landslides tend to be smaller; while earthquake induced landslides may be quite large. All soil types can be affected by natural landslide triggering conditions.

²⁰ DOGAMI. [Open-File Report, O-16-02](#), *Landslide Susceptibility Overview Map of Oregon* (2016)

Figure EA-4 Landslide Susceptibility Exposure



Low	Landsliding unlikely. Areas classified as Landslide Density = Low (less than 7%) and areas classified as Slopes Prone to Landsliding = Low.
Moderate	Landsliding possible. Areas classified as Landslide Density = Low to Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = Moderate OR areas classified as Landslide Density = Moderate (7%-17%) and areas classified as Slopes Prone to Landsliding = Low.
High	Landsliding likely. Areas classified as Landslide Density = High (greater than 17%) and areas classified as Slopes Prone to Landsliding = Low and Moderate OR areas classified as Landslide Density = Low and Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = High.
Very High	Existing landslides Landslide Density and Slopes Prone to Landsliding data were not considered in this category. Note: the quality of landslide inventory (existing landslides) mapping varies across the state.

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

Note: To view detail click the link above to access Oregon HazVu

Mitigation Activities

Estacada works to mitigate future landslide hazards. The Municipal Code Title 16 stipulates that detailed analysis must be performed by experts for development on slopes greater than 33%, in recent landslide areas, and on known weak foundation soils. Because of Estacada's progressive actions very little development has occurred on steep slopes.

Please review Volume I, Section 2 for additional information on this hazard.

Severe Weather

Severe weather can account for a variety of intense, and potentially damaging hazard events. These events include extreme heat, windstorms, and winter storms. The following section describes the unique probability, and vulnerability of each identified weather hazard.

Extreme Heat

The HMAC determined that the City's probability for extreme heat events is **moderate** and that their vulnerability is **moderate**. *The probability rating decreased, and the vulnerability rating did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the City as well.

A severe heat episode or "heat wave" occurs about every two to three years, and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days with temperatures greater than or equal to 90-degrees, or 100-degrees, Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit, and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The City of Estacada has not experienced any life-threatening consequences from the few historical extreme heat events, although changes in climate indicate that the area should expect to see more extreme heat events.

Please review Volume I, Section 2 for additional information on this hazard.

Windstorm

The HMAC determined that the City's probability for windstorm is **high** and that their vulnerability to windstorm is **moderate**. *These ratings did not change since the previous version of this NHMP addendum. Note: Previously, the severe hazard profile was a single risk assessment for windstorm and winter storm, which is now divided into two separate severe storm hazards.*

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent, and probability of a potential event within the region. Because windstorms typically occur during winter months, they are sometimes accompanied by flooding and winter storms (ice, freezing rain, and very rarely, snow). Other severe weather

events that may accompany windstorms, including thunderstorms, hail, lightning strikes, and tornadoes are generally negligible for Estacada.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation, and economic disruptions result as well.

Please review Volume I, Section 2 for additional information on this hazard.

Winter Storm (Snow/Ice)

The HMAP determined that the City's probability for winter storm is **high** and that their vulnerability to winter storm is **moderate**. *These ratings did not change since the previous version of this NHMP addendum. Note: Previously, the severe hazard profile was a single risk assessment for windstorm and winter storm, which is now divided into two separate severe storm hazards.*

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent, and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the City typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

There have been two Governor Disaster declarations for extreme storms in January of 2016 and 2017, but there was no damage to infrastructure within the city. The area most affected is Lakeshore Drive which runs parallel to the Clackamas River and is lined with large fir trees. Most winter storms typically do not cause significant damage, they are frequent, and have the potential to impact economic activity. Road closures due to winter weather are an uncommon occurrence but can interrupt commuter, and commercial traffic as noted above.

Vulnerability Assessment

Due to insufficient data and resources, Estacada is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables EA-5 through EA-8.

Damage from high winds generally has resulted in downed utility lines, and trees usually limited to several localized areas. Electrical power can be out anywhere from a few hours to several days. Outdoor signs have also suffered damage. If the high winds are accompanied by rain (which they often are), blowing leaves, and debris clog drainage-ways, which in turn may cause localized urban flooding. The area most affected is Lake Shore Drive which runs parallel to the Clackamas River and is lined with large fir trees. The street has overhead power lines so power outages are frequent. Generally, the power does not stay out very long, but it has been out for up to three days at a time on Lake Shore Drive. Estacada's power grid is divided, so usually the power will go out in half the town at a time. Another potential problem is the heavily treed area behind the cemetery. Trees and branches blown over in this area during severe storms could affect the high school grounds.

Mitigation Activities

Mitigating severe weather can be difficult because storms affect all areas of the city, but Estacada has made progress to reduce the effects of storms. Most utilities are underground and all new utilities of new construction or remodels that exceed \$25,000 are required to be undergrounded, but in case of power outages only some of the city's critical facilities have back up power generation. Estacada also has a designated snow plow and sanding route to help expedite snow removal; plowing arterials first then smaller streets.

Please review Volume I, Section 2 for additional information on this hazard.

Volcanic Event

The HMAC determined that the City's probability for a volcanic event is **low** and that their vulnerability to a volcanic event is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of volcanic hazards, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the western portion of the County is likely to affect Estacada as well. Several volcanoes are located near Estacada, the closest of which are Mount Hood, Mount Adams, Mount Saint Helens, Mount Rainier, and the Three Sisters.

Vulnerability Assessment

Due to insufficient data and resources, Estacada is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables EA-5 through EA-8.

Due to Estacada's relative distance from volcanoes, the city is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Depending on wind patterns and which volcano erupts, however, the city may experience ash fall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city could experience a heavier coating of ash. Within Estacada, public health would be a primary concern, and keeping transportation routes open/accessible would be important as well.

Mitigation Activities

The existing volcano hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Wildfire

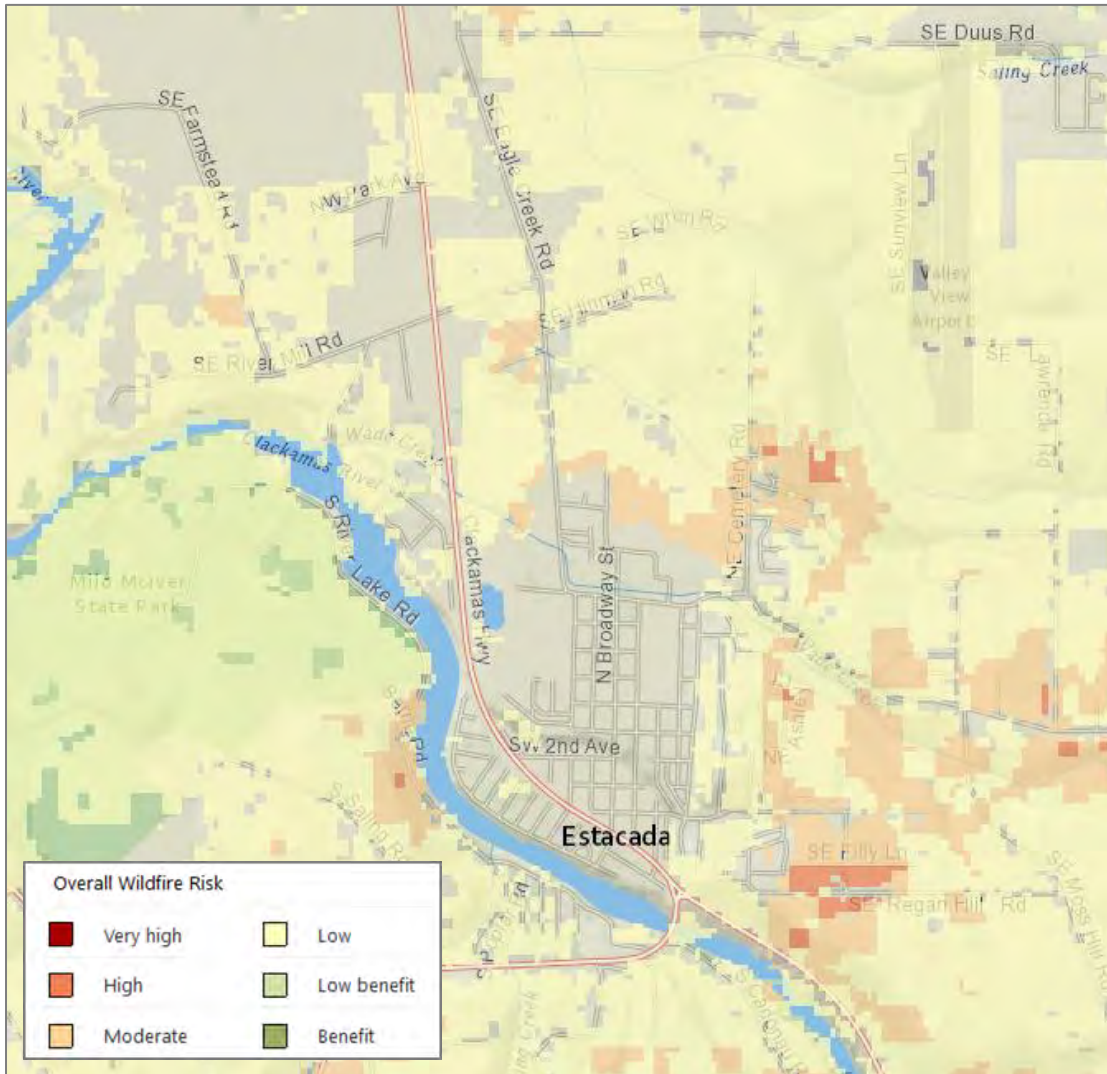
The HMAC determined that the City's probability for wildfire is **low**, and that their vulnerability to wildfire is **low**. *These ratings both decreased since the previous version of this NHMP addendum.*

The [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) was completed in May 2018. The CWPP is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of

key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard: <https://www.clackamas.us/dm/CWPP.html>. Information specific to Estacada is found in the following chapter: [Chapter 10.05: Estacada Rural Fire District #69](#).

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions. Weather, and urbanization conditions are primarily at cause for the hazard level. Estacada has not experienced a wildfire within City limits. Figure EA-5 shows overall wildfire risk in Estacada.

Figure EA-5 Overall Wildfire Risk



Source: [Oregon Wildfire Risk Explorer](#), date accessed November 26, 2018.

Clackamas County has two major physiographic regions: the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern Clackamas County. The Willamette River Valley, which includes Estacada, is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range has a relatively small population and is characterized by heavily forested

slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to its dense forest land. Human caused fires are responsible for most fires in Clackamas County.

The forested hills within Estacada are in Ranger Woods and, just outside the city limits and to the west of Estacada, is McIver Park.²¹ There was a fuels reduction project in McIver Park from 2013 to 2017, which used seasonal crews to get rid of excess vegetation and provided education signage in recreation areas. Areas of dense vegetation within city limits include the hill west of Ginseng, the area south of SE Coupland Road, and east of Espinosa, along highway 224.

Most of the city has less severe (moderate or less) wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions.²² However, conditions vary widely and with local topography, fuels, and local weather (including wind) conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts.

Vulnerability Assessment

Due to insufficient data and resources, Estacada is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables EA-5 through EA-8.

The potential community impacts, and vulnerabilities described in Volume I, Section 2 are generally accurate for the City as well. Estacada's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. The City will update the City's wildfire risk assessment if the fire plan presents better data during future updates (an action item is included to participate in future updates to the CWPP).

Property can be damaged or destroyed with one fire as structures, vegetation, and other flammables easily merge to become unpredictable, and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

Mitigation Activities

Estacada uses several mitigation tools to reduce the city's risk to wildfires. Public outreach is a primary mitigation tool used by Estacada Rural Fire District #69. The city has a weed and noxious growth ordinance that prohibits grass over 10 inches, thistles, and blackberries. Property owners must also maintain the planting strip between sidewalks and curbs in front of their property.

Please review the [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) and Volume I, Section 2 for additional information on this hazard.

²¹ Clackamas County Community Wildfire Protection Plan, *Estacada Rural Fire District #69* (2018), Table 10.5-1.

²² [Oregon Wildfire Risk Explorer](#), date accessed November 26, 2018.

ATTACHMENT A: ACTION ITEM FORMS

ACTION ITEM FORMS

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* - Priority Action Item

Note: The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity.

Summary of Action Changes

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

Previous NHMP Actions Completed:

No actions were completed.

See 2018 status identified in each action for activities that have been completed since the previous plan.

New NHMP Actions added to this version (2019): FL #1, WF #1. See actions below for detail.

Previous NHMP Actions Removed from this version:

Multi-Hazard Action #3 (2012): “Identify and pursue funding opportunities to develop and implement hazard mitigation activities” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Multi-Hazard Action #4 (2012): “Continue to update and improve hazard assessments in the Natural Hazards Mitigation Plan as new information becomes available” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Flood Action #1 (2012): “Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances” was removed from the list since it was determined by the steering committee that this is a function of NFIP participation and did not need to be included as an action in their NHMP since participation in the NFIP requires compliance.

Note: 2012 Actions FL#2 and FL #3 were renumbered to 2019 Actions FL #1 and FL #2

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 NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the County, participating cities, and special districts. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. The City 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, the City 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 several 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 City 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.

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:	
Develop and maintain public education programs to inform the public about methods for mitigating the impacts of natural hazards.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Conducting public outreach campaigns raises awareness about natural hazards and helps illustrate what residents and businesses can do to reduce the impact of a natural disaster on their properties, thereby reducing the impact of natural hazards on the City of Estacada. • The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the county's actions to mitigate hazards. • <u>2018 Status</u>: There is a Map Your Neighborhood Program at each Fire Station and the utility bills contain notices about earthquake and storm awareness. The City is developing public education programs to inform the public. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Conduct public education as hazard seasons approach, include earthquake awareness month in April, wildfire prevention in summer, and flood and severe storm information in winter; • Educate citizens on the importance of proper yard debris disposal, as well as resources available for hazard mitigation, response, and preparedness; • Identify property owners in flood, landslide, and wildfire hazard zones, and conduct a target mailing to disseminate information on all hazards; • Target neighborhood associations to sponsor CERT teams; • Partner with Clackamas County and other jurisdictions to develop public education flyers for all hazards; • Include insurance information in public outreach and education materials and promote purchase of appropriate insurance coverage; • Include hazard information on the city website and link to the fire district website; and • Utilize the city newsletter, Estacada News, and AM radio station to disseminate hazard information • Use faith based, civic and humanitarian, and business groups to affiliate volunteers. 			
Coordinating Organization:		City Manager's Office	
Internal Partners:		External Partners:	
HMAC		Estacada Rural Fire District #69, Estacada News, Clackamas County, Oregon Emergency Management	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #2

Proposed Action Item:		Alignment with Plan Goals:	
Integrate the goals and action items from the Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Zoning Ordinance			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating natural hazards plans into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community. <u>2018 Status</u>: The City of Estacada continues to adhere to all state and national building codes. The City last amended their development code in 2017. The floodplain ordinance was last updated in 2002 (new FIRMs are preliminary and effective maps are expected March 2019). The City updated their comprehensive plan in December 2018. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Use the mitigation plan to help the City's Comprehensive Land Use Plan meet 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; Use zoning codes to regulate development in hazard-prone areas; Integrate the city's mitigation actions into the current emergency operations plan and capital improvement plans (where appropriate); Partner with other organizations and agencies with similar goals to promote building codes that are more disaster resistant at the state level; Use citizen input for the creation of appropriate ordinances; and Use the natural hazard mitigation planning resources provided by the Oregon Partnership for Disaster Resilience to learn how to better integrate the NHMP into existing documents and programs. 			
Coordinating Organization:		City Manager's Office	
Internal Partners:		External Partners:	
City Council, Planning Commission		Department of Land Conservation and Development, Department of Geology and Mineral Industries, Oregon Department of Transportation, Department of Environmental Quality, Clackamas County	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, DLCD Technical Assistance Grant		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Earthquake #1*

Proposed Action Item		Alignment with Plan Goals:	
Conduct seismic evaluations and upgrades on all critical city facilities and implement appropriate structural and non-structural mitigation strategies.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> In the City of Estacada 55% of the buildings were built prior to the 1990s, many are not up to the current seismic standards. Given the changes in the USGS data, there are many buildings that require seismic retrofits. The facilities have both structural and non-structural vulnerabilities that may affect the facilities performance in a regional catastrophic seismic event. Seismic retrofits (structural and non-structural) are needed to ensure performance after a catastrophic event; and Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. <u>2018 Status:</u> Seismic upgrades on schools and library are complete. Through the Seismic Rehabilitation Grant Program the Estacada School District is in the process of retrofitting Estacada Middle School (2016-2017 grant award, \$1,065,500) and the Estacada Fire District #69 has retrofitted their Main Fire Station (2016-2017 grant award, \$702,794). 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Identify structures for conducting seismic evaluations; Obtain funding to perform seismic evaluations; Prioritize seismic upgrades based on criticality of need and population served; Gain funding to retrofit/replace facilities; Partner with appropriate organizations to implement seismic upgrades; and Seismically retrofit important facilities to guarantee continuous operation during and after a natural disaster. 			
Coordinating Organization:		City Manager's Office	
Internal Partners:		External Partners:	
Public Works		Estacada Rural Fire District #69, DOGAMI	
Potential Funding Sources:		Estimated cost:	Timeline:
SRGP, HMA (PDM, HMGP)		High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item.		
Priority:	High		

* - High Priority Action Item

Flood #1*

Proposed Action Item:		Alignment with Plan Goals:	
Increase capacity of culverts by identifying and proposing mitigation actions for culverts that are prone to flooding within the City.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Zoning Code, FEMA FIRMs, Comprehensive Plan, Stormwater Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will help reduce the level of flood damage to new and existing buildings in communities while providing homeowners, renters and business owners additional flood insurance protection. <u>2018 Status:</u> Increased capacity of Wade Creek culvert. Installed piping from SE 4th and Shafford Streets to Highway 211/224 to combat stormwater flooding. Updated the Stormwater Master Plan. The city continues to comply with the NFIP. Is looking at several specific locations for increased culvert capacity projects. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Identify culverts with low capacity and have a history of flooding. Identify funding sources, i.e. FEMA's HMA, to implement mitigation projects. Identify methods for reducing risk of flooding at Wade Creek Pond 			
Coordinating Organization:		City Manager's Office	
Internal Partners:		External Partners:	
HMAC, Public Works		Department of Land Conservation and Development; Association of State Floodplain Managers	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, SDC Funds, Capital Improvements Funds		Moderate to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	High		

* - High Priority Action Item

Flood #2*

Proposed Action Item:		Alignment with Plan Goals:	
Implement the projects detailed in the Stormwater Master Plan.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Zoning Code, FEMA FIRMs, Comprehensive Plan, Stormwater Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Stormwater management is a key element in maintaining and enhancing a community's livability. There is a direct link between stormwater and a community's surface and ground waters. As a community develops, the impervious surfaces that are created increase the amount of runoff during rainfall events, disrupting the natural hydrologic cycle. Without control, these conditions erode stream channels and prevent groundwater recharge. Parking lots, roadways, and rooftops increase the pollution levels and temperature of stormwater runoff that is transported to streams, rivers, and groundwater resources. Protecting these waters is vital for a great number of uses, including fish and wildlife habitat, recreation, and drinking water. The Estacada Stormwater Master Plan includes projects to improve the stormwater system. <u>2018 Status:</u> Projects include the construction of Reclamation Overflow Inlets on 4th Street Hill and Hill way, rebuilt the channel bank to retain the creek so it won't run onto the Wastewater Treatment Plant property; enclosed the creek ditch in at 36" storm pipe along Short Street and North Broadway. Currently working on re-establishing the channel along Wade Creek for approximately 1,000 ft by removing silt and build-up. In 2015 made stormwater flooding street improvements. Identifying projects to pursue for the future. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Identify funding sources to implement projects; Projects include channel improvement, ditch restoration, culvert replacement, erosion protection, ditch and culvert improvement, box culvert creation, and storm drain installation. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
City Manager's Office		Engineering Firm, Clackamas County Planning Department	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Medium to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	High		

* - High Priority Action Item

Severe Weather #1

Proposed Action Item:		Alignment with Plan Goals:	
Reduce negative effects from severe windstorm and severe winter storm events.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Stormwater Master Plan, Street Tree Master Plan, Zoning Code			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure[201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to cause power outages can assist a community in mitigating its overall risk to wind and winter storms. <u>2018 Status:</u> PGE has an ongoing tree trimming program that trims diseased trees or trees that are dangerous and can potentially fall during the next storm. Ordinance 2000-12, chapter 15.12.070 of the City Code states that new developments must have underground power lines. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Reduce power outages by partnering with PGE to obtain funding to bury power lines subject to frequent failures; Encourage burial of power lines for existing development; Ensure that there are back up underground lines to major businesses & employers; Develop partnerships to implement programs to keep trees from threatening lives, property, and public infrastructure; Continue regular tree trimming practices; Partner with PGE to continue hazardous tree inventory and mitigation programs; Create sheltering programs; and Promote safe installation and use of generators. Promote 72 hour kits 			
Coordinating Organization:		City Manager's Office	
Internal Partners:		External Partners:	
Public Works		PGE, Reliance Connects, Estacada Rural Fire District #69, Estacada School District, Estacada Chamber of Commerce, Red Cross, private landowners	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Severe Weather #2

Proposed Action Item:		Alignment with Plan Goals:	
Encourage facilities to become certified Red Cross shelter sites and maintain a list of disaster shelters located throughout Estacada.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Clackamas County Community Wildfire Protection Plan (2018)			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. By encouraging more facilities to become shelter sites there will be more capacity for emergency response. In the event of an evacuation after a natural disaster event, residents need to know where they can go to seek shelter. In the past, shelters become unused because residents are unaware there are shelters in the area. <u>2018 Status:</u> In 2014 a Red Cross Shelter was opened at the Estacada First Baptist Church in response to the 36 Pit Fire. The Church currently maintains the Red Cross certification. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Seek out potential shelter sites and encourage Red Cross Certification. Maintain a spreadsheet listing potential shelter sites for all types of hazards. Cooling/warming shelters should also be included. Host an annual open house for businesses, to determine whether they are fit to be a shelter site and provide ways in which they can prepare to be a shelter site. Provide the list of shelters on the city of Estacada's website so residents are aware of where to seek shelter. 			
Coordinating Organization:		City Manager's Office	
Internal Partners:		External Partners:	
Estacada Rural Fire District #69		Private Properties, Red Cross	
Potential Funding Sources:		Estimated cost:	Timeline:
General Funds		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

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; Enhance Natural Systems; Augment Emergency Services; 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:			
The wildfire mitigation action items provide direction on specific activities that organizations and residents in Estacada can take to reduce wildfire hazards. 2018 Status: Ongoing. CWPP updated in 2018.			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
Wildfire Risk Assessment (Ch. 4):			
<ol style="list-style-type: none"> Maintain and update the Fuels Reduction (FR) and Communities at Risk (CAR) maps and databases. Continue to track structure vulnerability data throughout the County through structural triage assessments. Update the Overall Wildfire Risk Assessment as new data becomes available. 			
Hazardous Fuels Reduction and Biomass Utilization (Ch. 5):			
<ol style="list-style-type: none"> Develop and maintain an inventory of potential and successful FR projects by meeting with parks and natural lands managers quarterly. Continue securing funding to implement projects/hire seasonal ODF staff. 			
Emergency Operations (Ch. 6):			
<ol style="list-style-type: none"> Develop and FDB Communications Works Group. Conduct a Conflagration Exercise. 			
Education and Community Outreach (Ch. 7):			
<ol style="list-style-type: none"> Develop Firewise toolkit for CAR's. Create incentives for fuels reduction. Update and distribute the Burn Permitting and Fire Restrictions Brochure. Continue to improve address signage throughout the County. 			
Structural Ignitability Policies and Programs (Ch. 8):			
<ol style="list-style-type: none"> Identify a DTD representative for the WFEP. Improve coordination with Rural Fire Agencies. Integrate WU into Plan Map and include a public outreach strategy. 			
Coordinating Organization:		Estacada Rural Fire District #69	
Internal Partners:		External Partners:	
City Manager's Office, Public Works		Clackamas Fire Defense Board, ODF, U.S. Forest Service, public land management agencies	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, ODF, operating budgets		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	High (CWPP identified priority actions listed above)		

* - High Priority Action Item

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ATTACHMENT B: PUBLIC INVOLVEMENT SUMMARY

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

To provide the public information regarding the draft NHMP addendum, and provide an opportunity for comment, an announcement (see text below) was announced in the city's newspaper (Estacada News) and a [link](#) including the draft plan and an opportunity to comments was provided in the "Community News" section on their homepage. The opportunity to review the draft plan and to comment was left open from February 14 through March 4, 2019.

During the public review period there were no comments provided.

Press Release

Clackamas County Pre-Disaster Mitigation Planning PRESS RELEASE

DATE: February 14, 2019
TO: Estacada News
FROM: Melanie Wagner, Assistant to the City Manager
SUBJECT: Press Release for Estacada addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan Update – Notice and Opportunity for Public Comment

For Immediate Release

Estacada seeks additional public input on update to Natural Hazard Mitigation Plan

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

A natural hazard mitigation plan provides communities with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities, and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

An electronic version of the updated draft Estacada NHMP addendum will be available for formal public comment beginning **February 14, 2019**. To view the draft please visit: www.CityofEstacada.org

If you have any questions regarding the Estacada NHMP addendum or the update process in general, please contact: Melanie Wagner, Assistant to the City Manager at (503) 630-8270 x203 or wagner@cityofestacada.org ; or Michael Howard, Assistant Program Director for the Oregon Partnership for Disaster Resilience at (541) 346-8413 or mrhoward@uoregon.edu.

City of Gladstone Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan



Photo Credit: City of Gladstone

March 2019

Volume II: Gladstone Addendum



Prepared for:

City of Gladstone

Prepared by:

University of Oregon
Institute for Policy Research and Engagement
Oregon Partnership for Disaster Resilience

Planning grant funding provided by:



FEMA

Federal Emergency Management Agency (FEMA)
Pre-Disaster Mitigation Program
Grant: EMS-2017-PC-0005
Sub-grant Application Reference: PDMC-PL-10-OR-2016-001, and

Additional Support Provided by:



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FEMA

December 16, 2019

The Honorable Jim Bernard
Chair, Clackamas County Commissioners
2020 Kaen Road Suite A
Oregon City, Oregon 97045

Dear Chairman Bernard:

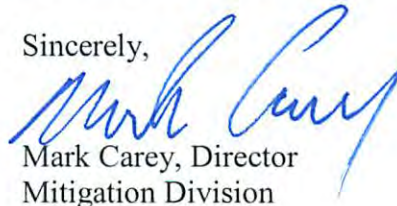
On April 12, 2019, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance (HMA) grants through April 11, 2024, through your state.

Clackamas County	City of Estacada	City of Lake Oswego
City of West Linn	City of Wilsonville	City of Johnson City
City of Oregon City	City of Happy Valley	City of Canby
Clackamas Fire District	City of Gladstone	City of Sandy

The updated list of approved jurisdictions includes the cities of Sandy and Gladstone which recently adopted the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval, please contact Joseph Murray, State Hazard Mitigation Planner with the Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities. If you have questions regarding FEMA's mitigation grant programs, please contact Amie Bashant, State Hazard Mitigation Officer with the Oregon Military Department, Office of Emergency Management, at 503-378-4660.

Sincerely,



Mark Carey, Director
Mitigation Division

Enclosure

JG:vl

RESOLUTION # 1167

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

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

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

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

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

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

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

WHEREAS, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *City of Gladstone addendum* to the *Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan* and pre-approved it (dated, October 3, 2019) contingent upon this official adoption of the participating governments and entities;

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

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


WHEREAS, City of Gladstone adopts the NHMP and directs the City Administrator to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.

NOW, THEREFORE, BE IT RESOLVED, that the City of Gladstone adopts *the Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan* as an official plan; and

BE IT FUTURE RESOLVED, that the City of Gladstone will submit this Adoption Resolution to the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the *Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan*.

This Resolution is adopted by the Gladstone City Council and approved by the Mayor this 12TH day of NOVEMBER 2019.

ATTEST:



Tamara Stempel, Mayor



Tami Bannick, City Recorder

Purpose

This is an update of the Gladstone addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation and Volume III (Appendices) which provide additional information. This addendum meets the following requirements:

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

Updates to Gladstone’s addendum are further discussed throughout the NHMP and within Volume III, Appendix B, which provides an overview of alterations to the document that took place during the update process.

Gladstone adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on **November 12, 2019**. FEMA Region X approved the Clackamas County NHMP on April 12, 2019 and the City’s addendum on **December 16, 2019**. With approval of this NHMP the City is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act’s hazard mitigation project grants through **April 11, 2024**.

Mitigation Plan Mission

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

The City concurs with the mission statement developed during the Clackamas County planning process (Volume I, Section 3):

Promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

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

The City concurs with the goals developed during the Clackamas County planning process (Volume I, Section 3). All NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Below is a list of the NHMP goals:

GOAL #1: PROTECT LIFE AND PROPERTY

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

GOAL #2: ENHANCE NATURAL SYSTEMS

- Balance watershed planning, natural resource management, and land use planning with natural hazards mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

GOAL #3: AUGMENT EMERGENCY SERVICES

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, and business, and industry.
- Coordinate and integrate natural hazards mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL #4: ENCOURAGE PARTNERSHIPS FOR IMPLEMENTATION

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

GOAL #5: PROMOTE PUBLIC AWARENESS

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

NHMP Process, Participation and Adoption

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

Gladstone first developed an addendum to Clackamas County's Natural Hazards Mitigation Plan in 2003. This plan was updated in 2009, 2012/2013, and in 2018/2019. The most recent previous update of the Gladstone addendum to the Clackamas County NHMP was approved by FEMA on April 8, 2013.

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

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research, and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM), Clackamas County, and Gladstone to update their NHMP. This project is funded through the Federal Emergency Management Agency's (FEMA) Fiscal-Year 2016 (FY16) Pre-Disaster Mitigation (PDM) Competitive Grant Program EMS-2017-PC-0005 (PDMC-PL-10-OR-2016-001). Members of the Gladstone NHMP Hazard Mitigation Advisory Committee (HMAC) also participated in the County NHMP update process (Volume III, Appendix B).

The Clackamas County NHMP, and Gladstone addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. The Gladstone HMAC guided the process of developing the NHMP.

Convener

The Gladstone City Administrator serves as the NHMP addendum convener. The convener of the NHMP will take the lead in implementing, maintaining and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the City of Gladstone HMAC met formally and informally, to discuss updates to their addendum (Volume III, Appendix B). The HMAC reviewed and revised the City's addendum, with focus on the NHMP's risk assessment and mitigation strategy (action items).

This addendum reflects decisions made at the designated meetings and during subsequent work and communication with Clackamas County Resilience Coordinator, and the OPDR. The changes are highlighted with more detail throughout this document and within Volume III, Appendix B. Other documented changes include a revision of the City's risk assessment and hazard identification sections, NHMP mission and goals, action items, and community profile.

The Gladstone HMAC was comprised of the following representatives:

- Convener, Jacque Betz, City Administrator
- Colin Black, Senior Center Manager

- Jim Whynot, Public Works Director
- Jeff Smith, Interim Fire Chief
- Rick Huffman, Fire Chief
- John Schmerber, Police Chief

Public participation was achieved with the establishment of the HMAC, which was comprised of City officials representing different departments and sectors and members of the public. The HMAC served as the local review body for the NHMP's development. Community members were provided an opportunity for comment via the NHMP review process, and through a survey administered by Clackamas County (Volume III, Appendix G).

NHMP Implementation and Maintenance

The City Council will be responsible for adopting the Gladstone addendum to the Clackamas County NHMP. This addendum designates a HMAC and a convener to oversee the development and implementation of action items. Because the City addendum is part of the County's multi-jurisdictional NHMP, the City will look for opportunities to partner with the County. The City's HMAC will convene after re-adoption of the Gladstone NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The City Administrator will serve as the convener and will be responsible for assembling the HMAC. The HMAC will be responsible for:

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating and training new HMAC members on the NHMP and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement; and
- Documenting successes and lessons learned during the year.

The convener will also remain active in the County's implementation and maintenance process (Volume I, Section 4).

The City will utilize the same action item prioritization process as the County (Volume I, Section 4).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, and Building Codes, as well as the [Clackamas County NHMP](#), and the [State of Oregon NHMP](#).

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the city. Plans and policies already

in existence have support from residents, businesses and policy makers. Where possible, Gladstone will implement the NHMP's recommended actions through existing plans and policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Future development without proper planning may result in worsening problems associated with natural hazards. Gladstone's acknowledged comprehensive plan is the City of Gladstone Comprehensive Plan (1980, updated September 2014). The Oregon Land Conservation and Development Commission first acknowledged the plan in 1980. The City implements the plan through the Development Code.

Gladstone currently has the following plans, regulations, and projects that relate to natural hazard mitigation. For a complete list visit the City's [website](#):

- [Comprehensive Plan](#)
- [Zoning Map](#)
- [Municipal Code](#)
 - [Chapter 08.04 Nuisances](#)
 - [Chapter 13.05 Water Supply Cross Connections](#)
 - [Chapter 13.14 Industrial Waste Requirements](#)
 - [Chapter 15.06 Earthwork and Erosion Control Standards](#)
 - [Chapter 17.25 HCAD-Habitat Conservation Area District](#)
 - [Chapter 17.27 WQ-Water Quality Resource Area District](#)
 - [Chapter 17.29 FM-Flood Management Area District](#)
 - [Chapter 17.56 Drainage](#)
 - [Chapter 17.57 Flood Hazard Regulations*](#)
- [Transportation Systems Plan](#)
- [Water System Master Plan](#)
- [Stormwater Master Plan](#)
- [Sanitary Sewer Master Plan](#)
- [Parks Master Plan](#)
- [Gladstone Projects](#)
- Capital Improvement Program
- [Emergency Management Page](#)

Other plans:

- [Clackamas County Community Wildfire Protection Plan](#)
 - [Gladstone Fire Department](#)

Government Structure

The City of Gladstone has a council-mayoral form of government. The City Council consists of seven members; a mayor and six councilors. The mayor presides over Council meetings. The mayor and City Council members are elected to four-year terms of office through a general election. The City Council is responsible for identifying problems and needs within

the community and then addressing those problems through community goals and objectives.

Code Enforcement is responsible to maintaining community safety and neighborhood livability using various municipal codes. They prioritize gaining voluntary compliance through education and assistance, with civil or criminal penalties if that does not work.

The public works department, in addition to maintaining streets, water, sewer, and parks, offers sand bags to residents during flood events. The city also maintains the water supply and the wastewater treatment system.

Additionally, the City of Gladstone administers a Volunteer Emergency Management Program. The program realizes that Gladstone has limited personnel and equipment resources for a sustained medium to large scale natural or human caused emergency. Continued Public Participation

An open public involvement process is essential to the development of an effective NHMP. To develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunity for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the NHMP during review.¹ Keeping the public informed of the City's efforts to reduce its risk to future natural hazard events is important for successful NHMP implementation and maintenance. The City is committed to involving the public in the NHMP review and updated process (Volume I, Section 4). The City posted the plan update for public comment before FEMA approval, and after approval will maintain the plan on the City's website:

<https://www.ci.gladstone.or.us/>

NHMP Maintenance

The Clackamas County NHMP and City addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the County NHMP update process, the City will also review and update its addendum (Volume I, Section 4). The convener will be responsible for convening the HMAc to address the questions outlined below.

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

¹ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

- Has the community been affected by any disasters? Did the NHMP accurately address the impacts of this event?

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

Mitigation Strategy

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

The City's mitigation strategy (action items) were first developed during the 2009 NHMP planning process and revised during subsequent NHMP updates. During these processes, the HMAC assessed the City's risk, identified potential issues, and developed a mitigation strategy (action items).

During the 2018/2019 update process the City re-evaluated their mitigation strategy (action items). During this process action items were updated, noting what accomplishments had been made and whether the actions were still relevant; any new action items were identified at this time (see Volume III, Appendix B for more information on changes to action items).

Priority Action Items

Table GA-1 presents a list of mitigation actions. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity. High priority actions are shown in **bold** text with grey highlight. The City will focus their attention, and resource availability, upon these achievable, high leverage, activities over the next five-years. Although this methodology provides a guide for the HMAC in terms of implementation, the HMAC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for detailed information for each action. Full text of the plan goals referenced in Table GA-1 is located on page GA-2.

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Table GA-I Gladstone Action Items

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
MH #1	Integrate the goals and mitigation actions from the Gladstone Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	Planning	Planning Commission	Ongoing	✓	✓	✓	✓	✓
MH #2	Develop, enhance, and implement education programs designed to reduce the losses from natural hazards.	Gladstone Emergency Management and Support (GEMS)	Police, Fire	Ongoing	✓		✓	✓	✓
MH #3	Improve vegetation management throughout the city.	Public Works	Fire	Ongoing	✓	✓		✓	✓
MH #4	Enhance strategies for debris management for all hazards.	Public Works	City Administrator's Office	Ongoing	✓	✓		✓	
MH #5	Maintain the Gladstone Emergency Operations Plan.	Police	Public Works, Fire, City Administrator's Office	Ongoing	✓		✓	✓	
MH #6	Evaluate and upgrade stormwater management infrastructure and identify appropriate mitigation strategies.	Public Works	City Administrator's Office	Long Term	✓	✓	✓	✓	
MH #7	Update failing water distribution system	Public Works	Fire, City Administrator's Office	Long Term	✓	✓			✓

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
EQ #1	Conduct seismic evaluations on identified critical/essential facilities and infrastructure for implementing appropriate structural and non-structural mitigation strategies.	City Administrator's Office	Fire, Police, GEMS, Public Works	Long Term	✓		✓		
FL #1	Ensure continued compliance in the National Flood Insurance Program through enforcement of local floodplain management ordinances.	City Administrator's Office	Fire, Public Works	Ongoing	✓	✓	✓	✓	
FL #2	Coordinate with Clackamas County to address the flooding issues on Glen Echo that stem from the two-way diversion on Hull Avenue put in by Clackamas County.	Public Works	City Administrator's Office	Ongoing	✓	✓		✓	
FL #3	Maintain and Implement the Gladstone Stormwater Master Plan.	Public Works	City Administrator's Office	Ongoing	✓	✓	✓		
LS #1	Reduce the vulnerability of property owners in landslide-prone areas.	City Administrator's Office	Public Works	Ongoing	✓	✓		✓	✓
SW #1	Reduce negative effects from severe windstorm and severe winter storm events.	Public Works	City Administrator's Office, Fire, Police	Ongoing	✓	✓	✓	✓	✓
WF #1	Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan.	Fire	City Administrator's Office, Planning	Ongoing	✓	✓	✓	✓	✓

Source: City of Gladstone HMAAC, 2018

Note: Full text of the plan goals referenced in this table is located on page GA-2.

Risk Assessment

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

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

The local level rationale for the identified mitigation strategies (action items) is presented herein and within Volume I, Section 2 and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure GA-1. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure GA-1 Understanding Risk



Hazard Analysis

The Gladstone HMAC developed their hazard vulnerability assessment (HVA), using their previous HVA and the County’s HVA as a reference. Changes from their previous HVA and the County’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Gladstone, which are discussed throughout this addendum.

Table GA-2 shows the HVA matrix for Gladstone listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response and recovery. The method provides the jurisdiction with a sense of hazard priorities but does not predict the occurrence of a hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake and Crustal earthquake) and two chronic hazards (flood and winter storm) rank as the top hazard threats to the City (Top Tier). Windstorm, wildfire, and extreme heat comprise the next highest ranked hazards (Middle Tier), while landslide, drought, and volcanic event comprise the lowest ranked hazards (Bottom Tier).

Table GA-2 Hazard Analysis Matrix – Gladstone

Hazard	Maximum				Total Threat Score	Hazard Rank	Hazard Tiers
	History	Vulnerability	Threat	Probability			
Earthquake - Cascadia	4	45	100	49	198	#1	Top Tier
Flood	16	40	80	56	192	#2	
Earthquake - Crustal	6	50	100	21	177	#3	
Winter Storm	14	30	70	56	170	#4	
Windstorm	10	35	50	42	137	#5	Middle Tier
Wildfire	6	25	50	35	116	#6	
Extreme Heat Event	8	20	50	28	106	#7	
Landslide	2	25	20	35	82	#8	Bottom Tier
Drought	10	10	30	28	78	#9	
Volcanic Event	2	20	40	14	76	#10	

Source: Gladstone HMAc, 2018.

Table GA-3 categorizes the probability and vulnerability scores from the hazard analysis for the City and compares the results to the assessment completed by the Clackamas County HMAc. Variations between the City and County are noted in **bold** text within the city ratings.

Table GA-3 Probability and Vulnerability Comparison

Hazard	Gladstone		Clackamas County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Low	High	Low
Earthquake - Cascadia	Moderate	High	Moderate	High
Earthquake - Crustal	Low	High	Low	High
Extreme Heat	Moderate	Moderate	Low	High
Flood	High	High	High	Moderate
Landslide	Moderate	Moderate	High	Low
Volcanic Event	Low	Low	Low	Moderate
Wildfire	Moderate	Moderate	High	Moderate
Windstorm	Moderate	Moderate	Moderate	Low
Winter Storm	High	Moderate	Moderate	Moderate

Source: Gladstone and Clackamas County HMAc, 2018.

Community Characteristics

Table GA-4 and the following section provides information on City specific demographics and assets. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation.

Considering the City specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation. Between 2010 and 2016 the City grew by 319 people (1%; as of 2018 the population was 11,880) and median household income increased by about 8%.² Between 2018 and 2040 the population is forecast to grow by 2% to 12,083.³ New development has complied with the standards of the [Oregon Building Code](#) and the city's development code.

Transportation/Infrastructure

Gladstone is roughly 12 miles south from Portland and adjacent to Milwaukie, Oregon City, and West Linn. It is located within the Portland Metro with Highway 99E, otherwise known as McLoughlin Blvd, running north to south through the southwestern corner of Gladstone. The majority of Gladstone lies west of Interstate 205 and Highway 212/224 is located just north of the city boundary. The Union Pacific Railroad main line, which carries both passengers and freight, crosses through Gladstone east of Interstate 205 and west of the Clackamas River.

Motor vehicles represent the dominant mode of travel through and within Gladstone. Portland Tri-Met has a light-rail line in Milwaukie and is the bus service that provides public transit to the City. There are no port services available on Willamette and Clackamas Rivers near Gladstone, but there are recreational areas along the river.

Economy

Gladstone's proximity to major transportation routes and access to rail has made it a desirable place for commercial and industrial development. Gladstone is a mature community that is mostly a bedroom community. The city's residents work in a variety of industries, with "office and administrative support" (about 18% of workforce) and "professional and related occupations" (around 15%) accounting for the top two occupations.⁴

Gladstone has an economic advantage due to its location at the north end of the Willamette Valley and its proximity to Portland. There are four areas of concentrated commercial zoning in the southern part of the city as well as a few areas zoned for light industrial. The commercial and light industrial areas are located along Highway 99E, Portland Avenue, and the interface between Interstate 205 and SE 82nd.

²Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018 and Social Explorer, Table T57, U.S. Census Bureau, 2012-2016 and 2006-2010 American Community Survey Estimates.

³Metro, 2040 Distributed Forecast (2016).

⁴Social Explorer, Table 50, U.S. Census Bureau, 2012-2016 American Community Survey Estimates

Table GA-4 Community Characteristics

Population Characteristics		
2010 Population	11,495	
2016 Population [2018 Population]	11,660	11,880
2040 Forecasted Population*	12,083	
Race (non-Hispanic) and Ethnicity (Hispanic)		
White	83%	
Black/ African American	1%	
American Indian and Alaska Native	< 1%	
Asian	3%	
Native Hawaiian and Other Pacific Islander	< 1%	
Some Other Race	0%	
Two or More Races	2%	
Hispanic or Latino	11%	
Limited or No English Spoken	5%	
Vulnerable Age Groups		
Less than 15 Years	2,189	18%
65 Years and Over	1,796	15%
Disability Status		
Total Population	1,833	16%
Children	344	13%
Seniors	703	40%

Income Characteristics		
Households by Income Category		
Less than \$15,000	414	9%
\$15,000-\$29,999	922	20%
\$30,000-\$44,999	498	11%
\$45,000-\$59,999	692	15%
\$60,000-\$74,999	587	13%
\$75,000-\$99,999	618	13%
\$100,000-\$199,999	860	18%
\$200,000 or more	107	2%
Median Household Income	\$57,169	
Poverty Rates		
Total Population	1,948	17%
Children	455	17%
Seniors	141	8%
Housing Cost Burden		
Owners with Mortgage	1,024	36%
Renters	1,148	61%

Source: U.S. Census Bureau, 2012-2016 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018. [Metro, 2040 Distributed Forecast](#). Note: * = Population forecast within Metro UGB

Housing Characteristics		
Housing Units		
Single-Family	3,490	69%
Multi-Family	1,179	23%
Mobile Homes	356	7%
Year Structure Built		
Pre-1970	1,899	38%
1970-1989	2,106	42%
1990 or later	1,029	21%
Housing Tenure and Vacancy		
Owner-occupied	2,814	56%
Renter-occupied	1,884	37%
Seasonal	0	0%
Vacant	336	7%

Gladstone has grown substantially since its incorporation in 1911 and has an area today of 2.5 square miles. It is in the south-central region of Clackamas County, located approximately 12 miles south of the City of Portland. Gladstone is part of the Clackamas River Water Providers, which is a coalition that gets its water from the Clackamas River.

Located at 57 feet above sea level, Gladstone’s climate is consistent with a Mediterranean climate zone, with warm summers and cool, wet winters. Gladstone receives most of its rainfall between October and May, and averages 46 inches of rain, and less than a couple inches of snow, per year.⁵

According to the [Comprehensive Plan](#), land has been designated for single-family residential, medium-density residential, multi-family residential, central commercial, general commercial, and light industrial. The plan incorporates natural hazard considerations, resulting in slopes of 25% or greater being considered unbuildable for future housing needs.

⁵ [“Monthly Average for Gladstone, OR”](#) The Weather Channel Interactive, Inc. Retrieved May 1, 2019.

Community Assets

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of Gladstone. It is important to note that the facilities identified as “critical” and “essential” are characterized differently than the structural code that identifies buildings as “essential” and “non-essential.” The structural code uses different language and criteria and therefore have completely different meanings than the buildings identified in this addendum.

Critical Facilities

Facilities that are critical to government response, and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include: 911 Centers, Emergency Operations Centers, Police, and Fire Stations, Public Works facilities, sewer, and water facilities, hospitals, bridges, roads, shelters, and more.

Table GA-5 Critical Facilities in Gladstone

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Facilities									
City Hall		X							
Gladstone Senior Center (EOC)		X							
Police Station		X							
Public Works		X							
Fire Stations									
Main Fire Station		X							
Potential Shelter Sites									
Gladstone Christian Church - Red Cross shelter		X							
Tri-City Baptist – Red Cross shelter (backup EOC)		X							

Hazardous Materials:

Facilities that, if damaged, could cause serious secondary impacts may also be considered “critical.” A hazardous material facility is one example of this type of critical facility. Those sites that store, manufacture, or use potentially hazardous materials include: Cal Spas Chemical Storage, Classic Pool and Spa, First Student Bus Barn, Gas Stations, and Gladstone Public Works.

Essential Facilities

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public's ability to recover from the emergency. These facilities may include: City buildings such as the Public Services Building, the City Hall, and other public facilities such as schools.

Table GA-6 Essential Facilities in Gladstone

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Essential Facilities									
Schools									
Gladstone High School		X					X		
John Wetten Elementary		X					X		
Kraxberger Middle School		X					X		
Churches									
Assembly of God									
Church of Christ									
Church of Jesus Christ of Latter-Day Saints									
Faith and Life Center Free Methodist Church									
First Baptist Church									
Seventh-Day Adventist									
St. Stephen Lutheran Church									
Food Providers									
Safeway									
Other Essential Facilities									
Avamere Rehabilitation of Clackamas									
Gladstone Children and Family Services									
Holiday Inn Express									
Somerset Assisted Living									

Critical Infrastructure:

Infrastructure that provides necessary services for emergency response include:

Table GA-7 Critical Infrastructure in Gladstone

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Infrastructure									
Bridges									
Oregon City Bridge		X							
82 nd Bridge (pedestrian and sewer)		X							
Transportation Networks									
Communication Towers		X							
Highway 205		X		X					
McLoughlin Blvd Corridor (Highway 99E)		X		X					
NW Natural Pipelines off McLoughlin Blvd		X							
Power Substation on Jennings		X							
Railroad		X		X					
Other Critical Infrastructure									
Clackamas River Water		X							
Oak Lodge Water		X							
Pump Stations		X							
Sanitary Sewer Collection System and Pump Station		X							
Stormwater Infrastructure		X							
Water Lines		X							

Environmental Assets:

Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic, and functional ecosystem services for the community include:

Table GA-8 Environmental Assets in Gladstone

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Environmental Assets									
Billy Goat Island				X			X		
Detention Ponds									
Gladstone High School Bio-swale									
McLoughlin/Risley Wetland				X	X		X		
Olsen Wetland				X					
Willamette and Clackamas Rivers and Riparian Corridors				X					
Parks									
Abernathy Lane Trail									
Cross Park					X		X		
Dahl Beach		X		X	X		X		
Diecrick Field									
Gladstone Nature Park									
Glen Echo Wetland									
High Rock Park					X				
Max Patterson Memorial City Park									
Meldrum Bar Park		X		X	X		X		
Nick Shannon Park							X		
Ridgegate Tracts									
Robin Hood Park									
Salty Acres Wetlands									
Stocker Park									

Economic Assets/Population Centers:

Economic assets include businesses that employ large numbers of people and provide an economic resource to the city of Gladstone. If damaged, the loss of these economic assets could significantly affect economic stability, and prosperity. Population Centers usually are aligned with economic centers, and are a concern during evacuation/notification during a hazard event include:

Table GA-9 Economic Assets/Population Centers in Gladstone

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Economic Assets / Population Centers									
Economic Centers									
82 nd /Arlington Corridor		X							
Budget Inn									
Holiday Inn – Essential Facility									
McLoughlin Blvd Corridor (Highway 99E)		X							
Oatfield/Oakridge Corridor		X			X		X		
Safeway		X							
Apartment Complexes									
Autumn Oaks									
Brook Side									
Fairway Village									
River Green				X					
River Place									
River Run									
Tall Oaks					X				

Vulnerable Populations:

Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, often experience the impacts of natural hazards and disasters more acutely. Populations that have special needs or require special consideration include:

Table GA-10 Vulnerable Populations in Gladstone

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Vulnerable Populations									
Assisted Living Facilities									
Avamere Rehabilitation of Clackamas – Essential Facility									
Gladstone Senior Center – Critical Facility									
Somerset Assisted Living – Essential Facility									
Somerset Lodge									
Child Care Centers									
Assembly of God Daycare									
Gladstone Center for Children and Families (GCCF)									
St. Stephen’s Church Daycare									
YMCA Gladstone									
Mobile Home Parks									
Tri-City Mobile Home Park		X		X					
Two Rivers Coop Home Park		X		X					
Other Vulnerable Populations									
7 th Day Adventist Annual Conference (Gladstone Park)									
Schools – see Essential Facility									

Hazard Characteristics

Drought

The HMAC determined that the City's probability for drought is **moderate** and that their vulnerability to drought is **low**. *These ratings did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent and probability of a potential event. Due to the climate of Clackamas County, past and present weather conditions have shown an increasing potential for drought.

The City of Gladstone Public Works Department manages Gladstone's water supply. Gladstone maintains a local system of three water tanks, two pump stations, and almost 40 miles of pipelines. These pipelines and other water infrastructure has not been updated or repaired properly, so the City Council approved water and sewer rate increases for 2018 and 2019 to help with maintenance costs. The City is also part of a regional water treatment provider, the North Clackamas County Water Commission. The City draws its water supply from the Clackamas River. There is potential contamination sources within the Clackamas Watershed area from agriculture, managed forest land, wastewater treatment plans, and other sources.⁶

Vulnerability Assessment

Due to insufficient data and resources, Gladstone is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables GA-5 through GA-10.

Mitigation Activities

The existing drought hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Earthquake (Cascadia Subduction Zone)

The HMAC determined that the City's probability for a Cascadia Subduction Zone (CSZ) earthquake is **moderate** and that their vulnerability to a CSZ earthquake is **high**. *The probability rating decreased, and the vulnerability rating did not change, since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake and Crustal earthquake.*

Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent and probability of a potential event. Generally, an event that affects the County is likely to affect Gladstone as well. The causes and characteristics of an earthquake event are appropriately described within the Volume I, Section 2 as well as the location and

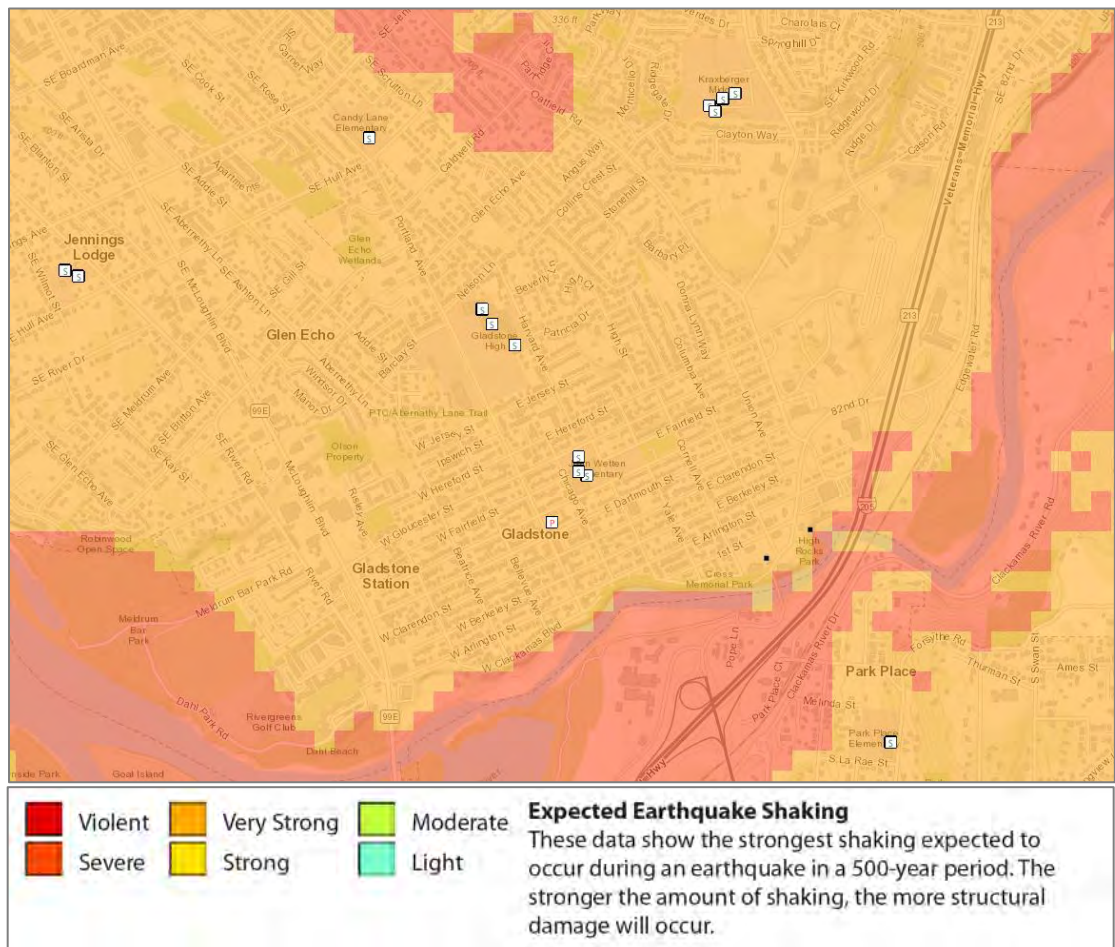
⁶ Profita, C. [Clackamas Watershed Collects Pollutants and Drinking Water](#) (2013). OPB.org.

extent of potential hazards. Previous occurrences are well documented within Volume I, Section 2 and the community impacts described by the County would generally be the same for Gladstone as well.

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Gales Creek-Newberg-Mt Angel Structural Zone, Portland Hills Fault Zone, and the Oatfield Fault Zone (discussed in the crustal earthquake section).

Figure GA-2 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the city is expected to experience very strong shaking (orange), while areas around the rivers will experience severe shaking (light red) in a CSZ event.

Figure GA-2 Cascadia Subduction Zone Expected Shaking



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

Note: To view detail click the link above to access Oregon HazVu.

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year. Scientists have found evidence that 11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These

earthquakes took place roughly between 300 and 5,400 years ago with an average occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D.⁷

The city's proximity to the Cascadia Subduction Zone, potential slope instability and the prevalence of certain soils subject to liquefaction and amplification combine to give the city a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places the city predominately within the "Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades). Within the Northwest Oregon region, damage and shaking is expected to be strong and widespread - an event will be disruptive to daily life and commerce and the main priority is expected to be restoring services to business and residents.

The City is not within the severe shaking area, though there is significant area around the City that have severe and very severe shaking if a large earthquake were to occur. These areas include Interstate 205 and Highway 99E, which could result in Gladstone having access issues from emergency vehicles and other response efforts.

Earthquake (Crustal)

The HMAC determined that the City's probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**. *The probability rating decreased, and the vulnerability rating did not change, since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake and Crustal earthquake.*

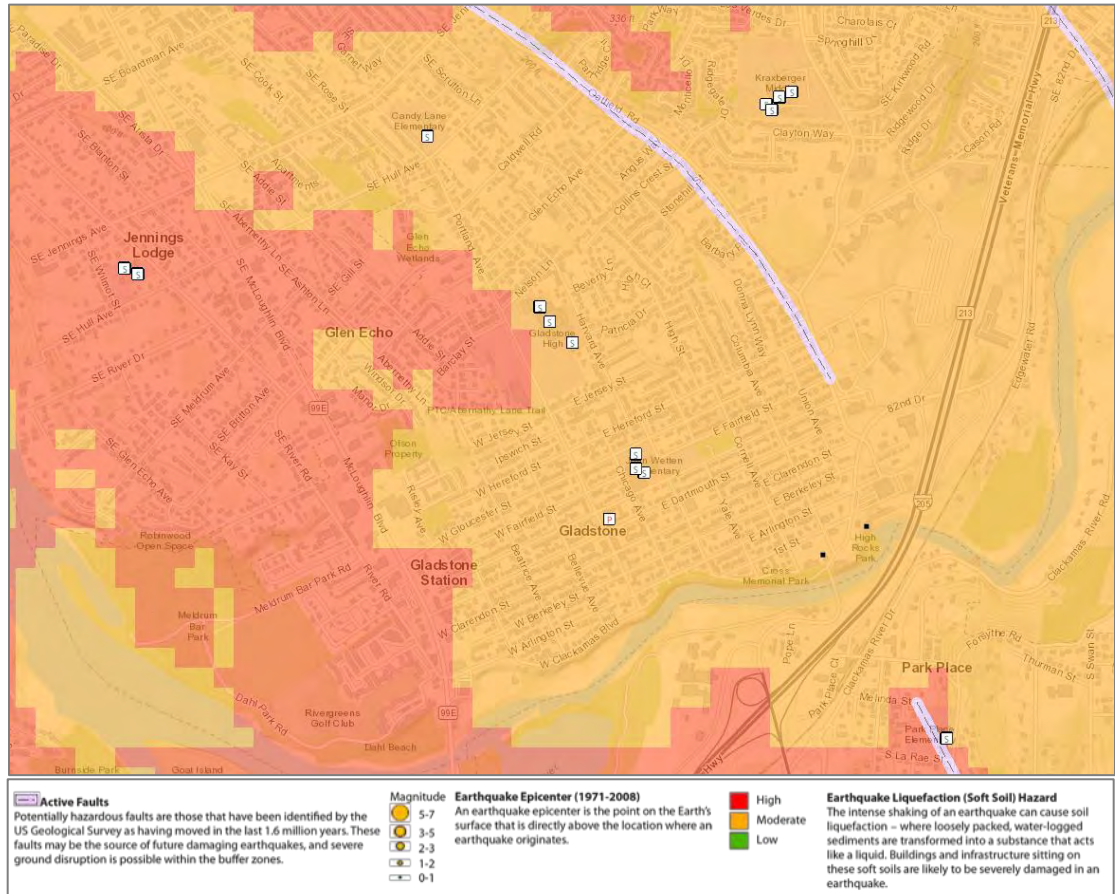
Volume I, Section 2 describes the causes and characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Gladstone as well. Figure GA-3 shows a generalized geologic map of the Gladstone area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows the areas of greatest concern within the City limits as red and orange.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

Gladstone has the Oatfield and Portland Hills Faults running through the city, which can generate high-magnitude earthquakes. Historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

⁷ The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. <http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf>

Figure GA-3 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](https://www.oregon.gov/DOGAMI/Statewide-Geohazards-Viewer)

Note: To view detail click the link above to access Oregon HazVu

Oatfield Fault Zone

The Oatfield Fault Zone is a series of NE-trending fault lines that may be part of the Portland Hills-Clackamas River structural zone. The fault forms linear magnetic anomalies and southwest-facing escarpments in volcanic rocks of the Miocene Columbia River Basalt Group. The fault zone extends for approximately 18 miles through Portland and down past Gladstone in northern Oregon.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and lies about 15 miles northeast of Gladstone.

Vulnerability Assessment

Due to insufficient data and resources, Gladstone is currently unable to perform a quantitative risk assessment for this hazard. However, in 2018 the Department of Geology and Mineral Industries (DOGAMI) completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)), findings from that report are provided at the end of the crustal earthquakes hazard section.

Seismic building codes were implemented in Oregon in the 1970s, however, stricter standards did not take effect until 1991 and early 2000s. As noted in the community profile, approximately 80% of residential buildings were built prior to 1990, which increases the City’s vulnerability to the earthquake hazard. Information on specific public buildings’ (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table GA-11; each “X” represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), zero (0) have a very high (100% chance) collapse potential and two (2) have a high (greater than 10% chance) collapse potential.

For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables GA-5 through GA-10.

Table GA-11 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Gladstone High (18800 Portland Ave)	Clac_sch64	X	X, X		
John Wetten Elementary (250 E Exeter St)	Clac_sch63	X	X	X	
Walter L Kraxberger Middle (17777 Webster Rd)	Clac_sch90	X	X, X	X	
Gladstone City Buildings					
Gladstone Fire Main Station (EOC) (555 Portland Ave)	Clac_fir44	X			
Police Station (formerly fire) (535 Portland Ave)	Clac_fir 40	X			
City Hall (formerly police) (525 Portland Ave)	Clac_pol09		X		

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#) “*” – Site ID is referenced on the [RVS Clackamas County Map](#)
Note: Bold indicates facilities that have been seismically retrofitted or rebuilt.

In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

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

Mitigation Activities

Gladstone has taken mitigation steps to reduce the city's vulnerability in earthquake events. The city's reservoir was seismically upgraded in the 1990s following the Scotts Mills Quake and the Gladstone High School has a new building and seismic work done in 2009. The Gladstone Fire Department received a grant for seismic retrofits that was completed in 2010. Seismic retrofit grant awards per the [Seismic Rehabilitation Grant Program](#)⁸ have been funded to retrofit the Police Department (2013-2014 grant award, \$360,729). The City is also building a new Civic Center to house City Hall and the Police Station at 18505 Portland Ave, which will be completed in 2020.

Earthquake Regional Impact Analysis

In 2018 DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)). Their study focused on damage to buildings, and the people that occupy them, and to two key infrastructure sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and night time (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damages varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood structures that fare worse in an earthquake. The Portland Hills fault scenario created greater damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios, however, the impact is considerably less than it is to the transportation routes. Additional, capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts.

Table GA-12 shows the permanent resident population that are vulnerable to injury or death (casualty) and the buildings in the City that are susceptible to liquefaction and landslides, it does not predict that damage will occur in specific areas due to either liquefaction or landslide. More population and property are exposed to higher degrees of expected damage or casualty under the Portland Hills Fault "wet" scenario than in any other scenario.

⁸ The Seismic Rehabilitation Grant Program (SRGP) is a state of Oregon competitive grant program that provides funding for the seismic rehabilitation of critical public buildings, particularly public schools and emergency services facilities.

Table GA-12 Expected damages and casualties for the CSZ fault and Portland Hills fault: earthquake, soil moisture, and event time scenarios

	Cascadia Subduction Zone (M9.0)		Portland Hills Fault (M6.8)	
	"Dry" Soil	"Wet" Saturated Soil	"Dry" Soil	"Wet" Saturated Soil
Number of Buildings	4,022	4,022	4,022	4,022
Building Value (\$ Million)	1,129	1,129	1,129	1,129
Building Repair Cost (\$ Million)	51	69	437	504
Building Loss Ratio	5%	6%	39%	45%
Debris (Thousands of Tons)	27	32	139	157
Long-Term Displaced Population	63	235	1,816	2,656
Total Casualties (Daytime)	48	61	351	394
Level 4 (Killed)	3	3	11	24
Total Casualties (Nighttime)	13	26	197	258
Level 4 (Killed)	0	1	5	7

Source: DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8, 12-9, 12-10, and 12-11.

Cascadia Subduction Zone Scenario

The City of Gladstone is expected to have a 5% building loss ratio with a repair cost of \$51 million under the CSZ “dry” scenario, and 6% building loss ratio with a repair cost of \$69 million under the CSZ “wet” scenario.⁹ The city is expected to have around 48 daytime or 13 nighttime casualties during the CSZ “dry” scenario and 61 daytime or 26 nighttime casualties during the CSZ “wet” scenario. It is expected that there will be a long-term displaced population of around 63 for the CSZ “dry” scenario and 235 for the CSZ “wet” scenario.¹⁰

Portland Hills Fault Scenario

The City of Gladstone is expected to have a 39% building loss ratio with a repair cost of \$437 million under the CSZ “dry” scenario, and 45% building loss ratio with a repair cost of \$504 million under the CSZ “wet” scenario.¹¹ The long-term displaced population and casualties are greatly increased for all the Portland Hills Fault scenarios. The city is expected to have around 351 daytime or 197 nighttime casualties during the Portland Hills Fault “dry” scenario and 394 daytime or 258 nighttime casualties during the Portland Hills Fault “wet” scenario. It is expected that there will be a long-term displaced population of around 1,816 for the Portland Hills Fault “dry” scenario and 2,656 for the Portland Hills Fault “wet” scenario.¹²

Recommendations from the report included topics within Planning, Recovery, Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMPs mitigation strategies (Table GA-1 and Volume I, Section 3).

⁹ DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8 and 12-9.

¹⁰ Ibid, Tables 12-8 and 12-9.

¹¹ Ibid, Tables 12-10 and 12-11

¹² Ibid, Tables 12-10 and 12-11.

For more detailed information on the report, the damage estimates, and the recommendations see: *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, [O-18-02](#)).

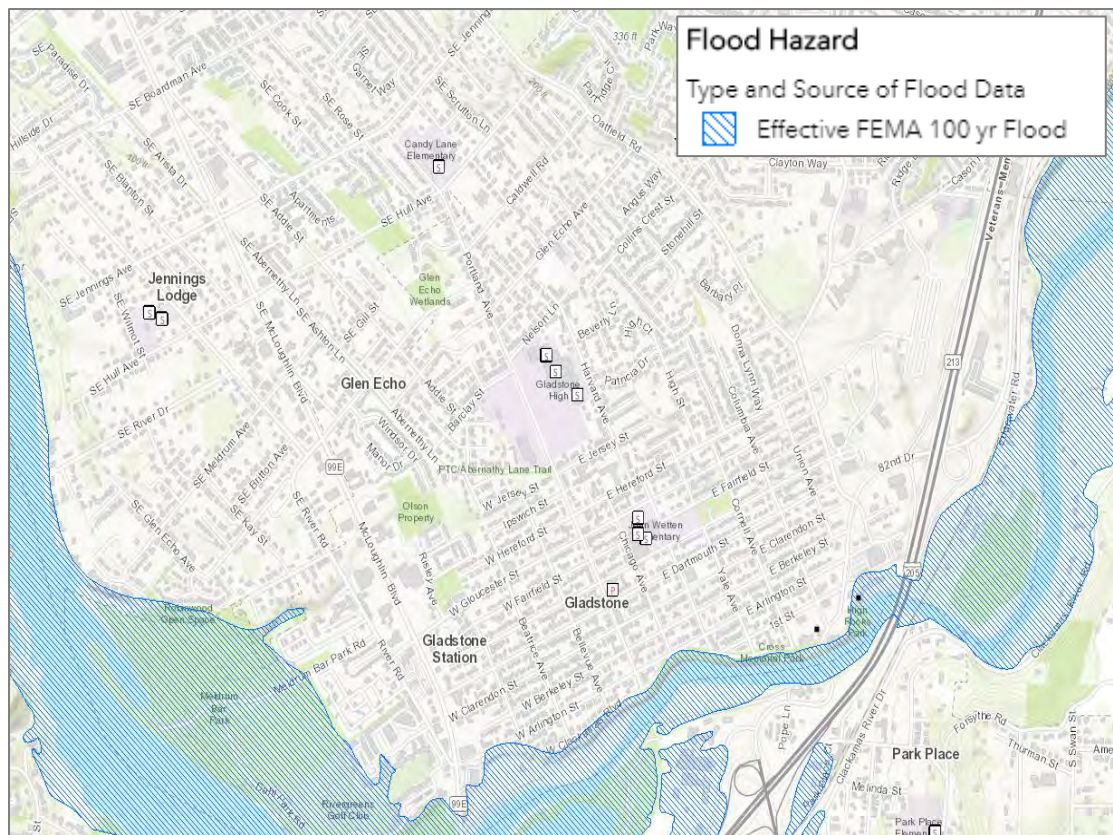
Please review Volume I, Section 2 for additional information on this hazard.

Flood

The HMAC determined that the City's probability for flood is **high** and that their vulnerability to flood is **high**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent, and probability of a potential event. Figure GA-4 illustrates the flood hazard area for Gladstone.

Figure GA-4 Special Flood Hazard Area



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

Note: To view detail click the link above to access Oregon HazVu

While Gladstone does not show many areas within the FEMA mapped special flood hazard areas (100-year flood vulnerability), with roughly 274 acres (21% of the total land within the city) is located within the 100-year floodplain. A larger flooding event, such as the 500-year flood, could cause serious damage. The city can experience urban flooding which is primarily due to inadequate storm drain pipes, and culverts that are too small. Additionally, the extent of flooding will vary depending on climatic conditions and precipitation levels. Typically, roads are covered with water in urban flooding events, and water will occasionally

overflow manholes in some parts of the city. Newer homes are built on higher ground to avoid flooding issues, and many older homes have pumps within their crawlspaces to avoid flood events.

Vulnerability Assessment

Due to insufficient data and resources, Gladstone is currently unable to perform a quantitative risk assessment for this hazard. There are no critical facilities in the 100-year floodplain. The only essential facility exposed to flooding is the river View Care Center as well as sewer, water lines, and roads. These roads include Clackamas Blvd, Edgewater Rd, River Ln, Evergreen Ln, south end of Rinearson Rd, and the south end of Rivergreens Rd.

Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage, and economic loss from business interruption. It is important for the City to be aware of flooding impacts and assess its level of risk.

The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners, and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of Gladstone outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage.

The extent of flooding hazards in Gladstone primarily depends on climate and precipitation levels. Additionally, withdrawals for irrigation and drinking water, as well as stream and wetland modifications or vegetation removal can influence water flow. In the past flooding has occurred along Edgewater Rd, Evergreen Ln, and Portland Ave. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables GA-5 through GA-10.

Mitigation Activities

Gladstone employs several mitigation strategies to reduce the city's risk to flood events. The city development code includes policies and regulations for flood prone areas including the Water Quality Resources area district, Habitat Conservation area district, and Flood Management area district. Development review practices and conditions of development require developers to account for all stormwater management onsite to reduce the risks of urban flooding in the future. Gladstone regularly inspects and maintains the stormwater facilities. Enclosed pipe sections and catch basins are routinely cleaned and inspected using the combination truck, and a regular street sweeping program reduces the amount of debris and contaminants entering the stormwater system. The Stormwater Master Plan and Water System Mater Plan both address the potential for urban flooding and actions to avoid it in the future.

National Flood Insurance Program (NFIP)

FEMA's Flood Insurance Study (FIS), and Flood Insurance Rate Maps (FIRMs) are effective as of June 17, 2008. Table GA-13 shows that as of July 2018, Gladstone has 51 National Flood Insurance Program (NFIP) policies in force. Of those, 18 are for properties that were

constructed before the initial FIRMs. Gladstone had a Community Assistance Visit (CAV) recently in June 2015, though it does not participate in the Community Rating System (CRS). The table shows that all flood insurance policies are for residential structures, primarily single-family homes. There has been a total of 11 paid claims for \$152,331. The City complies with the NFIP through enforcement of their flood management area district and flood hazard regulations within their development code.

The Community Repetitive Loss record for Gladstone identifies no Repetitive Loss Properties¹³ or Severe Repetitive Loss Properties¹⁴.

Table GA-13 Flood Insurance Detail

	Clackamas County	Gladstone
Effective FIRM and FIS	6/17/2008	6/17/2008
Initial FIRM Date	-	3/15/1977
Total Policies	1,957	51
Pre-FIRM Policies	1,086	18
Policies by Building Type		
Single Family	1,761	42
2 to 4 Family	30	3
Other Residential	58	0
Non-Residential	9	0
Minus Rated A Zone	123	8
Insurance in Force	\$541,833,400	\$15,276,400
Total Paid Claims	590	11
Pre-FIRM Claims Paid	450	6
Substantial Damage Claims	83	0
Total Paid Amount	\$20,830,662	\$152,331
Repetitive Loss Structures	51	0
Severe Repetitive Loss Properties	4	0
CRS Class Rating	-	NP
Last Community Assistance Visit	-	6/1/2015

Source: Information compiled by Department of Land Conservation, and Development, July 2018.

Note: The portion of the cities of Portland and Tualatin that are within Clackamas County are not included in this table.

NP = Not Participating

Please review Volume I, Section 2 for additional information on this hazard.

¹³ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

¹⁴ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP, and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000, and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

Landslide

The HMAC determined that the City's probability for landslide is **moderate** and that their vulnerability to landslide is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Gladstone does not have a history of landslides. This is due to the relatively flat topography within the UGB as well as the City's requirements of geological analysis on slopes of 20% or greater, usually located along stream embankments, before extensive tree removal, excavation, or construction occurs.

The biggest landslide threat is in the residential Oatfield/Oakridge corridor. This area has several steep slopes and slow ground movement. A home on Oakridge Drive slowly slid over the years and was eventually removed from the property. Ground movement is also common on Parkway and Caldwell, as several homeowners on these streets have put pilings under their homes.

Landslide susceptibility exposure for Gladstone is shown in Figure GA-5. Most of Gladstone demonstrates a low landslide susceptibility exposure. Steep slopes are primarily located along the Willamette and Clackamas Rivers, some of these locations are in High Rocks Park, Cross Park, Dahl Park, and Meldrum Park. The McLoughlin/Risley Wetland, a tributary to the Willamette River, has small areas of steep slopes as well. There is approximately 7% within Gladstone that have very high or high landslide susceptibility exposure, while approximately 22% show moderate landslide susceptibility exposure.¹⁵

Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard, and assets.

Vulnerability Assessment

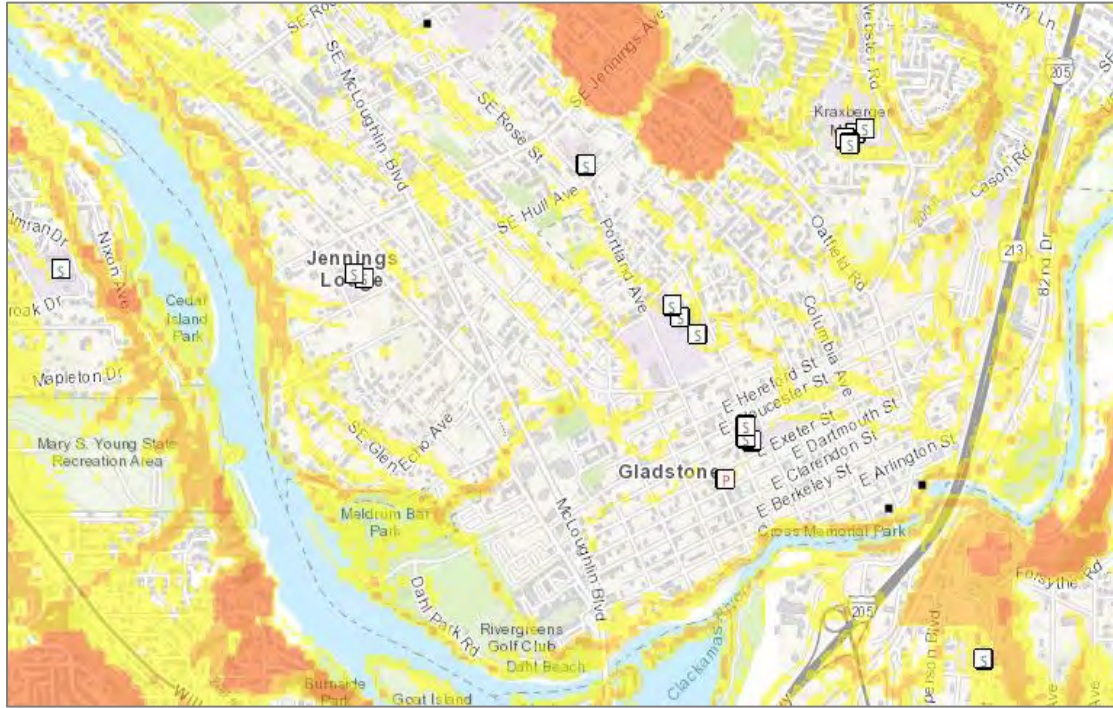
Due to insufficient data and resources, Gladstone is currently unable to perform a quantitative risk assessment for this hazard. However, DOGAMI completed a statewide landslide susceptibility assessment in 2016 ([O-16-02](#)), general findings from that report are provided above and within Figure GA-5.

Potential landslide-related impacts are adequately described within Volume I, Section 2, and include infrastructure damages, economic impacts (due to isolation, and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides, and debris flows can potentially occur during any winter, and thoroughfares beyond City limits are susceptible to obstruction as well. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables GA-5 through GA-10.

The most common type of landslides are slides caused by erosion. Slides move in contact with the underlying surface, are generally slow moving, and can be deep. Rainfall-initiated landslides tend to be smaller; while earthquake induced landslides may be quite large. All soil types can be affected by natural landslide triggering conditions.

¹⁵ DOGAMI. [Open-File Report, O-16-02](#), *Landslide Susceptibility Overview Map of Oregon* (2016)

Figure GA-5 Landslide Susceptibility Exposure



Low	Landsliding unlikely. Areas classified as Landslide Density = Low (less than 7%) and areas classified as Slopes Prone to Landsliding = Low.
Moderate	Landsliding possible. Areas classified as Landslide Density = Low to Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = Moderate OR areas classified as Landslide Density = Moderate (7%-17%) and areas classified as Slopes Prone to Landsliding = Low.
High	Landsliding likely. Areas classified as Landslide Density = High (greater than 17%) and areas classified as Slopes Prone to Landsliding = Low and Moderate OR areas classified as Landslide Density = Low and Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = High.
Very High	Existing landslides Landslide Density and Slopes Prone to Landsliding data were not considered in this category. Note: the quality of landslide inventory (existing landslides) mapping varies across the state.

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

Note: To view detail click the link above to access Oregon HazVu

Mitigation Activities

Gladstone works to mitigate future landslide hazards. The city development code includes several policies and regulations to protect slopes. Within the Comprehensive Plan there is language that make slopes of 25% or greater as unbuildable. The Municipal Code has surface and subsurface drainage requirements (17.56) to limit the potential of changes to surface drainage on slopes.

Please review Volume I, Section 2 for additional information on this hazard.

Severe Weather

Severe weather can account for a variety of intense, and potentially damaging hazard events. These events include extreme heat, windstorms, and winter storms. The following section describes the unique probability, and vulnerability of each identified weather hazard.

Extreme Heat

The HMAC determined that the City's probability for extreme heat events is **moderate** and that their vulnerability is **moderate**. *The probability rating increased, and the vulnerability rating did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the City as well.

A severe heat episode or "heat wave" occurs about every two to three years, and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days with temperatures greater than or equal to 90-degrees, or 100-degrees, Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit, and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The City of Gladstone has not experienced any life-threatening consequences from the few historical extreme heat events, although changes in climate indicate that the area should expect to see more extreme heat events.

Please review Volume I, Section 2 for additional information on this hazard.

Windstorm

The HMAC determined that the City's probability for windstorm is **moderate** and that their vulnerability to windstorm is **moderate**. *The probability rating decreased and vulnerability rating did not change, since the previous version of this NHMP addendum. Previously, the severe storm hazard profile was a single risk assessment, which is now divided into three separate severe weather hazards: Extreme Heat, Windstorm, and Winter Storm.*

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent, and probability of a potential event within the region. Because windstorms typically occur during winter months, they are sometimes accompanied by flooding and winter storms (ice, freezing rain, and very rarely, snow). Other severe weather events that may accompany windstorms, including thunderstorms, hail, lightning strikes, and tornadoes are generally negligible for Gladstone.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation, and economic disruptions result as well.

Damage from high winds generally has resulted in downed utility lines, and trees usually limited to several localized areas. Electrical power can be out anywhere from a few hours to

several days. Outdoor signs have also suffered damage. If the high winds are accompanied by rain (which they often are), blowing leaves, and debris clog drainage-ways, which in turn may cause localized urban flooding.

Please review Volume I, Section 2 for additional information on this hazard.

Winter Storm (Snow/Ice)

The HMAC determined that the City's probability for winter storm is **high** and that their vulnerability to winter storm is **moderate**. *These ratings did not change, since the previous version of this NHMP addendum. Previously, the severe storm hazard profile was a single risk assessment, which is now divided into three separate severe weather hazards: Extreme Heat, Windstorm, and Winter Storm.*

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent, and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the City typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

The biggest impact of winter storms is congestion on roadways. In 2016 and 2017 the Governor declared a state of emergency for the county, though no major damage was reported in city limits.

Most winter storms typically do not cause significant damage, they are frequent, and have the potential to impact economic activity. Road, and rail closures due to winter weather are an uncommon occurrence but can interrupt commuter, and commercial traffic as noted above.

Vulnerability Assessment

Due to insufficient data and resources, Gladstone is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Assets section and Tables GA-5 through GA-10.

Mitigation Activities

Mitigating severe weather can be difficult because storms affect all areas of the city, but Gladstone has made progress to reduce the effects of storms. Most utilities are above ground, though all new utilities are required to be underground. All water, phone and sewer lines have been placed underground. Gladstone also has snowplows and clears arterials first to help expedite snow removal.

Please review Volume I, Section 2 for additional information on this hazard.

Volcanic Event

The HMAC determined that the City's probability for a volcanic event is **low** and that their vulnerability to a volcanic event is **low**. *The probability rating did not change, while the vulnerability decreased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of volcanic hazards, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the western portion of the County is likely to affect Gladstone as well. Several volcanoes are located near Gladstone, the closest of which are Mount Hood, Mount Adams, Mount Saint Helens, Mount Rainier, and the Three Sisters.

Vulnerability Assessment

Due to insufficient data and resources, Gladstone is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables GA-5 through GA-10.

Due to Gladstone's relative distance from volcanoes, the city is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Depending on wind patterns and which volcano erupts, however, the city may experience ashfall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city could experience a heavier coating of ash.

Mitigation Activities

The existing volcano hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Wildfire

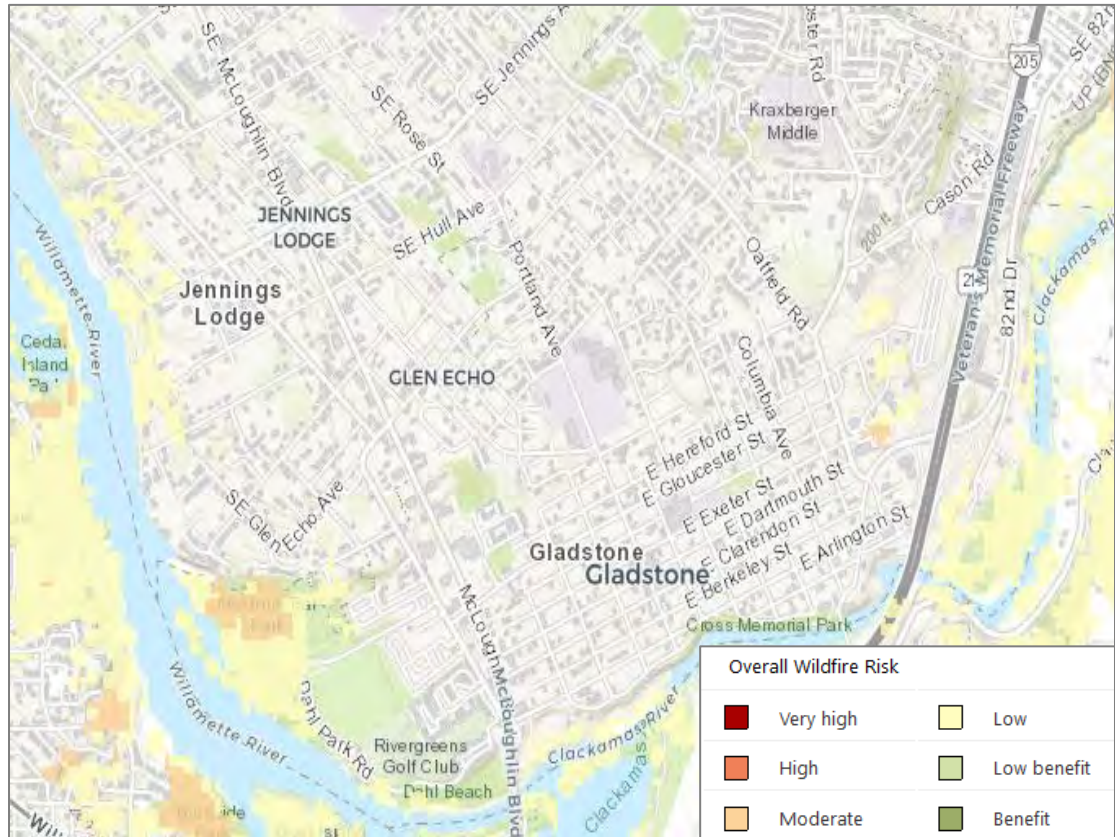
The HMAC determined that the City's probability for wildfire is **moderate**, and that their vulnerability to wildfire is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

The [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) was completed in May 2018. The CWPP is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard: <https://www.clackamas.us/dm/CWPP.html>. Information specific to Gladstone is found in the following chapter: [Chapter 10.6: Gladstone Fire Department](#).

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions. Weather, and urbanization conditions are primarily at cause for the hazard level. Gladstone has not experienced a wildfire within City limits, but the city has abundant wooded areas that are a concern in the case of a wildfire event. Figure GA-6 shows overall wildfire risk in Gladstone.

Clackamas County has two major physiographic regions: the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern Clackamas County. The Willamette River Valley, which includes Gladstone, is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range has a relatively small population and is characterized by heavily forested slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to its dense forest land. Human caused fires are responsible for most fires in Clackamas County. In Gladstone most instances the fires have been small enough to contain quickly and easily.

Figure GA-6 Overall Wildfire Risk



Source: [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

Gladstone is surrounded mostly by urban areas which creates a buffer from the forested areas. There are some areas of heavy tree coverage and other fuel supplies include the open field along Webster Rd, Billy Goat Island, Meldrum Bar, and Nick Shannon Park. Additionally, these areas are located adjacent to potential wildfire hazard zones: the business corridor along Highway 99E, area between Ridgeway Dr and Parkway Dr, area near Bird Song Way, Rinearson Creek wetlands, and the Oatfield/Oakridge corridor. Identified High and Medium Priority Communities at Risk (CARs) located within the City are: (High) Billy Goat Island, Dahl Beach, Parkway Woods, and (Medium) Risley Wetlands.¹⁶ Wildfires are not a frequent occurrence within the city, but regional wildfires occasionally introduce pollutants within

¹⁶ Clackamas County Community Wildfire Protection Plan, *Molalla Fire Department* (2018), Table 10.13-1.

the city. Gladstone sits in the bottom of a valley, and pollution from regional fires settles in the area, causing health concerns for residents.

Most of the city has less severe (moderate or less) wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions.¹⁷ However, conditions vary widely and with local topography, fuels, and local weather (including wind) conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts.

Vulnerability Assessment

Due to insufficient data and resources, Gladstone is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables GA-5 through GA-10.

The potential community impacts, and vulnerabilities described in Volume I, Section 2 are generally accurate for the City as well. Gladstone's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. The City will update the City's wildfire risk assessment if the fire plan presents better data during future updates (an action item is included to participate in future updates to the CWPP).

Property can be damaged or destroyed with one fire as structures, vegetation, and other flammables easily merge to become unpredictable, and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

Mitigation Activities

Gladstone uses several mitigation tools to reduce the city's risk to wildfires. Gladstone Fire Department adopted a district-wide wildland map that governs new construction, and an active public education program for high risk-wildfire areas (including information on fire prevention and defensible space).

Please review the [2017 Clackamas Community Wildfire Protection Plan \(CWPP\)](#) and Volume I, Section 2 for additional information on this hazard.

¹⁷ [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

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ATTACHMENT A: ACTION ITEM FORMS

ACTION ITEM FORMS

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* - Priority Action Item

Note: The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity.

Summary of Action Changes

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

Previous NHMP Actions Completed:

Multi-Hazard #6 (2012/2013): “Update and revise the Gladstone Emergency Operations Plan” was updated. In 2014 the City updated the Emergency Operations Plan and is now transitioning this action item into maintaining the plan.

Flood Action #3 (2012/2013): “Develop a Stormwater Master Plan” was updated. In 2014 the City completed its Stormwater Master Plan and is now transitioning this action item into maintaining and implementing the plan they completed.

See 2018 status identified in each action for activities that have been completed since the previous plan.

New NHMP Actions added to this version (2019):

Multi-Hazard #5 (2018/2019): “Maintain the Gladstone Emergency Operations Plan” revised the 2012 MH#6. In 2014 the City updated the Emergency Operations Plan and is now transitioning this action item into maintaining the plan.

Multi-Hazard #7 (2018/2019): “Update failing water distribution system” was added.

Flood Action #3 (2018/2019): “Maintain and implement the Gladstone Stormwater Master Plan” revised the 2012 FL#3. In 2014 the City completed its Stormwater Master Plan and is now transitioning this action item into maintaining and implementing the plan they completed.

Wildfire Action #1 (2018/2019): “Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan” was added and replaced 2012 WF#1 and WF#2.

Previous NHMP Actions Removed from this version:

Multi-Hazard Action #3 (2012/2013): “Continue to update and improve hazard assessments in the Natural Hazards Mitigation Plan as new information becomes available” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and considered during the five-year plan updates and did not need to be included as an action.

Multi-Hazard Action #8 (2012/2013): “Identify and pursue funding opportunities to develop and implement hazard mitigation activities” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Wildfire Action #1 (2012/2013): “Conduct community based fuel reduction demonstration projects in the wildland urban interface” was removed from the list since it was determined by the steering committee that this is a function of the Clackamas County Wildfire Protection Plan, which is a new action item, and did not need to be separated out as an individual action.

Wildfire Action #2 (2012/2013): “Promote fire resistant strategies for new and existing developments” was removed from the list since it was determined by the steering committee that this is a function of the Clackamas County Wildfire Protection Plan, which is a new action item, and did not need to be separated out as an individual action.

Note: 2012/2013 Actions MH#4, MH#5, MH#6 and MH#7 were renumbered to 2018/2019 Actions MH#3, MH#4, MH#5, and MH#6.

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 NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the County, participating cities, and special districts. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. The City 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, the City 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 several 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 HMAP but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and/or resources toward completion of the action items.

Internal partner organizations are departments within the City 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.

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 mitigation actions from the Gladstone Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Natural Hazard Mitigation Plan; Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating natural hazards plans into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community. <u>2012 Status:</u> The city adopted the 2008 FEMA maps and studies, and the updated areas of the development code that require stormwater detention on lots before releasing it to waterways (approved by the Planning Commission and City Council in September, 2009). Metro is now an external partner instead of a coordinating organization. The 2009 update expanded the action item to include ideas for implementation. <u>2018 Status:</u> Several plans have been updated – Water System Master Plan (2014), Stormwater Master Plan (2014), Sanitary Sewer Master Plan (2017), Parks Master Plan (2017), Transportation Master Plan (2017). The comprehensive plan has not been updated since 2006. The City could use technical assistance on comprehensive plan/code review and updates (potential funding: DLCD Technical Assistance Grant). 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Use the mitigation plan to help the update the Goal 7 section within Gladstone’s Comprehensive Land Use Plan; Integrate mitigation actions into current plans and policies where appropriate in order to ensure that mitigation becomes an integral component of the city’s long term priorities; and Use the natural hazard mitigation planning resources provided by the Oregon Partnership for Disaster Resilience to learn how to better integrate the NHMP into existing documents and programs (to be released Spring, 2010). Look into technical assistance on comprehensive plan or municipal code review and updates 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Planning Commission		Metro, Clackamas County Emergency Management, Oregon Office of Emergency Management, FEMA	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund; DLCD Technical Assistance Grant		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

Multi-Hazard #2

Proposed Action Item:		Alignment with Plan Goals:	
Develop, enhance, and implement education programs designed to reduce the losses from natural hazards.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the county's actions to mitigate hazards. <u>2012 Status:</u> The City Newsletter regularly includes articles about emergency preparedness and hazard mitigation, especially as hazard seasons approach. GEMS canvasses the city and passes out emergency preparedness/mitigation information at community events such as Chautauqua and National Night Out. A GEMS subcommittee focuses on one type of hazard at a time and targets educational pieces about that hazard. Events include an "Emergency Preparedness 101" class at the senior center, preparedness presentations at the LDS church, and fire and police booths every August at the Chautauqua Festival. The city plans to have a rehearsal shelter exercise in fall 2012. <u>2018 Status:</u> Continue to utilize the resources noted above, particularly city newsletter, social media (twitter, facebook, next door, Instagram) 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Gather hazard related information and public information materials, and disseminate to the public through the Gladstone City Newsletter and city website; Identify property owners in the flood, landslide, and wildfire hazard zones, and conduct a targeted mailing to disseminate hazard information; Encourage local businesses to develop business continuity plans; Partner with Clackamas County and other jurisdictions to develop education outreach for all hazards; Conduct public education as hazard seasons approach. Provide information for earthquake awareness month in April, wildfire prevention in summer, and flood and severe storm information in winter; Post hazard information on the Gladstone Fire Department website; Prepare and distribute an informational brochure on unstable slopes, historical landslide areas, and mitigation strategies; and Encourage individual homeowners to implement mitigation practices. 			
Coordinating Organization:		Gladstone Emergency Management and Support (GEMS)	
Internal Partners:		External Partners:	
Police, Fire		Clackamas County Emergency Management	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, DLCDC Technical Assistance Grant		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

Multi-Hazard #3

Proposed Action Item:		Alignment with Plan Goals:	
Improve vegetation management throughout the city.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating vegetation management into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community. <u>2012 Status</u>: The city continues to clear fueling vegetation in green spaces, utilizes the jail work crew for work around the city, and continues hazardous tree removal efforts. Several volunteer and local service clubs and organizations continue to be committed to removing invasive species and replacing them with native species. <u>2018 Status</u>: Includes codes enforcement, education, utilities manage vegetation around their infrastructure. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Partner with Clackamas County, Oregon Department of Forestry, US Forestry Service, ODOT, and citizens to control vegetation along transportation corridors; Identify appropriate practices for eliminating invasive species such as blackberry and English Ivy; Maintain vegetation coverage for slope stability; Provide education to the public about justifications for, and benefits of vegetation mitigation practices; and Encourage fuels reduction on private property by providing education for pruning and remove trees and using native vegetation 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Fire		Clackamas Soil and Water Conservation District, Fire Co-op, Oregon Department of Forestry, US Forestry Service, Clackamas County, Clackamas River Basin Council, ODOT	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

Multi-Hazard #4

Proposed Action Item:		Alignment with Plan Goals:	
Enhance strategies for debris management for all hazards.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Landscaping and vegetation make a difference in mitigating the impacts of natural hazards. Trees break the force of the wind and stabilize the soil. Wetlands absorb much of the overflow from stream channels. Fire-resistant vegetation can retard the spread of wildfires toward vulnerable buildings. Limiting or regulating the amount of vegetation cleared off a hillside lot reduces the risk of increasing the number of landslide-prone areas in a community. Planting vegetation or maintaining slope terraces can also reduce slope-runoff. Planners can use landscaping requirements to preserve or enhance the protection such natural features afford. These requirements may be part of site plan reviews or a separate set of zoning regulations and environmental performance standards. <u>2012 Status:</u> Action was not implemented due to limited staff time and resources. The 2009 update added ideas for implementation. As of 2012, the city continues leaf pickup in the fall to prevent streets from clogging and buildup. <u>2018 Status:</u> City worked with County to create the regional Disaster Debris Management Plan. Local site for debris deposition identified (9090 McLoughlin Blvd). 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Research debris management strategies used by other jurisdictions; Develop a debris management plan; Obtain funding for better equipment to handle debris; and Partner with neighboring jurisdictions and organizations to manage debris during disasters. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
City Administrator's Office		Gladstone Disposal, Clackamas County, Metro	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

Multi-Hazard #5

Proposed Action Item:		Alignment with Plan Goals:	
Maintain the Gladstone Emergency Operations Plan.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Emergency Operations Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Mapping out evacuation routes for all hazards before those hazards occur help first responders and residents know the routes to take when a situation arises. • <u>2012 Status</u>: Action was not implemented due to limited staff time and resources. The EOP was last updated in 2005 and GEMS works with it the plan on a regular basis. Public Works receives updates from PGE when their EOP has changes. As of 2012, the Emergency Operations Plan is currently in the process of being updated. The GEMS group meets 3 times a quarter and continues to work to get the public involved and aware. • <u>2018 Status</u>: EOP updated in 2014. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Consult and integrate appropriate information from neighboring jurisdictions' emergency operations plans such as the Clackamas County Emergency Operations Plan and the PGE Emergency Operations Plan 			
Coordinating Organization:		Police	
Internal Partners:		External Partners:	
Public Works; Fire; City Administrator's Office		Clackamas County, Oregon City, Milwaukie, West Linn	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2005 plan update process		
Priority:	Medium		

Multi-Hazard #6*

Proposed Action Item:		Alignment with Plan Goals:	
Evaluate and upgrade stormwater management infrastructure and identify appropriate mitigation strategies.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Stormwater Management Plan; Capital Improvement Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Stormwater management infrastructure is very important for various types of hazards. <u>2012 Status:</u> Gladstone has mapped the water system using GPS units and continues to map surface water management areas. The city has tentative plans for updating the stormwater system in Municipal Separate Storm Sewer (MS4) plans. Funding to replace the asbestos concrete water lines is ongoing. The 2009 update now lists Oak Lodge Sanitary District as an external partner instead of a coordinating organization. <u>2018 Status:</u> MOU with DEQ regarding stormwater/sanitary sewer overflow concerns. Stormwater Master Plan updated in 2014. Gladstone has completed water, sewer, and stormwater master plans. Gladstone is currently working on sustainable funding for its utilities to address its infrastructure needs. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Identify culverts that are insufficient for handling high flows and obtain funding for upgrades; Obtain funding to replace or line antiquated clay sewer lines in the downtown area Obtain funding to replace 16 miles of asbestos concrete water lines in Oak Ridge area (landslide prone) with ductile iron. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
City Administrator's Office		Oak Lodge Sanitary District, URS Corporation (engineering firm), WES	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan update process		
Priority:	High		

* Indicates High Priority Action Item

Multi-Hazard #7*

Proposed Action Item:		Alignment with Plan Goals:	
Update failing water distribution system.		Protect Life and Property; Enhance Natural Systems; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Water System Management Plan; Gladstone Projects; Capital Improvement Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Water infrastructure is very important for various types of hazards. 			
Ideas for Implementation:			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Fire; City Administrator's Office		URS Corporation	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Medium to High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	High		

* Indicates High Priority Action Item

Earthquake #1

Proposed Action Item:		Alignment with Plan Goals:	
Conduct seismic evaluations on identified critical/essential facilities and infrastructure for implementing appropriate structural and non-structural mitigation strategies.		Protect Life and Property; Augment Emergency Services	
Alignment with Existing Plans/Policies:			
Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. • <u>2012 Status:</u> Partially Complete/Deferred: The Gladstone Fire Station received a grant for seismic upgrades. An engineering firm has been hired but the project will not be fully completed for a couple more years. In 1996 the upper reservoir had seismic upgrades done, and all new reservoirs are seismically upgraded. GEMS educate citizens on nonstructural mitigation projects and distribute Red Cross information pamphlets at community events. As of 2012, the seismic upgrade to the fire department has been completed. The city of Gladstone is seeking funding for the possible upgrade to police and city hall. This project is still in the decision phase. • <u>2018 Status:</u> Police Department retrofit via 2013-2014 SRGP grant. The City is building a new Civic Center to house City Hall and the Police Station at 18505 Portland Ave to be completed in 2020: https://www.ci.gladstone.or.us/generalnews/project/gladstone-civic-center 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Obtain funding to perform evaluations; • Obtain funding to retrofit/replace the Police and Fire Station (City Hall) as a model project for other critical facilities in Gladstone. • Prioritize seismic upgrades based on criticality of need and population served; and • Partner with agencies responsible for maintaining the 205 Bridge, Oregon City Bridge, and the sewerage treatment walking bridge to upgrade these bridges. 			
Coordinating Organization:		City Administrator's Office	
Internal Partners:		External Partners:	
Fire, Police, Gladstone Emergency Management and Support, Public Works		ODOT, Clackamas County, WES, Oak Lodge Sanitary, DOGAMI, FEMA	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Seismic Rehabilitation Grant Program, Hazard Mitigation Assistance Grants		Moderate to High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

Flood #1

Proposed Action Item:		Alignment with Plan Goals:	
Ensure continued compliance in the National Flood Insurance Program through enforcement of local floodplain management ordinances.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Stormwater Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. The Stormwater Master Plan addresses the issues around urban flooding that Molalla is currently vulnerable to. 2018 Status: The Dahl Beach project was completed in 2016 and is still in its 5 year monitoring phase to make sure that it will mitigate or improve environmental conditions as well as decrease flooding. The City continues to have flooding issues along the Clackamas River and during rain events due to inadequate storm drainage. The City Council passed utility increases for 2018-2019 for improving the water and sewage infrastructure. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Community Assistance Visits (CAV) are scheduled visits to communities participating in the NFIP for: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. Actively participate with DLCD and FEMA during Community Assistance Visits; Assess the floodplain ordinances to ensure they reflect current flood hazards and situations, and meet NFIP requirements; Coordinate with the county to ensure that floodplain ordinances and NFIP regulations are maintained and enforced; and Mitigate areas that are prone to flooding and/or have the potential to flood. These areas include Clackamas Blvd., Edgewater Road, River Lane, Evergreen Lane, Rivergreen Golf Course, Dahl Park, Meldrum Bar Park, south end of Rivergreens Road (Rivergreens Apartments), complex on River Road south of Rivergreens Apartment, south end of Jensen Road (golf course), bottom of Rinearson Road, and Glen Echo between Addie and Portland Avenue. 			
Coordinating Organization:		City Administrator's Office	
Internal Partners:		External Partners:	
Fire, Public Works		FEMA, DLCD, Clackamas County Planning Department	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

Flood #2

Proposed Action Item:		Alignment with Plan Goals:	
Coordinate with Clackamas County to address the flooding issues on Glen Echo that stem from the two-way diversion on Hull Avenue put in by Clackamas County.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Stormwater Master Plan;			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Glen Echo Wetland is 2.97 acres and was dedicated to the city in 1988. There are issues around the two way diversion on Hull Avenue. <u>2018 Status</u>: The City replaced the pump at Glen Echo, though there are still bottlenecks and floods in the area. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Hire an engineering firm to conduct a study on areas that have flooded since the two-way diversion was put in, including Glen Echo and Rinearson Road; Identify appropriate staff members to present the flooding issues to Clackamas County; Develop an Intergovernmental Agreement with Clackamas County; and Work with county staff to develop mitigation projects to alleviate the flooding problems. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
City Administrator's Office		FEMA, DLCD, Clackamas County Planning Department, URS Corporation, Oak Lodge Sanitary	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Medium to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

Flood #3

Proposed Action Item:		Alignment with Plan Goals:	
Maintain and Implement the Gladstone Stormwater Master Plan.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services	
Alignment with Existing Plans/Policies:			
Stormwater Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Stormwater management infrastructure is very important to reduce risk related to the flood hazard. <u>2018 Status</u>: The City completed the Plan in 2014 and regularly completes projects identified in the plan. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Identify appropriate staff members to work on maintaining a stormwater management plan; Identify funding to implement the plan; and Identify mitigation action items that reduce the city's vulnerability to flood and landslide related hazards 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
City Administrator's Office		Clackamas County Water Environment Services, Department of Environmental Quality, Metro	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Medium to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

Landslide #1

Proposed Action Item:		Alignment with Plan Goals:	
Reduce the vulnerability of property owners in landslide-prone areas.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Development Code			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. <u>2018 Status:</u> The city does not currently regulate landslides or geologic hazards. The Comprehensive Plan includes a Geologic Hazards Map, goal, and policies that relate to geologic hazards. Non-regulatory landslide maps exist (DOGAMI Bulletin 99), which have been revised via DOGAM Report O-16-02. 			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
<ul style="list-style-type: none"> The City of Gladstone should update their comprehensive plan and implementing codes to respond to changes in state law or regulatory streamlining. Focus efforts on Oatfield Road, Oakridge, Parkway, Caldwell and the area from Jennings to Glen Echo; Develop public information to emphasize economic risk when building on potential or historical landslide areas; Update the landslide hazard map when LIDAR data becomes available; and Review the planning and building codes and make updates or changes, if necessary. 			
Coordinating Organization:		City Administrator's Office	
Internal Partners:		External Partners:	
Public Works		DOGAMI, Clackamas County, Metro	
Potential Funding Sources:		Estimated cost:	Timeline:
General fund		Medium to High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2012 plan development process		
Priority:	Medium		

Severe Weather #1

Proposed Action Item:		Alignment with Plan Goals:	
Reduce negative effects from severe windstorm and severe winter storm events.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Stormwater Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure[201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to cause power outages can assist a community in mitigating its overall risk to wind and winter storms. <u>2018 Status</u>: The city is continually looking for ways to reduce negative effects from storms. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Reduce power outages by partnering with PGE to obtain funding to bury power lines subject to frequent failures; Continue regular tree trimming practices; Partner with PGE to continue hazardous tree inventory and mitigation programs; and Continue to require that new developments place utilities underground. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
City Administrator's Office, Gladstone Fire, Police		PGE; ODOT; private landowners	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

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; Enhance Natural Systems; Augment Emergency Services; 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:			
The wildfire mitigation action items provide direction on specific activities that organizations and residents in Gladstone can take to reduce wildfire hazards.			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
<u>Wildfire Risk Assessment (Ch. 4):</u>			
<ol style="list-style-type: none"> Maintain and update the Fuels Reduction (FR) and Communities at Risk (CAR) maps and databases. Continue to track structure vulnerability data throughout the County through structural triage assessments. Update the Overall Wildfire Risk Assessment as new data becomes available. 			
<u>Hazardous Fuels Reduction and Biomass Utilization (Ch. 5):</u>			
<ol style="list-style-type: none"> Develop and maintain an inventory of potential and successful FR projects by meeting with parks and natural lands managers quarterly. Continue securing funding to implement projects/hire seasonal ODF staff. 			
<u>Emergency Operations (Ch. 6):</u>			
<ol style="list-style-type: none"> Develop and FDB Communications Works Group. Conduct a Conflagration Exercise. 			
<u>Education and Community Outreach (Ch. 7):</u>			
<ol style="list-style-type: none"> Develop Firewise toolkit for CAR's. Create incentives for fuels reduction. Update and distribute the Burn Permitting and Fire Restrictions Brochure. Continue to improve address signage throughout the County. 			
<u>Structural Ignitability Policies and Programs (Ch. 8):</u>			
<ol style="list-style-type: none"> Identify a DTD representative for the WFEP. Improve coordination with Rural Fire Agencies. Integrate WU into Plan Map and include a public outreach strategy. 			
Coordinating Organization:		Gladstone Fire Department	
Internal Partners:		External Partners:	
City Administrator's Office, Planning		Clackamas Fire Defense Board, Oregon Department of Forestry, U.S. Forest Service, U.S. Bureau of Land Management, public land management agencies	
Potential Funding Sources:		Estimated cost:	Timeline:
ODF, operating budgets		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item (replaced WF #1 and WF #2)		
Priority:	High (CWPP identified priority actions listed above)		

* Indicates High Priority Action Item

ATTACHMENT B: PUBLIC INVOLVEMENT SUMMARY

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

To provide the public information regarding the draft NHMP addendum, and provide an opportunity for comment, an announcement (see text below) was provided on the city's website and social media pages including a method for the public to provide comment.

The public review period was open from August 1 through August 16. During the public review period there were no comments provided.

Press Release

Gladstone Natural Hazard Mitigation Plan

Clackamas County
Pre-Disaster Mitigation Planning

PRESS RELEASE

DATE: July 31, 2019

FROM: Jacque M Betz, City Administrator

SUBJECT: Press Release for Gladstone addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan Update – Notice and Opportunity for Public Comment

For Immediate Release

Gladstone seeks additional public input on update to Natural Hazard Mitigation Plan

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

A natural hazard mitigation plan provides communities with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities, and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

An electronic version of the updated draft Gladstone NHMP addendum will be available for formal public comment beginning August 2, 2019 To view the draft please visit: (www.ci.gladstone.or.us)

If you have any questions regarding the Gladstone NHMP addendum or the update process in general, please contact: Jacque Betz, City Administrator at (503) 557-2769 or betz@ci.gladstone.or.us; or Michael Howard, Assistant Program Director for the Oregon Partnership for Disaster Resilience at (541) 346-8413 or mrhoward@uoregon.edu.

Supporting Documents

 City of Gladstone Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan (3 MB)

Social Media



Gladstone is in the process of updating our Natural Hazard Mitigation Plan or NHMP. Please see the attached press release for more information.

**Clackamas County
Pre-Disaster Mitigation Planning
PRESS RELEASE**

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The City of Gladstone
August 2 at 9:39 AM · 🌐

For more information on the City of Gladstone's Natural Hazard Mitigation Plan, please visit:
https://www.ci.gladstone.or.us/.../gladstone_addendum_draft.p...

Thank you.

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City of Happy Valley Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan



Photo Credit: Jake Egbert

March 2019

Volume II: Happy Valley Addendum



Prepared for:

City of Happy Valley

Prepared by:

**University of Oregon
Institute for Policy Research and Engagement
Oregon Partnership for Disaster Resilience**

Planning grant funding provided by:



FEMA

Federal Emergency Management Agency (FEMA)
Pre-Disaster Mitigation Program
Grant: EMS-2017-PC-0005
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Additional Support Provided by:



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FEMA

September 25, 2019

The Honorable Jim Bernard
Chair, Clackamas County Commissioners
2020 Kaen Road Suite A
Oregon City, Oregon 97045

Dear Chairman Bernard:

On April 12, 2019, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan* as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance grants through April 11, 2024, through your state.

Clackamas County	City of Estacada	City of Lake Oswego
City of West Linn	City of Wilsonville	City of Johnson City
City of Oregon City	City of Happy Valley	City of Canby
Clackamas Fire District		

The updated list of approved jurisdictions includes the cities of Canby, Happy Valley, Oregon City, Johnson City, and the Clackamas Fire District which recently adopted the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan*. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Joseph Murray, State Hazard Mitigation Planner with Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities.

Sincerely,

Mark Carey, Director
Mitigation Division

Enclosure

JG

Resolution # 19-21

A Resolution Adopting the City of Happy Valley Representation in the Updates to the Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan

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

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

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

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

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

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

Whereas, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *City of Happy Valley addendum* to the *Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan* and pre-approved it (dated, June 6, 2019) contingent upon this official adoption of the participating governments and entities;

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

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

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

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


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

Adopted this 17th day of September, 2019



Tom Ellis
Mayor

ATTEST:



Ben Bryant
Assistant City Manager

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Purpose

This is an update of the Happy Valley addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation and Volume III (Appendices) which provide additional information. This addendum meets the following requirements:

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

Updates to Happy Valley's addendum are further discussed throughout the NHMP and within Volume III, Appendix B, which provides an overview of alterations to the document that took place during the update process.

Happy Valley adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on **September 17, 2019**. FEMA Region X approved the Clackamas County NHMP on **April 12, 2019** and the City's addendum on **September 25, 2019**. With approval of this NHMP the City is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **April 11, 2024**.

Mitigation Plan Mission

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

The City concurs with the mission statement developed during the Clackamas County planning process (Volume I, Section 3):

Promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

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

The City concurs with the goals developed during the Clackamas County planning process (Volume I, Section 3). All NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Below is a list of the NHMP goals:

GOAL #1: PROTECT LIFE AND PROPERTY

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

GOAL #2: ENHANCE NATURAL SYSTEMS

- Balance watershed planning, natural resource management, and land use planning with natural hazards mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

GOAL #3: AUGMENT EMERGENCY SERVICES

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, and business, and industry.
- Coordinate and integrate natural hazards mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL #4: ENCOURAGE PARTNERSHIPS FOR IMPLEMENTATION

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

GOAL #5: PROMOTE PUBLIC AWARENESS

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

NHMP Process, Participation and Adoption

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

Happy Valley first developed an addendum to Clackamas County's Natural Hazards Mitigation Plan in 2009. This plan was updated in 2013 and in 2018. The last update of the

Happy Valley addendum to the Clackamas County NHMP was approved by FEMA on April 8, 2013.

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

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research, and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM), Clackamas County, and Happy Valley to update their NHMP. This project is funded through the Federal Emergency Management Agency's (FEMA) Fiscal-Year 2016 (FY16) Pre-Disaster Mitigation (PDM) Competitive Grant Program EMS-2017-PC-0005 (PDMC-PL-10-OR-2016-001). Members of the Happy Valley NHMP Hazard Mitigation Advisory Committee (HMAC) also participated in the County NHMP update process (Volume III, Appendix B).

The Clackamas County NHMP, and Happy Valley addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. The Happy Valley HMAC guided the process of developing the NHMP.

Convener

The Happy Valley Director of Community Services and Public Safety serves as the NHMP addendum convener. The convener of the NHMP will take the lead in implementing, maintaining and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the City of Happy Valley HMAC met formally and informally, to discuss updates to their addendum (Volume III, Appendix B). The HMAC reviewed and revised the City's addendum, with focus on the NHMP's risk assessment and mitigation strategy (action items).

This addendum reflects decisions made at the designated meetings and during subsequent work and communication with Clackamas County Resilience Coordinator, and the OPDR. The changes are highlighted with more detail throughout this document and within Volume III, Appendix B. Other documented changes include a revision of the City's risk assessment and hazard identification sections, NHMP mission and goals, action items, and community profile.

The Happy Valley HMAC was comprised of the following representatives:

- Convener, Steve Campbell, Director of Community Services and Public Safety
- Chris Randall, Director of Public Works
- Ryan Kersey, Code Enforcement Manager

Public participation was achieved with the establishment of the HMAC, which was comprised of City officials representing different departments and sectors and members of the public. The HMAC served as the local review body for the NHMP's development.

Community members were provided an opportunity for comment via the NHMP review process, and through a survey administered by Clackamas County (Volume III, Appendix G).

NHMP Implementation and Maintenance

The City Council will be responsible for adopting the Happy Valley addendum to the Clackamas County NHMP. This addendum designates a HMAC and a convener to oversee the development and implementation of action items. Because the City addendum is part of the County's multi-jurisdictional NHMP, the City will look for opportunities to partner with the County. The City's HMAC will convene after re-adoption of the Happy Valley NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The City's Director of Community Services and Public Safety will serve as the convener and will be responsible for assembling the HMAC. The HMAC will be responsible for:

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating and training new HMAC members on the NHMP and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement; and
- Documenting successes and lessons learned during the year.

The convener will also remain active in the County's implementation and maintenance process (Volume I, Section 4).

The City will utilize the same action item prioritization process as the County (Volume I, Section 4).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, and Building Codes, as well as the [Clackamas County NHMP](#), and the [State of Oregon NHMP](#).

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the city. Plans and policies already in existence have support from residents, businesses and policy makers. Where possible, Happy Valley will implement the NHMP's recommended actions through existing plans and policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and

implemented. Implementation opportunities are further defined in action items when applicable.

Future development without proper planning may result in worsening problems associated with natural hazards. Metro, the regional government for Clackamas, Multnomah, and Washington counties, determines many land use laws for the tri-county region and sets the urban growth boundary. The entire Portland Metro area is subject to tremendous growth pressures due to its desirable location and the restrictions on urban sprawl placed by urban growth boundary requirements.

Happy Valley's acknowledged comprehensive plan is the City of Happy Valley Comprehensive Plan (1984, updated October 2017). The Oregon Land Conservation and Development Commission first acknowledged the plan in 1984. The City implements the plan through the Development Code.

Happy Valley currently has the following plans, regulations, and projects that relate to natural hazard mitigation. For a complete list visit the City's [website](#):

- [Comprehensive Plan](#)
- [Development Code](#)
 - [Section 8.08.290 Noxious Vegetation](#)
 - [Section 9.08.070 Execution of Operation](#)
 - [Section 9.08.090 Task Assignments](#)
 - [Section 15.12.040 Hazards](#)
 - [Chapter 15.24 Flood Damage Prevention](#)
 - [Chapter 16.32 Steep Slopes Development Overlay Zone](#)
 - [Chapter 16.42 Landscaping, Street Trees, Fences and Walls, Recreation Areas](#)
- [Parks Master Plan](#)
- [Pedestrian System and Trail Master Plan](#)
- [Pleasant Valley/North Carver Comprehensive Plan](#)
- [Stormwater Management Plan for Clackamas County Service District No. 1 and the City of Happy Valley](#)
- [Transportation System Plan](#)
- Winter Response Operations Plan

Other plans:

- [Clackamas County Community Wildfire Protection Plan](#)
 - [Clackamas Fire District #1 \(CFD#1\)](#)

Government Structure

The City of Happy Valley has a council-manager form of government. The City Council consists of five members; a mayor and four councilors. The mayor presides over Council meetings. The mayor and City Council members are elected to four-year terms of office through a general election. The City Council is responsible for identifying problems and needs within the community and then addressing those problems through community goals and objectives.

The Economic and Community Development Department is responsible for residential building and planning and monitoring future. They make recommendations to City Council for changes to the Planning and Land Development Ordinance, Historic District Zones, the Comprehensive Plan and the Zoning Map.

The City of Happy Valley provides a variety of services to promote the safety and welfare of its residents. Public services that support the demands of a growing community include Community Services, Economic and Community Development, Public Safety, Public Works.

Community Services: Responsible for community and business outreach, passports program, park reservations, community events, customer service responsibilities, and school programs.

Economic and Community Development: This department consists of the economic development, planning, engineering, and building divisions to manage development projects within the city and produces the strategic vision of the city.

Public Safety: Consists of the Municipal Court, Happy Valley Police, Code Enforcement, and Clackamas Fire District #1 who provide services to enhance the health and safety of Happy Valley residents.

Public Works: Responsible for maintaining streets, streetlights, water, sewer, and stormwater systems and manages the Willamette River Water Treatment and Wastewater Treatment Plants. Public works is also responsible for emergency management and response.

Continued Public Participation

An open public involvement process is essential to the development of an effective NHMP. To develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunity for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the NHMP during review.¹ Keeping the public informed of the City's efforts to reduce its risk to future natural hazard events is important for successful NHMP implementation and maintenance. The City is committed to involving the public in the NHMP review and update process (Volume I, Section 4). The City posted the plan update for public comment before FEMA approval, and after approval will maintain the plan on the City's website: <https://www.happyvalleyor.gov/>.

NHMP Maintenance

The Clackamas County NHMP and City addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the County NHMP update process, the City will also review and update its addendum (Volume I, Section 4). The convener will be responsible for convening the HMAC to address the questions outlined below.

- Are there new partners that should be brought to the table?

¹ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

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

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

Mitigation Strategy

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

The City's mitigation strategy (action items) were first developed during the 2009 NHMP planning process and revised during subsequent NHMP updates. During these processes, the HMAC assessed the City's risk, identified potential issues, and developed a mitigation strategy (action items).

During the 2018 update process the City re-evaluated their mitigation strategy (action items). During this process action items were updated, noting what accomplishments had been made and whether the actions were still relevant; any new action items were identified at this time (see Volume III, Appendix B for more information on changes to action items).

Priority Action Items

Table HA-1 presents a list of mitigation actions. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity. High priority actions are shown in **bold** text with grey highlight. The City will focus their attention, and resource availability, upon these achievable, high leverage, activities over the next five-years. Although this methodology provides a guide for the HMAC in terms of implementation, the HMAC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for detailed information for each action. Full text of the plan goals referenced in Table HA-1 is located on page HA-2.

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Table HA-1 Happy Valley Action Items

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
MH #1	Develop, enhance, and implement public education programs to inform the public about methods for mitigating the impacts of natural hazards.	Planning	Public Works, Public Safety, Building, Planning Commission, Finance	Ongoing	✓		✓	✓	✓
MH #2	Integrate the goals and action items from the Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	Planning	Public Works, Building, Engineering, Planning Commission	Ongoing	✓	✓	✓	✓	✓
MH #3	Identify and pursue funding opportunities to develop and implement hazard mitigation activities.	Planning	Economic and Community Development, Planning Commission, Public Works, Finance, Code Enforcement,	Ongoing	✓	✓	✓	✓	✓
MH #4	Encourage greenspace management throughout the city.	Economic and Community Development	Planning, Public Works	Ongoing	✓	✓		✓	
EQ #1	Conduct seismic evaluations of the Community Policing Center, Public Works Complex, and identified shelters and implement appropriate structural and non-structural mitigation strategies.	Economic and Community Development, Public Works	Building, Engineering	Long Term	✓		✓	✓	
FL #1	Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.	Economic and Community Development	GIS, Public Works	Ongoing	✓	✓		✓	✓
FL #2	Increase capacity of culverts throughout the city.	Economic and Community Development	Engineering, Public Works	Ongoing	✓		✓	✓	

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
FL #3	Maintain and implement surface water management plan.	Public Works	Planning, Engineering, Building, Planning Commission	Ongoing	✓	✓			✓
SS #1	Reduce negative effects from severe windstorm, severe winter storm, and extreme heat events.	Economic and Community Development	Public Works, Engineering, Building	Ongoing	✓	✓	✓	✓	✓
VE #1	Implement volcanic ash mitigation actions.	Public Safety	Engineering, Planning	Ongoing	✓				
WF #1	Promote fire-resistant strategies for new and existing developments.	Planning	Engineering, Building, Planning Commission, Clackamas Fire District #1	Ongoing	✓	✓	✓	✓	✓
WF #2	Conduct community-based fuel reduction demonstration projects in the wildland-urban interface.	Community Services	Parks and Recreation, Clackamas Fire District #1	Ongoing	✓	✓		✓	✓
WF#3	Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan	Clackamas Fire District #1	Economic and Community Development, Public Works	Ongoing	✓	✓	✓	✓	✓

Source: City of Happy Valley HMAC, 2018

Note: Full text of the plan goals referenced in this table is located on page HA-2.

Risk Assessment

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

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

The local level rationale for the identified mitigation strategies (action items) is presented herein and within Volume I, Section 3 and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure HA-1. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure HA-1 Understanding Risk



Hazard Analysis

The Happy Valley HMA developed their hazard vulnerability assessment (HVA), using their previous HVA and the County’s HVA as a reference. Changes from their previous HVA and the County’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Happy Valley, which are discussed throughout this addendum.

Table HA-2 shows the HVA matrix for Happy Valley listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response and recovery. The method provides the jurisdiction with a sense of hazard priorities but does not predict the occurrence of a hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake and Crustal earthquake) and one chronic hazard (winter storm) rank as the top hazard threats to the City (Top Tier). Wildfire, extreme heat, drought, and windstorm comprise the next highest ranked hazards (Middle Tier), while flood, volcanic event, and landslide hazards comprise the lowest ranked hazards (Bottom Tier).

Table HA-2 Hazard Analysis Matrix – Happy Valley

Hazard	Maximum				Total Threat Score	Hazard Rank	Hazard Tiers
	History	Vulnerability	Threat	Probability			
Earthquake - Cascadia	4	45	100	49	198	#1	Top Tier
Earthquake - Crustal	6	50	100	21	177	#2	
Winter Storm	10	40	70	56	176	#3	
Wildfire	6	45	70	49	170	#4	Middle Tier
Windstorm	20	40	50	56	166	#5	
Landslide	14	45	20	63	142	#6	
Flood	16	20	30	56	122	#7	Bottom Tier
Volcanic Event	2	35	50	14	101	#7	
Drought	10	15	50	21	96	#9	
Extreme Heat	2	10	40	14	66	#10	

Source: Happy Valley HMAc, 2018.

Table HA-3 categorizes the probability and vulnerability scores from the hazard analysis for the City and compares the results to the assessment completed by the Clackamas County HMAc. Variations between the City and County are noted in **bold** text within the city ratings.

Table HA-3 Probability and Vulnerability Comparison

Hazard	Happy Valley		Clackamas County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Low	Low	High	Low
Earthquake - Cascadia	Moderate	High	Moderate	High
Earthquake - Crustal	Low	High	Low	High
Extreme Heat Event	Low	Low	Low	High
Flood	High	Moderate	High	Moderate
Landslide	High	High	High	Low
Volcanic Event	Low	Moderate	Low	Moderate
Wildfire	Moderate	High	High	Moderate
Windstorm	High	High	Moderate	Low
Winter Storm	High	High	Moderate	Moderate

Source: Happy Valley and Clackamas County HMAc, 2018.

Community Characteristics

Table HA-4 and the following section provides information on City specific demographics and assets. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation. Considering the City specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation. Between 2010 and 2016 the City grew by 4,580 people (32%; as of 2018 the population was 20,945) and median household income decreased by about 7%.² Between 2018 and 2040 the population is forecast to grow by 54% to 32,314.³ In May 2016, the City of Happy Valley annexed over 1,000 acres of land that had been primarily in the western portion of the former Damascus area. New development has complied with the standards of the [Oregon Building Code](#) and the city's development code.

Transportation/Infrastructure

Located six (6) miles from Portland, Happy Valley's proximity has made it a desirable place for commercial and industrial development.⁴ Happy Valley's Commercial areas are located near the primary routes of SE Sunnyside Road (provides access to Highway 205), SE 172nd Avenue, and Highway 212. Residential development is located nearby commercial areas, with most residential area located in the northern part of the City.

Motor vehicles represent the dominant mode of travel through and within Happy Valley. The City's public transit is provided by TriMet, which operates four bus routes and one light rail transit line to serve the greater Happy Valley area. The Max Green Line runs from Portland City Center to Clackamas Town Center, which has connection locations to three of the bus routes servicing within the city limits of Happy Valley. Ridership is moderately low on the bus routes serving Happy Valley, with the highest ridership route running along Sunnyside Road.⁵ Happy Valley does not have any industrial rail access. The Metro Regional Freight Plan identifies Highway 212 as a main roadway route and 172nd Avenue as a road connector for freight and commercial truck movement throughout the region. A multi-lane highway is proposed along the Highway 212/224 corridor to accommodate expected population growth.

Economy

The city's residents work in a variety of industries, with "professional and related occupations" (30% of workforce) and "management, business, and financial operations occupations" (21%) accounting for the top two occupations.⁶ Happy Valley's commercial sites are made accessible through Highways 205 and 224. Happy Valley is predominately residentially zoned, but also has commercial and campus industrial areas. The Urban and Rural Strategic Investment Zone provides 15-year property tax abatements on facilities and equipment to industries such as production, high tech, and manufacturing.

² Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018 and Social Explorer, Table T57, U.S. Census Bureau, 2012-2016 and 2006-2010 American Community Survey Estimates.

³ Metro, 2040 Distributed Forecast (2016).

⁴ Social Explorer, Table 50, U.S. Census Bureau, 2012-2016 American Community Survey Estimates

⁵ Happy Valley Transportation System Plan (2014).

⁶ Social Explorer, Table 50, U.S. Census Bureau, 2012-2016 American Community Survey Estimates

Table HA-4 Community Characteristics

Population Characteristics		
2010 Population	14,100	
2016 Population [2018 Population]	18,680	[20,945]
2040 Forecasted Population*	32,314	
Race (non-Hispanic) and Ethnicity (Hispanic)		
White	74%	
Black/ African American	< 1%	
American Indian and Alaska Native	< 1%	
Asian	18%	
Native Hawaiian and Other Pacific Islander	< 1%	
Some Other Race	< 1%	
Two or More Races	6%	
Hispanic or Latino	5%	
Limited or No English Spoken	9%	
Vulnerable Age Groups		
Less than 15 Years	3,876	22%
65 Years and Over	1,610	9%
Disability Status		
Total Population	1,328	8%
Children	128	3%
Seniors	402	25%

Income Characteristics		
Households by Income Category		
Less than \$15,000	168	3%
\$15,000-\$29,999	189	3%
\$30,000-\$44,999	305	6%
\$45,000-\$59,999	580	10%
\$60,000-\$74,999	557	10%
\$75,000-\$99,999	765	14%
\$100,000-\$199,999	2,190	39%
\$200,000 or more	825	15%
Median Household Income	\$106,197	
Poverty Rates		
Total Population	949	5%
Children	186	4%
Seniors	33	2%
Housing Cost Burden		
Owners with Mortgage	1,600	34%
Renters	344	41%

Source: U.S. Census Bureau, 2012-2016 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018. [Metro, 2040 Distributed Forecast](#). Note: * = Population forecast within Metro UGB

Housing Characteristics		
Housing Units		
Single-Family	5,001	88%
Multi-Family	612	11%
Mobile Homes	70	1%
Year Structure Built		
Pre-1970	546	10%
1970-1989	504	9%
1990 or later	4,633	82%
Housing Tenure and Vacancy		
Owner-occupied	4,728	83%
Renter-occupied	851	15%
Seasonal	40	< 1%
Vacant	104	2%

Happy Valley has grown substantially since its incorporation in 1965 and has an area today of 8.3 square miles. It is one of the fastest growing cities in Oregon and is projected to increase in population by 84% by 2040. It is in the northwestern region of Clackamas County, about 18 miles south of the Washington border and southeast of the City of Portland. The City is 497 feet above sea level and located at the northern end of the Willamette River watershed (Willamette Valley).

Because of its location Happy Valley's climate is consistent with the Marine west coast climate zone, with warm summers and cool, wet winters. Happy Valley receives most of its rainfall between October and May, and averages 49 inches of rain, and two (2) inches of snow, per year.⁷

The city's annexation of formerly Damascus property back in 2016 has resulted in the need for the [Pleasant Valley/North Carver Comprehensive Plan](#). Happy Valley has been awarded a Metro 2040 Planning and Development grant to fund the completion of the comprehensive plan and other mandatory master plans by 2020.

⁷ ["Monthly Average for Happy Valley, OR"](#) The Weather Channel Interactive, Inc. Retrieved November 1, 2018.

Community Assets

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of Happy Valley. It is important to note that the facilities identified as “critical” and “essential” are characterized differently than the structural code that identifies buildings as “essential” and “non-essential.” The structural code uses different language and criteria and therefore have completely different meanings than the buildings identified in this addendum.

Critical Facilities

Facilities that are critical to government response, and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include: 911 Centers, Emergency Operations Centers, Police, and Fire Stations, Public Works facilities, sewer, and water facilities, hospitals, bridges, roads, shelters, and more.

Table HA-5 Critical Facilities in Happy Valley

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Facilities									
City Hall/EOC	X							X	X
Community Policing Center	X							X	X
Fleet Services	X							X	X
Public Works Complex	X	X						X	X
Sunrise Water Authority	X							X	X
Fire Stations									
Station #5 – Mt Scott	X							X	X
Station #6 – Happy Valley	X							X	X
Station #7 – Pleasant Valley	X							X	X
Station #8 – Clackamas <i>Training and Maintenance Facility</i>	X							X	X
Potential Shelter Sites									
Abundant Life Church	X							X	X
Church of Jesus Christ of Latter Day Saints	X							X	X
Fire Training Center (Pleasant Valley Golf Course)	X							X	X
Happy Valley Park	X							X	X
Hood View Park	X							X	X
Happy Valley Library	X						X	X	X
Hospitals									
Columbia Clinic	X							X	X
Kaiser Hospital	X							X	X
Oregon Pediatrics	X							X	X
Willamette Hospital	X							X	X

Critical Infrastructure:

Infrastructure that provides necessary services for emergency response include:

Table HA-6 Critical Infrastructure in Happy Valley

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Infrastructure									
Arterials									
* designates road maintained by others									
132 nd Avenue		X							X
152 nd /147 th /145 th Avenues		X							X
162 nd Avenue		X							X
172 nd Avenue		X							X
Carver Road/Hwy 212*		X							X
Clatsop Street		X							X
Foster Road		X							X
Hwy 224*		X							X
Idleman Road		X							X
King Road		X		X					X
Ridge Crest Road		X							X
SE 122 nd /129 th Avenues		X		X					X
SE Mount Scott Blvd		X							X
Sunnyside Road		X							X
Bridges									
152 nd and Sunnyside Road		X							X
Hwy 212		X							X
Other Critical Infrastructure									
Gas Lines		X							X
Power Lines		X							X
Radio/cell phone towers (many on Ridge Way, one in Happy Valley Park, one on Idleman Road)		X							X
Sunrise Water Authority		X							X
Telephone Lines		X							X
Water and Sanitary/Sewer Pump Stations		X		X					X
Water Reservoirs		X							X

Hazardous Materials:

Facilities that, if damaged, could cause serious secondary impacts may also be considered "critical." A hazardous material facility is one example of this type of critical facility. Those sites that store, manufacture, or use potentially hazardous materials include: Camp Withycombe, Davis Trucking, and Fred Meyer Fuel.

Essential Facilities

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public’s ability to recover from the emergency. These facilities may include: City buildings such as the Public Services Building, the City Hall, and other public facilities such as schools.

Table HA-7 Essential Facilities in Happy Valley

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Essential Facilities									
Schools									
Cannady Elementary							X	X	
Happy Valley Middle School/Elementary							X	X	
Rock Creek Middle School							X	X	
Scouters Mountain Elementary							X	X	
Spring Mountain Elementary							X	X	
Verne A. Duncan Elementary							X	X	
Churches									
Emmanuel Community Church									
Happy Valley Baptist Church									
Happy Valley Evangelical Church									
New Hope Community Church									
Sunnyside Foursquare Church									

Cultural and Historic Assets

The cultural and historic heritage of a community is more than just tourist charm. For families that have lived in the city for generations and new resident alike, it is the unique places, stories, and annual events that make Happy Valley an appealing place to live. The cultural and historic assets are both intangible benefits and obvious quality-of-life-enhancing amenities. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important. Cultural and historic assets include: Rebstock Home, Deardorff Cemetery, Christian and Dara Meng House, Florian D. and Helen L. Meng House, John Donaldson House, Hazelfern Dairy, and The Ulrich Home. Due to their historic nature many of these facilities are vulnerable to the earthquake hazard.

Economic Assets/Population Centers:

Economic assets include businesses that employ large numbers of people and provide an economic resource to the city of Happy Valley. If damaged, the loss of these economic assets could significantly affect economic stability, and prosperity. Population Centers usually are aligned with economic centers, and are a concern during evacuation/notification during a hazard event include:

Table HA-8 Economic Assets/Population Centers in Happy Valley

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Economic Assets / Population Centers									
Community of Carver				X	X		X		
Davis Trucking					X				
Downtown Damascus					X		X		
East and West Happy Valley Crossroads					X				
Happy Valley Town Center					X				
Industrial Properties on Hwy 212					X				
Sunnyside Village					X				
Sunnyside Village Plaza					X				

Environmental Assets:

Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic, and functional ecosystem services for the community include:

Table HA-9 Environmental Assets in Happy Valley

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Environmental Assets									
Associated Trails Systems				X	X		X		
Eagle Landing Golf Course				X	X		X		
Happy Valley Park				X	X		X		
Happy Valley Wetland Park				X	X		X		
Hidden Falls Park				X	X		X		
Mitchell Creek				X	X		X		
Mount Scott Park					X		X		
Mt. Talbert				X	X		X		
Pleasant Valley Neighborhood Park				X	X		X		
Rebstock Park				X	X		X		
Rock Creek				X	X		X		
Scouters Mountain and adjacent green space				X	X		X		
Scouters Mountain Neighborhood Park					X		X		

Vulnerable Populations:

Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, often experience the impacts of natural hazards and disasters more acutely. Populations that have special needs or require special consideration include:

Table HA-10 Vulnerable Populations in Happy Valley

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Vulnerable Populations									
Carver Mobile Home Park		X	X	X	X			X	X
Day care facilities		X	X					X	X
<i>Schools listed under essential facilities</i>		X	X					X	X
Senior Care Facilities									
Adult Care Facilities		X	X					X	X
Other Facilities									
Day Spring Mobile Home Park		X	X					X	X
Happy Valley Mobile Park		X	X		X		X	X	X

Hazard Characteristics

Drought

The HMAC determined that the City's probability for drought is **low** and that their vulnerability to drought is **low**. *The probability and the vulnerability ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent and probability of a potential event. Due to the climate of Clackamas County, past and present weather conditions have shown an increasing potential for drought.

The Sunrise Water Authority distributes water to the City of Happy Valley through 200 miles of pipe from the Clackamas River Water and North Clackamas County Water Commission treatment plants on the Clackamas River. The water is pumped to thirteen different reservoirs scattered throughout the service territory at varying elevations. The system is a gravity fed system. Water is also extracted from wells located in the unincorporated community of Damascus during periods of peak water use and in case of drought conditions.

Vulnerability Assessment

Due to insufficient data and resources, Happy Valley is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables HA-5 through HA-10.

Mitigation Activities

The existing drought hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Earthquake (Cascadia Subduction Zone)

The HMAC determined that the City's probability for a Cascadia Subduction Zone (CSZ) earthquake is **moderate** and that their vulnerability to a CSZ earthquake is **high**. *The probability rating increased, and the vulnerability rating did not change, since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake and Crustal earthquake.*

Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent and probability of a potential event. Generally, an event that affects the County is likely to affect Happy Valley as well. The causes and characteristics of an earthquake event are appropriately described within the Volume I, Section 2 as well as the location and extent of potential hazards. Previous occurrences are well documented within Volume I, Section 2 and the community impacts described by the County would generally be the same for Happy Valley as well.

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Portland Hills Fault Zone, and Gales Creek-Newberg-Mt. Angel Structural Zone (discussed in the crustal earthquake section).

Figure HA-2 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the city is expected to experience very strong shaking (orange), while areas near rivers and streams will experience severe (light red) to violent (dark red) shaking in a CSZ event.

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year. Scientists have found evidence that 11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D.⁸

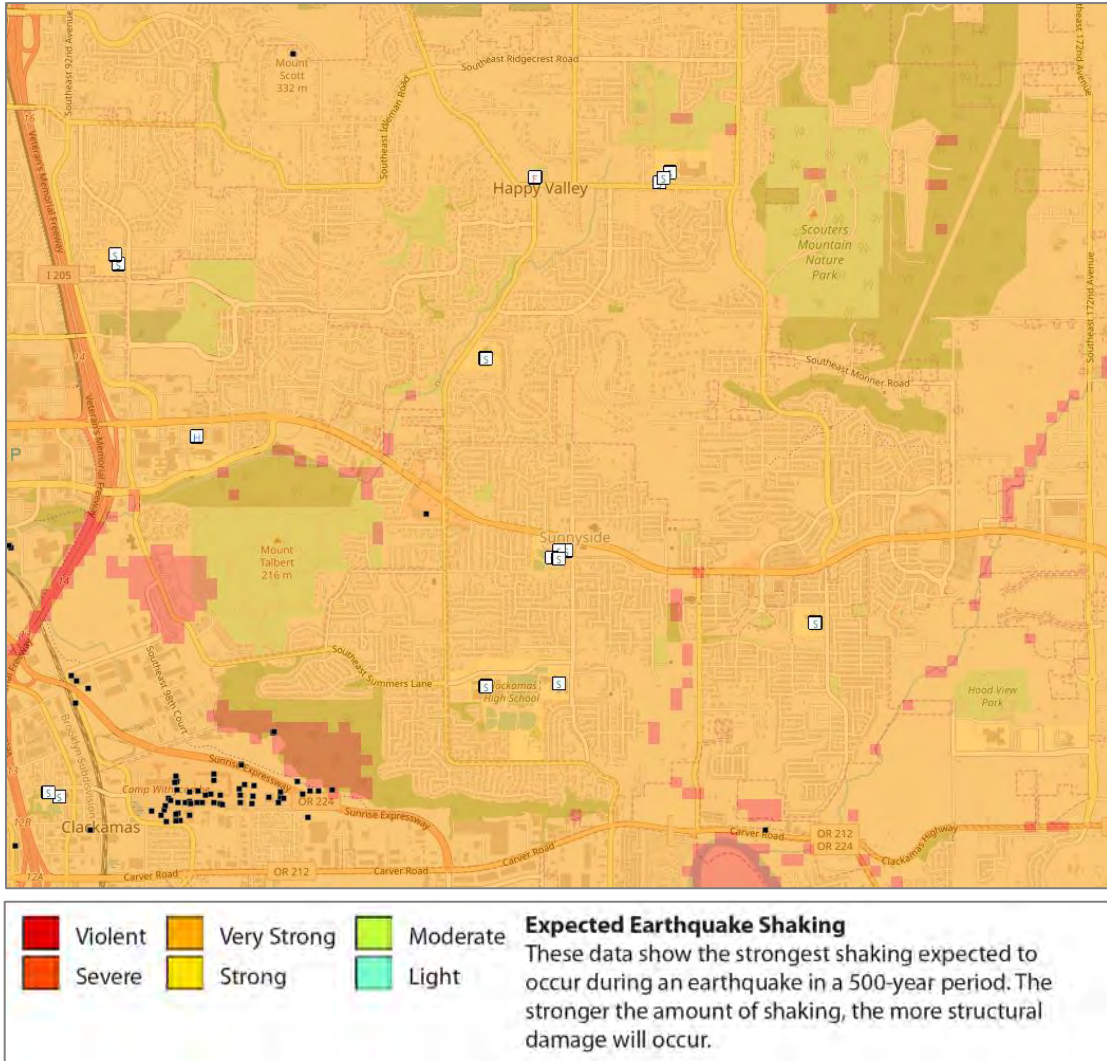
The city's proximity to the Cascadia Subduction Zone, potential slope instability and the prevalence of certain soils subject to liquefaction and amplification combine to give the city a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places the city predominately within the "Valley Zone" (Valley Zone, from the summit of the Coast Range

⁸ The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. <http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf>

to the summit of the Cascades). Within the Northwest Oregon region, damage and shaking is expected to be strong and widespread - an event will be disruptive to daily life and commerce and the main priority is expected to be restoring services to business and residents.

The majority of Happy Valley is located within the strong to very strong zone for expected earthquake shaking. An area of concern is located outside the City limits along Highway 205, which has an area of violent expected shaking. The destruction of Highway 205 could impede post disaster assistance to the City.

Figure HA-2 Cascadia Subduction Zone Expected Shaking



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

Note: To view detail click the link above to access Oregon HazVu.

Earthquake (Crustal)

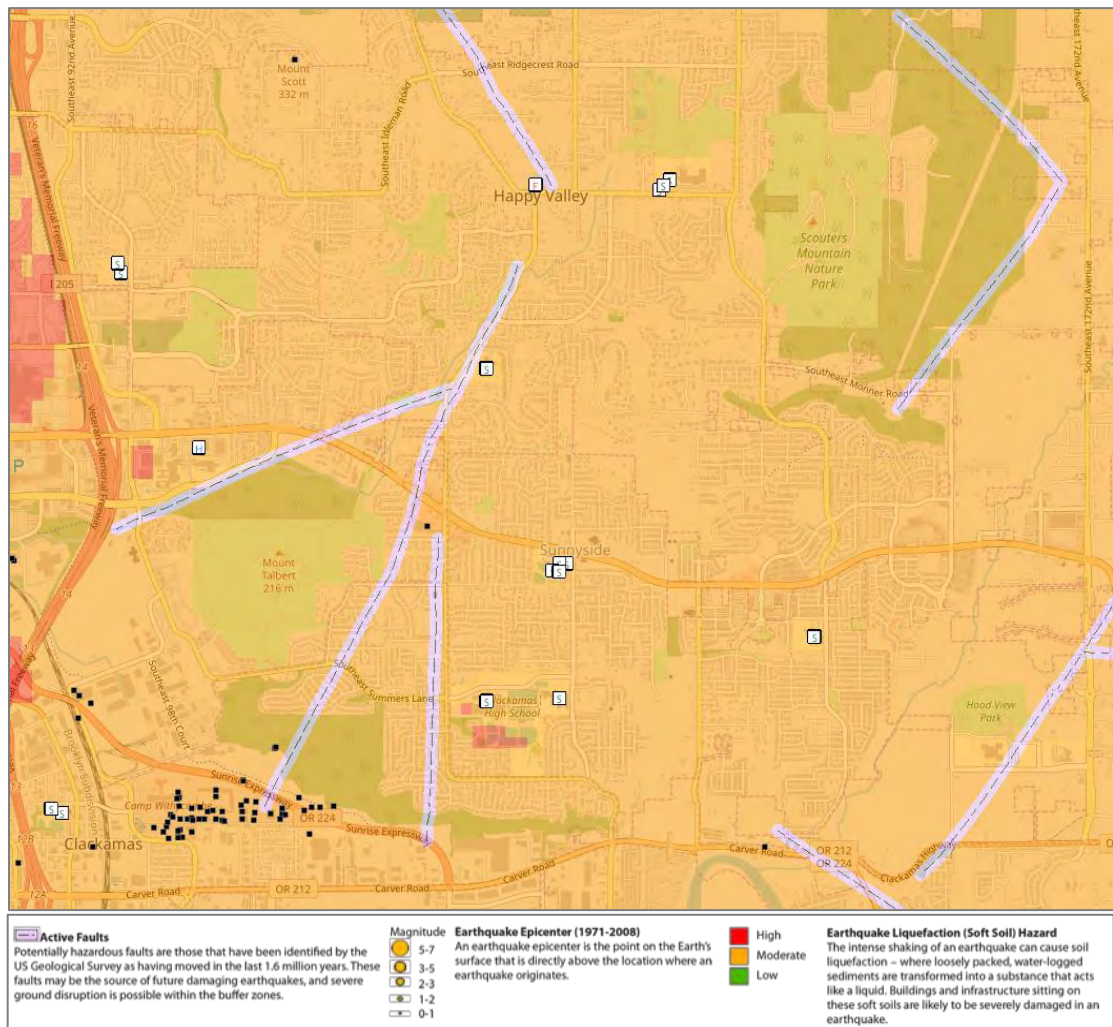
The HMAC determined that the City’s probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**. *These ratings did not change since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a*

single risk assessment, which is now divided into two separate earthquake hazards: Crustal earthquake, and Cascadia Subduction Zone (CSZ) earthquake.

Volume I, Section 2 describes the causes and characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Happy Valley as well. Figure HA-3 shows a generalized geologic map of the Happy Valley area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows the areas of greatest concern within the City limits as red and orange.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

Figure HA-3 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



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

Note: To view detail click the link above to access Oregon HazVu

There are several potential crustal faults and/or zones to the west of the City that can generate high-magnitude earthquakes. Among them are the Damascus-Tickle Creek Fault Zone (shown in Figure HA-3) and the Portland Hills Fault Zone about five (5) miles west of Happy Valley. Other nearby faults include the Oatfield faults which run to the west of the Portland Hills Fault Zone. While there are no reported recent earthquakes within Happy Valley limits, historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

Damascus-Tickle Creek Fault Zone

The Damascus-Tickle Creek Fault zone consists of numerous short northeast- and northwest-trending faults that form a broad, northeast-trending fault zone. The area is on the southern margin of the Portland basin and the faults fold and offset rocks of the Pliocene formation. The length of these faults is 16 km and some fault strands may have controlled the locations of eruptive vents. The fault zone is located approximately seven (7) miles from Portland and runs underneath the City of Happy Valley.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and lies about 5 miles west of Happy Valley.

Vulnerability Assessment

Due to insufficient data and resources, Happy Valley is currently unable to perform a quantitative risk assessment for this hazard. However, in 2018 the Department of Geology and Mineral Industries (DOGAMI) completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)), findings from that report are provided at the end of the crustal earthquakes hazard section.

Seismic building codes were implemented in Oregon in the 1970s, however, stricter standards did not take effect until 1991 and early 2000s. As noted in the community profile, approximately 19% of residential buildings were built prior to 1990, which makes the majority of the City's housing stock more resilient in the case of an earthquake. Information on specific public buildings' (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table HA-11; each "X" represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), three (3) have a moderate (greater than 1% chance) collapse potential and two (2) have a low (less than 1% chance) collapse potential.

For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables HA-5 through HA-10. In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

Utility systems will be significantly damaged, including damaged buildings and damage to utility infrastructure, including water treatment plants and equipment at high voltage substations (especially 230 kV or higher which are more vulnerable than lower voltage

substations). Buried pipe systems will suffer extensive damage with approximately one break per mile in soft soil areas. There would be a much lower rate of pipe breaks in other areas. Restoration of utility services will require substantial mutual aid from utilities outside of the affected area.

Table HA-11 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Cannady Elementary** (18031 SE Vogel Road)	None	2007 RVS report did not include structural appendix for this facility; to open in 2019.			
Duncan Elementary (14898 SE Parklane Drive)	None	2007 RVS report did not include structural appendix for this facility; built 2009.			
Mount Scott Elementary* (11201 SE Stevens Road)	Clac_sch70	X,X			
Oregon Trail Elementary* (13895 SE 152 Drive)	Clac_sch75		X		
Scouters Mountain Elementary (10811 SE 172 nd Ave)	None	2007 RVS report did not include structural appendix for this facility.			
Sunnyside Elementary* (13401 SE 132nd Avenue)	Clac_sch22	Mitigated per 2015-2017 SRGP grant.			
Spring Mountain Elementary (11645 SE Masa Lane)	Clac_sch80	X			
Happy Valley Elementary (13865 SE King Road)	Clac_sch18		X,X,X		
Rock Creek Middle (14897 SE Parklane Drive)	None	2007 RVS report did not include structural appendix for this facility.			
Clackamas High* (14489 SE 122 nd Avenue)	Clac_sch27	X			
Clackamas High – East Campus* (14331 SE 132 nd Avenue)	Clac_sch25	X			
Clackamas Fire District					
Station 5 – Mt Scott (9339 SE Causey Ave)	None	2007 RVS report did not include structural appendix for this facility; built 2003.			
Station 6 – Happy Valley (12901 SE King Road)	Clac_fir13	X			
Station 7 – Pleasant Valley (10921 SE 172 nd)	None	2007 RVS report did not include structural appendix for this facility.			
Station 8 – Clackamas (15990, 16100 SE 130th Avenue)	Clac_fir11, Clac_fir12	X X			

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#) “*” – Site ID is referenced on the [RVS Clackamas County Map](#)

Note 1: **Bold** indicates facilities that have been seismically retrofitted or rebuilt.

Note 2: * - school not in Happy Valley, ** - school not in Happy Valley, opening in Fall 2019.

Note 3: Clackamas Fire District #1 Fleet Services building (15800 SE 130th Ave) was not assessed during DOGAMI’s RVS in 2007; see Clackamas Fire District addendum for more information.

Mitigation Activities

Happy Valley has taken mitigation steps to reduce the city's vulnerability in earthquake events. City Hall and the water treatment plant are up to the newest building codes, meaning these buildings can be occupied even after large earthquake events. Seismic retrofit grant award per the [Seismic Rehabilitation Grant Program](#)⁹ has been funded to retrofit Sunnyside Elementary (Phase Two of 2015-2017 grant award, \$1,500,000). A \$433 million seismic retrofit/ school upgrade bond was ([3-487](#)) passed in 2016 for the North Clackamas School District, which will address the different needs of schools throughout the school district. For Happy Valley the bond will turn Rock Creek Middle School into a comprehensive high school to deal with overcrowding, as well as add six classrooms to Happy Valley Middle School.

Earthquake Regional Impact Analysis

In 2018 DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)). Their study focused on damage to buildings, and the people that occupy them, and to two key infrastructure sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and night time (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damages varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood structures that fare worse in an earthquake. The Portland Hills fault scenario created greater damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios, however, the impact is considerably less than it is to the transportation routes. Additional, capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts.

Table HA-12 shows the permanent resident population that are vulnerable to injury or death (casualty) and the buildings in the City that are susceptible to liquefaction and landslides, it does not predict that damage will occur in specific areas due to either liquefaction or landslide. More population and property are exposed to higher degrees of expected damage or casualty under the Portland Hills Fault "wet" scenario than in any other scenario.

⁹ The Seismic Rehabilitation Grant Program (SRGP) is a state of Oregon competitive grant program that provides funding for the seismic rehabilitation of critical public buildings, particularly public schools and emergency services facilities.

Table HA-12 Expected damages and casualties for the CSZ fault and Portland Hills fault: earthquake, soil moisture, and event time scenarios

	Cascadia Subduction Zone (M9.0)		Portland Hills Fault (M6.8)	
	"Dry" Soil	"Wet" Saturated Soil	"Dry" Soil	"Wet" Saturated Soil
Number of Buildings	5,856	5,856	5,856	5,856
Building Value (\$ Million)	2,692	2,692	2,692	2,692
Building Repair Cost (\$ Million)	59	75	243	318
Building Loss Ratio	2%	3%	9%	12%
Debris (Thousands of Tons)	28	32	79	100
Long-Term Displaced Population	8	89	118	552
Total Casualties (Daytime)	41	50	179	217
Level 4 (Killed)	2	2	10	13
Total Casualties (Nighttime)	5	11	30	65
Level 4 (Killed)	0	0	1	2

Source: DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8, 12-9, 12-10, and 12-11.

Cascadia Subduction Zone Scenario

The City of Happy Valley is expected to have a 2% building loss ratio with a repair cost of \$59 million under the CSZ “dry” scenario, and a 3% building loss ratio with a repair cost of \$75 million under the CSZ “wet” scenario.¹⁰ The city is expected to have around 41 daytime or 5 nighttime casualties during the CSZ “dry” scenario and 50 daytime or 11 nighttime casualties during the CSZ “wet” scenario. It is expected that there will be a long-term displaced population of around 8 for the CSZ “dry” scenario and 89 for the CSZ “wet” scenario.¹¹

Portland Hills Fault Scenario

The City of Happy Valley is expected to have a 9% building loss ratio with a repair cost of \$243 million under the CSZ “dry” scenario, and a 12% building loss ratio with a repair cost of \$318 million under the CSZ “wet” scenario.¹² The long-term displaced population and casualties are greatly increased for all the Portland Hills Fault scenarios. The city is expected to have around 179 daytime or 30 nighttime casualties during the Portland Hills Fault “dry” scenario and 217 daytime or 65 nighttime casualties during the Portland Hills Fault “wet” scenario. It is expected that there will be a long-term displaced population of around 118 for the Portland Hills Fault “dry” scenario and 552 for the Portland Hills Fault “wet” scenario.¹³

Recommendations from the report included topics within Planning, Recovery, Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMPs mitigation strategies (Table HA-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and the recommendations see: *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, [O-18-02](#)).

Please review Volume I, Section 2 for additional information on this hazard.

¹⁰ DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8 and 12-9.

¹¹ Ibid, Tables 12-8 and 12-9.

¹² Ibid, Tables 12-10 and 12-11

¹³ Ibid, Tables 12-10 and 12-11.

Flood

The HMAP determined that the City's probability for flood is **high** and that their vulnerability to flood is **moderate**. *The probability rating and the vulnerability ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent, and probability of a potential event. Figure HA-4 illustrates the flood hazard area for Happy Valley.

Portions of Happy Valley have areas of floodplain (special flood hazard areas, SFHA). These include the Mount Scott Creek, Rock Creek, and part of the Clackamas River. Though flooding occurs on the southern side of Clackamas River and Happy Valley is not affected. The geographic location of the flooding hazard was determined using the designated FEMA 100-year floodplain data, as well as the inundation line for the 1996 flood. There is potential flood impact along SE 192nd and SE 172nd Avenues, as well as near the newly annexed land along Carver Road (otherwise known as Highway 212/224).

Vulnerability Assessment

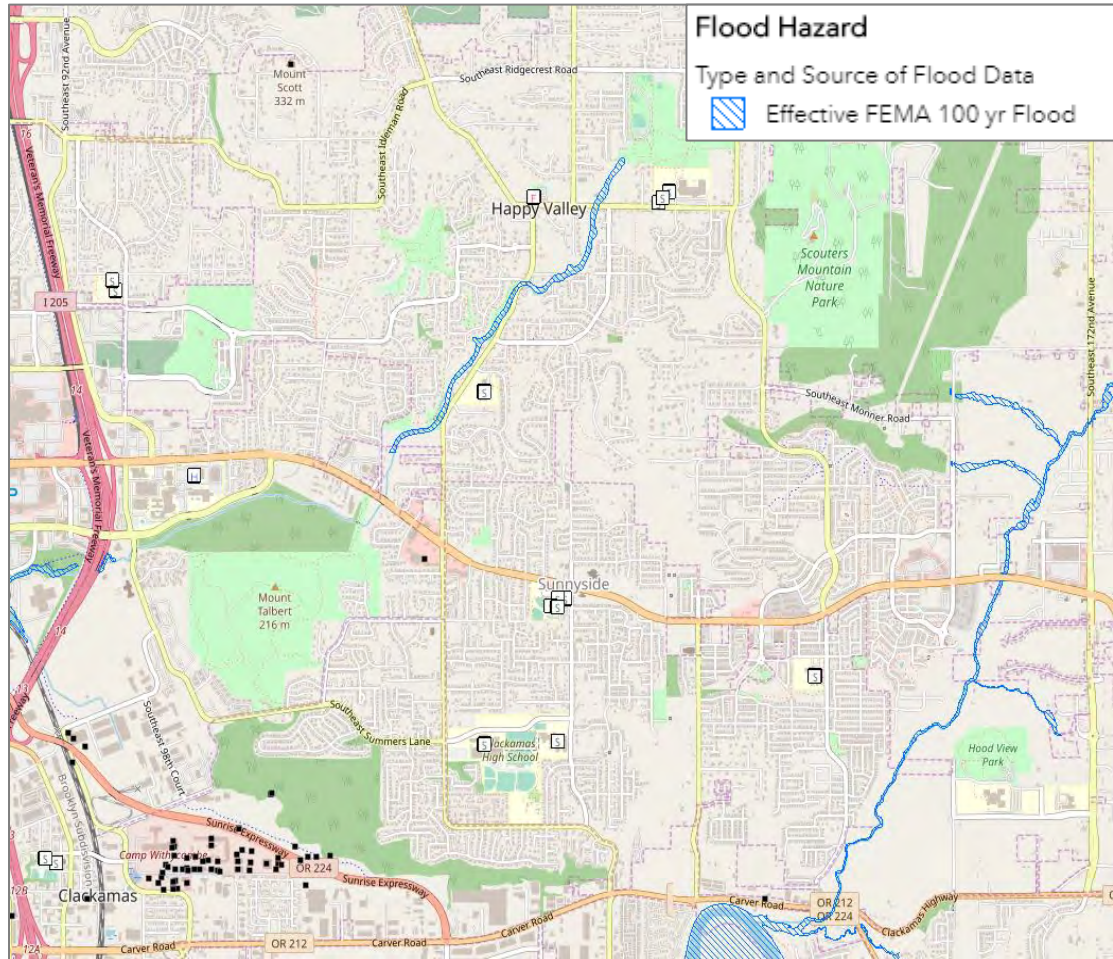
Due to insufficient data and resources, Happy Valley is currently unable to perform a quantitative risk assessment for this hazard. Happy Valley has a Flood Management Overlay Zone that creates standards for building within the flood zone and does not allow net fill. Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage, and economic loss from business interruption. It is important for the City to be aware of flooding impacts and assess its level of risk.

The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners, and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of Happy Valley outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage.

Happy Valley is also vulnerable to urban flooding events. Urban flooding is caused by heavy rain or snow fall from severe storms that culverts and drains cannot handle due to the intensity of rain fall or being undersized. An example of this is in January 2009 when a winter storm lead to urban flooding in many parts of the city, with one residential bridge being washed out near 122nd and Scott Creek Lane. The extent of flooding hazards in Happy Valley primarily depends on climate and precipitation levels. Additionally, withdrawals for irrigation and drinking water, as well as stream and wetland modifications or vegetation removal can influence water flow. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables HA-5 through HA-10.

Figure HA-4 Special Flood Hazard Area



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

Note: To view detail click the link above to access Oregon HazVu

National Flood Insurance Program (NFIP)

FEMA's Flood Insurance Study (FIS), and Flood Insurance Rate Maps (FIRMs) are effective as of June 17, 2008. Table HA-13 shows that as of July 2018, Happy Valley has 12 National Flood Insurance Program (NFIP) policies in force. Of those, one (1) is for a property that was constructed before the initial FIRMs. Happy Valley has not had a Community Assistance Visit (CAV). Happy Valley does not participate in the Community Rating System (CRS). The table shows that most flood insurance policies are for residential structures, primarily single-family homes. There has been a total of zero (0) paid claims. The City complies with the NFIP through enforcement of their flood damage prevention ordinance and their floodplain management program. The Community Repetitive Loss record for Happy Valley identifies no Repetitive Loss Properties¹⁴ or Severe Repetitive Loss Properties¹⁵.

¹⁴ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

¹⁵ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP, and has incurred flood-related damage for which 4 or more separate

Table HA-13 Flood Insurance Detail

	Clackamas County	Happy Valley
Effective FIRM and FIS	6/17/2008	6/17/2008
Initial FIRM Date	-	12/4/1979
Total Policies	1,957	12
Pre-FIRM Policies	1,086	1
Policies by Building Type		
Single Family	1,761	12
2 to 4 Family	30	0
Other Residential	58	0
Non-Residential	9	0
Minus Rated A Zone	123	0
Insurance in Force	\$541,833,400	\$4,200,000
Total Paid Claims	590	0
Pre-FIRM Claims Paid	450	0
Substantial Damage Claims	83	0
Total Paid Amount	\$20,830,662	-
Repetitive Loss Structures	51	0
Severe Repetitive Loss Properties	4	0
CRS Class Rating	-	NP
Last Community Assistance Visit	-	NP

Source: Information compiled by Department of Land Conservation, and Development, July 2018.

Note: The portion of the cities of Portland and Tualatin that are within Clackamas County are not included in this table. NP = Not Participating

Mitigation Activities

Happy Valley employs several mitigation strategies to reduce the city's risk to flood events. The city development code includes policies and regulations for flood prone areas including the Flood Management Overlay Zone, Flood Damage Prevention, East Happy Valley Natural Environmental Policies, and the Rock Creek Mixed Employment District. Clackamas County Water Environmental Services (CCWES) provides sewer, surface water, and stormwater services to the City of Happy Valley. The CCWES also does development and permitting for those services for anything that requires a building permit, construction of structures, roadways, and utilities, and land division. In 2017, the Clackamas River Water Providers, in partnership with the CCWES, started offering cash rebates and technical assistance to help local businesses upgrade their spill prevention equipment. Eligible businesses were provided with 50% off the cost to purchase or install secondary containment equipment for up to \$1,000. A specific area of concern for this program was businesses located within the Clackamas Industrial Area that is less than a quarter mile away from Clackamas River.¹⁶

Please review Volume I, Section 2 for additional information on this hazard.

claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000, and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

¹⁶ Happy Valley Monthly. [Rebates offered for local businesses to protect the Clackamas River](#) (2017).

Landslide

The HMAC determined that the City's probability for landslide is **high** and that their vulnerability to landslide is **high**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. While Happy Valley has a hilly terrain, there has only been a few landslides over the years. In 1996 a hillside in the Mt. Scott area slide into a homeowner's yard and continued past the home towards Foster Road with no injuries or severe damage sustained. In the Development Code, Chapter 16.32 deals with the Steep Slopes Development Overlay Zone. The Overlay Zone limits the potential residential density and facilitates transferring the development away from slope constrained lands. This provides special protection on lands within "transition slope areas" and "conservation slope areas".

Although there have been few landslides to occur in Happy Valley, steep slopes that do exist include Scouters Mountain, The Reserve, Rock Creek, Mt. Scott, Mt. Talbert, and the area east of SW 145th Avenue.

Landslide susceptibility exposure for Happy Valley is shown in Figure HA-5. Most of Happy Valley demonstrates a moderate to high landslide susceptibility exposure. Approximately 16% of Happy Valley has very high or high, and approximately 49% moderate, landslide susceptibility exposure.¹⁷

Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard, and assets.

Vulnerability Assessment

Due to insufficient data and resources, Happy Valley is currently unable to perform a quantitative risk assessment for this hazard. However, DOGAMI completed a statewide landslide susceptibility assessment in 2016 ([O-16-02](#)), general findings from that report are provided above and within Figure HA-5.

Potential landslide-related impacts are adequately described within Volume I, Section 2, and include infrastructure damages, economic impacts (due to isolation, and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides, and debris flows can potentially occur during any winter, and thoroughfares beyond City limits are susceptible to obstruction as well. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables HA-5 through HA-10.

The most common type of landslides are slides caused by erosion. Slides move in contact with the underlying surface, are generally slow moving, and can be deep. Rainfall-initiated landslides tend to be smaller; while earthquake induced landslides may be quite large. All soil types can be affected by natural landslide triggering conditions.

¹⁷ DOGAMI. [Open-File Report, O-16-02](#), *Landslide Susceptibility Overview Map of Oregon* (2016)

Severe Weather

Severe weather can account for a variety of intense, and potentially damaging hazard events. These events include extreme heat, windstorms, and winter storms. The following section describes the unique probability, and vulnerability of each identified weather hazard.

Extreme Heat

The HMAC determined that the City's probability for extreme heat events is **low** and that their vulnerability is **low**. *The probability rating increased, and the vulnerability rating did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the City as well.

A severe heat episode or "heat wave" occurs about every two to three years, and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days with temperatures greater than or equal to 90-degrees, or 100-degrees, Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit, and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The City of Happy Valley has not experienced any life-threatening consequences from the few historical extreme heat events, although changes in climate indicate that the area should expect to see more extreme heat events.

Please review Volume I, Section 2 for additional information on this hazard.

Windstorm

The HMAC determined that the City's probability for windstorm is **high** and that their vulnerability to windstorm is **high**. *The probability rating did not change, while the vulnerability rating increased, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent, and probability of a potential event within the region. Because windstorms typically occur during winter months, they are sometimes accompanied by flooding and winter storms (ice, freezing rain, and very rarely, snow). Other severe weather events that may accompany windstorms, including thunderstorms, hail, lightning strikes, and tornadoes are generally negligible for Happy Valley.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation, and economic disruptions result as well.

In general, Happy Valley is more susceptible to windstorms than other communities in Clackamas County because the city is situated at a higher elevation and closer to the Columbia Gorge. Damage from high winds generally has resulted in downed utility lines, and trees usually limited to several localized areas. Electrical power can be out anywhere from a

few hours to several days. Outdoor signs have also suffered damage. If the high winds are accompanied by rain (which they often are), blowing leaves, and debris clog drainage-ways, which in turn may cause localized urban flooding.

Please review Volume I, Section 2 for additional information on this hazard.

Winter Storm (Snow/Ice)

The HMAC determined that the City's probability for winter storm is **high** and that their vulnerability to winter storm is **high**. *The probability and the vulnerability ratings did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent, and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the City typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

The biggest impact of winter storms is the congestion of roadways and saturation of soils that could lead to landslides. Due to the steeper slopes of some communities, freezing weather can cause steep roadways to become difficult to traverse. Most winter storms typically do not cause significant damage, they are frequent, and have the potential to impact economic activity. Road, and transit closures due to winter weather are an uncommon occurrence but can interrupt commuter, and commercial traffic.

Vulnerability Assessment

Due to insufficient data and resources, Happy Valley is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Assets section and Tables HA-5 through HA-10.

Mitigation Activities

Mitigating severe weather can be difficult because storms affect all areas of the city, but Happy Valley has made progress to reduce the effects of storms. Happy Valley has a tree ordinance that provides standards and conditions for tree maintenance and removal. Each year trees are assessed for overhangs or low lying branches. Based on yearly assessments, the city removes trees and branches that appear potentially damaging or dangerous. All new construction is required to have underground utilities, therefore reducing the chance of utility interruption during severe weather events. There is a designated sand and snow plow route to help expedite snow remediation efforts, especially for those living on steeper slopes. Certain public buildings have backup power generation, such as City Hall. The Happy Valley Community Emergency Response Team (CERT) can be utilized for response and public outreach efforts.

Please review Volume I, Section 2 for additional information on this hazard.

Volcanic Event

The HMAC determined that the City's probability for a volcanic event is **low** and that their vulnerability to a volcanic event is **moderate**. *The probability rating did not change, while the vulnerability decreased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of volcanic hazards, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the western portion of the County is likely to affect Happy Valley as well. Several volcanoes are located near Happy Valley, the closest of which are Mount Hood, Mount Adams, Mount Saint Helens, Mount Rainier, and the Three Sisters.

Vulnerability Assessment

Due to insufficient data and resources, Happy Valley is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables HA-5 through HA-10.

Due to Happy Valley's relative distance from volcanoes, the city is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Depending on wind patterns and which volcano erupts, however, the city may experience ashfall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city could experience a heavier coating of ash.

Mitigation Activities

The existing volcano hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Wildfire

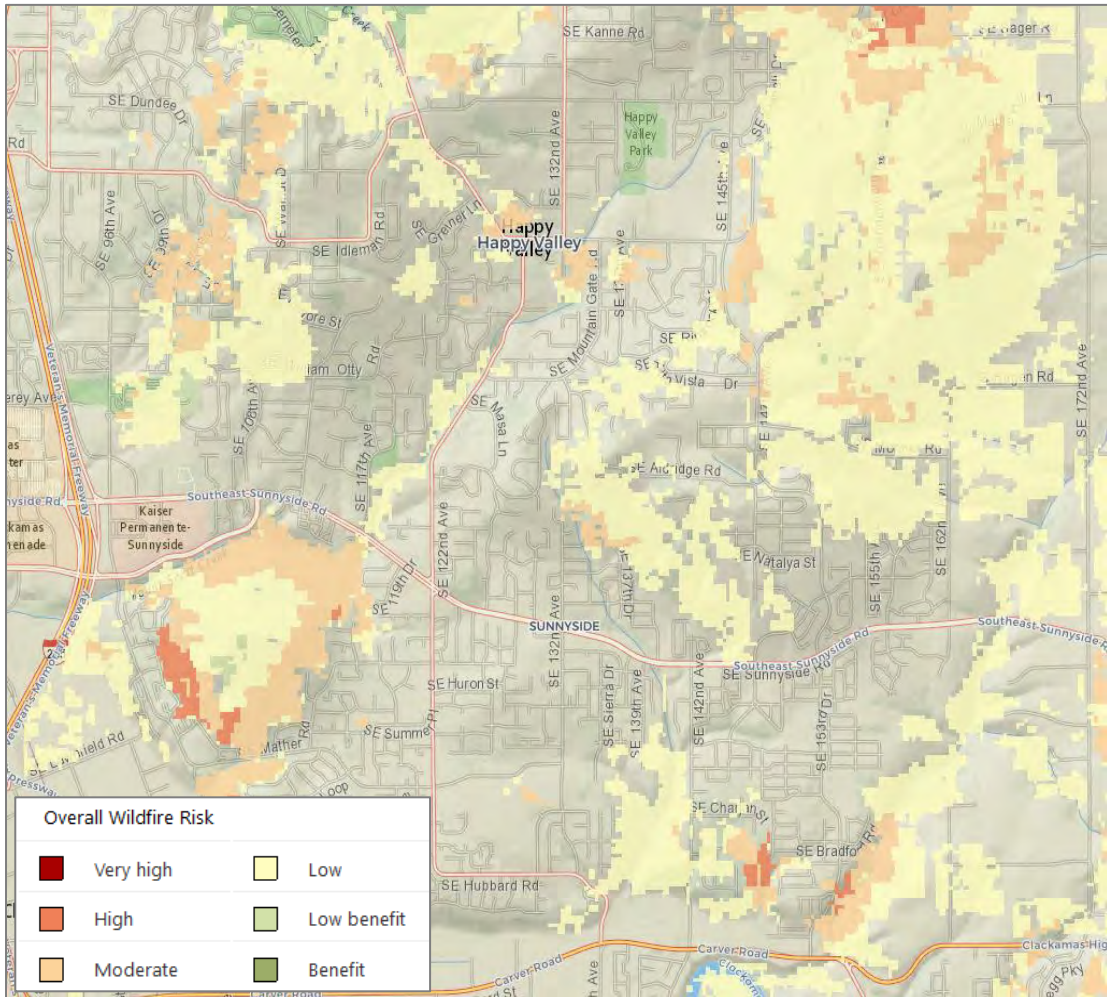
The HMAC determined that the City's probability for wildfire is **moderate**, and that their vulnerability to wildfire is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

The [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) was completed in May 2018. The CWPP is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard: <https://www.clackamas.us/dm/CWPP.html>. Information specific to Happy Valley is found in the following chapter: [Chapter 10.3: Clackamas Fire District #1](#).

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions. Weather, and urbanization conditions are primarily at cause for the hazard level. Happy Valley has not experienced a wildfire within City limits, but the city has abundant wooded areas that are a concern in the case of a wildfire event. Figure HA-6 shows overall wildfire risk in Happy Valley.

Clackamas County has two major physiographic regions: the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern Clackamas County. The Willamette River Valley, which includes Happy Valley, is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range has a relatively small population and is characterized by heavily forested slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to its dense forest land. Human caused fires are responsible for most fires in Clackamas County. In Happy Valley most instances of fire have been started by human activity, but the fires have been small enough to contain quickly and easily.

Figure HA-6 Overall Wildfire Risk



Source: [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

The forested hills within and surrounding Happy Valley that are interface areas include Mount Talbert, Scouter Mountain, Happy Valley Nature Trail, and the Highway 224 corridor. Scouters Mountain has a series of natural areas adjacent to homes and infrastructure, while Mount Talbert Nature Park has medium to high density residential development. Mount Talbert Nature Park has steep slopes and transient camps, which makes the area highly vulnerable to fire. High Priority Communities at Risk (CARs) within and around the city

include: Mt. Talbert (high) and Scouters Mountain (high), which have been identified by the CFD #1 as important areas for fuel reduction projects.¹⁸

Most of the city has less severe (moderate or less) wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions.¹⁹ However, conditions vary widely and with local topography, fuels, and local weather (including wind) conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts.

Vulnerability Assessment

Due to insufficient data and resources, Happy Valley is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables HA-5 through HA-10.

The potential community impacts, and vulnerabilities described in Volume I, Section 2 are generally accurate for the City as well. Happy Valley's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. The City will update the City's wildfire risk assessment if the fire plan presents better data during future updates (an action item is included to participate in future updates to the CWPP).

Property can be damaged or destroyed with one fire as structures, vegetation, and other flammables easily merge to become unpredictable, and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

Mitigation Activities

Happy Valley uses several mitigation tools to reduce the city's risk to wildfires. The city has a no smoking ordinance in all parks and public property, as well as a strict fireworks ordinance. CFD #1 notifies residents of the burn season and strictly enforces burning regulations. CFD #1 also adopted a district-wide wildland map that governs new construction, and an active public education program for high risk-wildfire areas.

The Clackamas Fire District #1 (CFD #1) serves the cities of Happy Valley, Johnson City, Milwaukie, and Oregon City and the unincorporated areas of Barton, Beavercreek, Boring, Carus, Carver, Central Point, Clackamas, Clarkes, Damascus, Eagle Creek, Highland, Hillview, Holcomb, Kelso, Jennings Lodge, Oak Grove, Redland, South End, Sunnyside, and Westwood. For more information on the fire district see their addendum.

Please review the [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#), Volume I, Section 2, and the [Clackamas Fire District #1 Addendum in Volume II](#) for additional information on this hazard.

¹⁸ Clackamas County Community Wildfire Protection Plan, *Happy Valley Fire Department* (2018), Table 10.3-1.

¹⁹ [Oregon Wildfire Risk Explorer](#), date accessed January 12, 2019.

ATTACHMENT A: ACTION ITEM FORMS

ACTION ITEM FORMS

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Wildfire #1	50
Wildfire #2*	51
Wildfire #3*	52

* - Priority Action Item

Note: The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity.

Summary of Action Changes

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

Previous NHMP Actions: Completed

No actions were completed.

See 2018 status identified in each action for activities that have been completed since the previous plan.

Previous NHMP Actions: Removed

Multi-Hazard Action #4 (2012): “Continue to update and improve hazard assessments in the Natural Hazards Mitigation Plan as new information becomes available.” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Note: 2012 Action MH#5 was renumbered to 2019 Action MH #4.

New NHMP Actions (2019):

- Volcanic Event #1,
- Wildfire Action #1

See action item forms below for detail.

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 NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the County, participating cities, and special districts. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. The City 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, the City 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 several 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 HMAAC but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and/or resources toward completion of the action items.

Internal partner organizations are departments within the City 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.

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:	
Develop, enhance, and implement public education programs to inform the public about methods for mitigating the impacts of natural hazards.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Conducting public outreach campaigns raises awareness about natural hazards and helps illustrate what residents and businesses can do to reduce the impact of a natural disaster on their properties, thereby reducing the impact of natural hazards on the City of Happy Valley. • The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the county's actions to mitigate hazards. • <u>2018 Status:</u> City continues to have an active CERT Team and publicize their EOP and NHMP at community events. City's Community Services team, local churches, and active CERT team collaborate to help residents put together 72-hour kits. Happy Valley expanded the public education to digital forms. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Conduct public education as hazard seasons approach; partner with Clackamas County. These include earthquake awareness month in April, wildfire prevention in summer, and flood and severe storm information in winter; • Educate citizens on the importance of proper yard debris disposal, as well as resources available for hazard mitigation, response, and preparedness; • Identify property owners in flood, landslide, and wildfire hazard zones, and conduct a target mailing to disseminate information on all hazards; • Target neighborhood associations to sponsor CERT teams; • Include hazard information on the city website and link to the Clackamas Fire District #1 website; • Utilize the city newsletter, Happy Valley Today, to disseminate hazard information • Promote purchase of appropriate insurance coverage through outreach and education; and • Use faith based, civic and humanitarian, and business groups to affiliate volunteers; 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works, Public Safety, Building, Planning Commission, Finance		Clackamas Fire District #1, North Clackamas School District, Clackamas County Sheriff's Office	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High		

* - High Priority Action Item

Multi-Hazard #2

Proposed Action Item:		Alignment with Plan Goals:	
Integrate the goals and action items from the Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Zoning Ordinance, Winter Response Operations Plan, Transportation Master Plan, Parks Master Plan, Pedestrian Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating natural hazards plans into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community. <u>2012 Status</u>: Happy Valley's Comprehensive Plan was updated in 2009 and included a land use ordinance limiting development on steep slopes. The NHMP was used to assist the city in updating their EOP. <u>2018 Status</u>: The Comprehensive Plan, Transportation Master Plan, and Parks Master Plan were updated in 2017-2018 and incorporated hazards into those updates. The Pedestrian Master Plan also includes hazards and will be completed by 2019. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Use the mitigation plan to help the City's Comprehensive Land Use Plan meet 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; Use zoning codes to regulate development in hazard-prone areas; Integrate the city's mitigation actions into the current emergency operations plan and capital improvement plans (where appropriate); Incorporate the Natural Hazards Mitigation Plan into deed restrictions and conditions of approval where appropriate; Partner with State IHMT and BCD to promote disaster resilient building codes; Use citizen input for the creation of appropriate ordinances; and Use the NHMP resources provided by the Oregon Partnership for Disaster Resilience to learn how to better integrate the NHMP into existing documents and programs. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works, Building, Engineering, Planning Commission		Department of Land Conservation and Development, Department of Geology and Mineral Industries, Oregon Department of Transportation, Department of Environmental Quality, Clackamas County	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, DLCD Technical Assistance Grant		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #3

Proposed Action Item:		Alignment with Plan Goals:	
Identify and pursue funding opportunities to develop and implement hazard mitigation activities.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating natural hazards plans into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community. <u>2012 Status:</u> Happy Valley's Police Department and Public Works buildings have been seismically upgraded and new generators were added. Funding has been used to purchase fuel tanks for the Public Works building. With help from the County's Water Environment Services (WES) Department, culverts in Happy Valley are being updated through the Municipal Separate Storm Sewer System (MS4) process, restoring capacity to flows. <u>2018 Status:</u> Happy Valley is continually identifying and pursuing funding opportunities. See Mitigation Activities within addendum for more information. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Meetings will be held annually to discuss, update, and implement actions in the NHMP. Funding opportunities should also be discussed at the annual meetings; Develop incentives for special service districts, citizens, and businesses to pursue hazard mitigation projects; Review mitigation projects during each city budget review cycle; Allocate city resources and assistance to mitigation projects when possible; Partner with other organizations and agencies to identify grant programs and foundations that may support mitigation activities; and Pursue funding opportunities for the five-year update. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works, Economic and Community Development, Planning Commission, Finance, Code Enforcement		Clackamas County Emergency Management, Clackamas Fire District #1, Clackamas County Sheriff, Oregon Emergency Management, FEMA Region X	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds, FEMA PDM, HMGP and FMA Grants, and other grants		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #4

Proposed Action Item:		Alignment with Plan Goals:	
Encourage greenspace management throughout the city.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Parks Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating natural hazards plans into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community. Landscaping and vegetation make a difference in mitigating the impacts of natural hazards. Trees break the force of the wind and stabilize the soil. Wetlands absorb much of the overflow from stream channels. Fire-resistant vegetation can retard the spread of wildfires toward vulnerable buildings. Limiting or regulating the amount of vegetation cleared off a hillside lot reduces the risk of increasing the number of landslide-prone areas in a community. Planting vegetation or maintaining slope terraces can also reduce slope-runoff. Planners can use landscaping requirements to preserve or enhance the protection such natural features afford. These requirements may be part of site plan reviews or a separate set of zoning regulations and environmental performance standards. <u>2012 Status</u>: Happy Valley did an invasive species project, continues its yearly wetland park project, which includes planting 20,000 seedlings. Development of an erosion control plan and code enforcement on hazardous slopes. <u>2018 Status</u>: Happy Valley updated development guidelines and Comprehensive Plan to include greenspace management. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Provide education to the public about justifications for, and benefits of vegetation mitigation; Identify appropriate practices for eliminating invasive species such as blackberry and English Ivy; Maintain healthy urban canopy and remove excess understory; Maintain vegetation coverage for slope stability; Identify hazardous trees for remediation or removal; and Coordinate with the Clackamas River Watershed Council and others. 			
Coordinating Organization:		Economic and Community Development	
Internal Partners:		External Partners:	
Planning, Public Works		Clackamas Fire District #1, Clackamas Soil and Water Conservation District, North Clackamas Urban Watersheds Council; Metro Regional Government Fire Co-op, Oregon Department of Forestry, US Forestry Service, Clackamas County	
Potential Funding Sources:		Estimated cost:	Timeline:
OWEB, General Fund, Metro Regional Government Fund		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Earthquake #1

Proposed Action Item		Alignment with Plan Goals:	
Conduct seismic evaluations of the Community Policing Center, Public Works Complex, and identified shelters and implement appropriate structural and non-structural mitigation strategies.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The Community Policing Center and Public Works Complex are not up to seismic standards. • The structural integrity of shelter facilities is not known. • Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. • Refer to risk assessment, and DOGAMI's rapid visual assessment scores • <u>2012 Status:</u> Happy Valley's safety committee is currently researching shelving and strapping options as non-structural mitigation activities. The Police Department and Public Works buildings have been seismically upgraded. • <u>2018 Status:</u> The Seismic Rehabilitation Grant Program has been funded to retrofit Sunnyside Elementary (2017 grant award, \$1,500,000). A \$433 million seismic retrofit/school upgrade bond was (3-487) passed in 2016 for the North Clackamas School District. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Identify structures for conducting seismic evaluations; • Obtain funding to perform seismic evaluations; • Conduct seismic evaluations on identified community assets (including shelters) for implementing appropriate structural and non-structural mitigation strategies; • Prioritize seismic upgrades based on criticality of need and population served; and • Seismically retrofit critical government facilities to guarantee continuous operation during and after a natural disaster. 			
Coordinating Organization:		Economic and Community Development, Public Works	
Internal Partners:		External Partners:	
Building, Engineering		Clackamas Fire District #1, North Clackamas School District, DOGAMI	
Potential Funding Sources:		Estimated cost:	Timeline:
FEMA, OEM, Seismic Grants (SRGP), Capital Funds, Local Bonds		High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item.		
Priority:	Medium		

Flood #1

Proposed Action Item:		Alignment with Plan Goals:	
Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Zoning Code, FEMA FIRMs, Comprehensive Plan, Stormwater Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The National Flood Insurance Program provides communities with federally backed flood insurance to homeowners, renters, and business owners, provided that communities develop and enforce adequate floodplain management ordinances. The benefits of adopting NFIP standards for communities are a reduced level of flood damage in the community and stronger buildings that can withstand floods. According to the NFIP, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance. The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will help reduce the level of flood damage to new and existing buildings in communities while providing homeowners, renters and business owners additional flood insurance protection. <u>2012 Status:</u> In 2009, Happy Valley's Floodplain Ordinance was updated. <u>2018 Status:</u> City complies with the NFIP through their floodplain ordinance. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Community Assistance Visits (CAV) are scheduled visits to communities participating in the NFIP for: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. Actively participate with DLCD and FEMA during Community Assistance Visits; Assess the floodplain ordinances to ensure they reflect current flood hazards and situations, and meet NFIP requirements; Coordinate with the county to ensure that floodplain ordinances and NFIP regulations are maintained and enforced; and Mitigate areas that are prone to flooding and/or have the potential to flood. This area includes Happy Valley Heights. 			
Coordinating Organization:		Economic and Community Development	
Internal Partners:		External Partners:	
GIS, Public Works		Department of Land Conservation and Development; Association of State Floodplain Managers, Federal Emergency Management Agency	
Potential Funding Sources:		Estimated cost:	Timeline:
FEMA, DLCD, Clackamas County Planning Department		Moderate to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Flood #2

Proposed Action Item:		Alignment with Plan Goals:	
Increase capacity of culverts throughout the city.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Zoning Code, FEMA FIRMs, Comprehensive Plan, Stormwater Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The rapid growth of Happy Valley over the past decade has resulted in an undersized culvert system. Much of the flooding experienced is a result of water overflowing culverts at the top of hills and rushing into property lower on the hill. 2012 Status: Projects include the construction of Reclamation Overflow Inlets on 4th Street Hill and Hill way, rebuilt the channel bank to retain the creek so it won't run onto the Wastewater Treatment Plant property; enclosed the creek ditch in at 36" storm pipe along Short Street and North Broadway. Currently working on re-establishing the channel along Wade Creek for approximately 1,000 ft by removing silt and build-up. 2012 Status: Modifications on current culverts were taking place and seven (7) grates had been retrofitted. 2018 Status: In 2016 replaced a culvert in Happy Valley Park. In 2014, the 122nd/Scott Creek Lane culvert was replaced with a bridge. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Identify undersized culverts, primarily in the Happy Valley Heights neighborhood; Prioritize construction projects based on criticality of need; Include culvert enhancement in the Capital Improvements Plan; Contact neighborhood associations to coordinate efforts on privately owned systems; and Coordinate with the Oregon Department of Transportation for access to culverts along roadways. 			
Coordinating Organization:		Economic and Community Development	
Internal Partners:		External Partners:	
Engineering, Public Works		ODOT, Neighborhood Associations, Clackamas County Water Environment Services	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Clackamas County Water Environmental Services		Medium to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Flood #3

Proposed Action Item:		Alignment with Plan Goals:	
Maintain and implement surface water management plan.		Protect Life and Property; Augment Emergency Services; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Zoning Code, FEMA FIRMs, Comprehensive Plan, Stormwater Master Plan, Surface Water Management Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Stormwater management is a key element in maintaining and enhancing a community's livability. There is a direct link between stormwater and a community's surface and ground waters. As a community develops, the impervious surfaces that are created increase the amount of runoff during rainfall events, disrupting the natural hydrologic cycle. Without control, these conditions erode stream channels and prevent groundwater recharge. Parking lots, roadways, and rooftops increase the pollution levels and temperature of stormwater runoff that is transported to streams, rivers, and groundwater resources. Protecting these waters is vital for a great number of uses, including fish and wildlife habitat, recreation, and drinking water. Happy Valley is within Clackamas County Water Environment Services Service Area 2: Stormwater and Wastewater. <u>2012 Status</u>: Updated Stormwater Management Plan in accordance with the Municipal Separate Storm Sewer Systems (MS4) DEQ permit. <u>2018 Status</u>: In 2017 the Surface Water Management Plan was updated. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Identify appropriate staff members to work on implementing the surface water management plan; Research consulting firms that specialize in stormwater management plans; Identify funding to create the plan; and Identify mitigation action items that reduce the city's vulnerability to flood and landslide related hazards. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Planning, Engineering, Building, Planning Commission		ODOT, Neighborhood Associations, Clackamas County Water Environment Services	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Clackamas County Water Environmental Services		Medium to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Severe Storm #1*

Proposed Action Item:		Alignment with Plan Goals:	
Reduce negative effects from severe windstorm, severe winter storm, and extreme heat events.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships and Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Stormwater Master Plan, Surface Water Management Plan, Winter Response Operations Plan, Zoning Code			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to cause power outages can assist a community in mitigating its overall risk to wind and winter storms. <u>2012 Status:</u> A Winter Storm Operational Plan was developed and the de-icing program was established with new equipment purchased. Two (2) new shelters were established under the Red Cross shelter certification. The Police Department and Public Works buildings received new generators and City identified potential buildings that can act as a cooling center. PGE continues regular tree trimming program in the City <u>2018 Status:</u> Created and implemented a hazardous tree evaluation. Happy Valley also updated the Winter Response Operations Plan in 2017. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Reduce power outages by partnering with PGE to obtain funding to bury power lines subject to frequent failures; Encourage burial of power lines for existing development; Ensure that there are back up underground lines to major businesses & employers; Develop partnerships to implement programs to keep trees from threatening lives, property, and public infrastructure; Continue regular tree trimming practices; Partner with PGE to continue hazardous tree inventory and mitigation programs; Create sheltering programs; and Promote safe installation and use of generators. Promote 72-hour kits 			
Coordinating Organization:		Economic and Community Development	
Internal Partners:		External Partners:	
Public Works, Engineering, Building		PGE, Reliance Connects, Red Cross, private landowners	
Potential Funding Sources:		Estimated cost:	Timeline:
General Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	High		

* - High Priority Action Item

Volcanic Event #I

Proposed Action Item:		Alignment with Plan Goals:	
Implement volcanic ash mitigation actions.		Protect Life and Property	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Surface Water Management Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. By preparing for volcanic ash for the manhole covers, Happy Valley will be better prepared for a volcanic event. <u>2018 Status</u>: New Action 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Adapt manhole covers to handle volcanic ash. 			
Coordinating Organization:		Public Safety	
Internal Partners:		External Partners:	
Engineering, Planning		Clackamas County Water Environment Services, FEMA, USGS	
Potential Funding Sources:		Estimated cost:	Timeline:
General Funds, FEMA, Clackamas County, OEM		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	Low		

Wildfire #1

Proposed Action Item:		Alignment with Plan Goals:	
Promote fire-resistant strategies for new and existing developments.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2017 Clackamas County Community Wildfire Protection Plan (2018)			
Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on existing and new buildings and infrastructure [201.6(c)(3)(ii)]. Developing and implementing programs to improve fire-resiliency will reduce the potential for wildfires to cause damage and can assist a community in mitigating its overall risk to wildfire events. • <u>2012 Status</u>: Ongoing. • <u>2018 Status</u>: City, and Metro, did controlled burns on Scouters Mountain and Mt. Talbert. 			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
<ul style="list-style-type: none"> • Require fuel breaks in site plans, describe the procedures for ongoing maintenance, and place information on the city website for public view; • Review roofing standards and develop recommendations for promoting non-combustible roofing; • Encourage installation of double pane windows; • Promote use of sprinkler systems in residential construction; • Maintain awareness of potential city growth into the wildland-urban interface; and • Encourage defensible space creation and use of fire-resistant landscaping. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Engineering, Building, Planning Commission		Clackamas Fire District #1, Oregon Department of Forestry, State Fire Marshal's Office, Metro	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Metro Fund		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Wildfire #2*

Proposed Action Item:		Alignment with Plan Goals:	
Conduct community-based fuel reduction demonstration projects in the wildland-urban interface.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships and Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2017 Clackamas County Community Wildfire Protection Plan (2018), Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Developing and implementing programs to mitigate life-loss will reduce the potential for wildfires to harm citizens and can assist a community in mitigating its overall risk to wildfire events. • The forest lands in and around Happy Valley have accumulated an unnatural buildup of fuel because of decades of timber harvest and aggressive fire suppression. Additionally, residential development near the wildland urban interface has increased exposure to wildfire hazards. • <u>2012 Status:</u> Worked with the County's North Clackamas Parks and Recreation to identify homes around Mt. Talbert to do fuel breaks and worked on fuel breaks around nature trails. • <u>2018 Status:</u> On Scatters Mountain and Mt. Talbert did controlled burns with Metro. 			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
<ul style="list-style-type: none"> • Require fuel breaks in site plans, describe the procedures for ongoing maintenance, and place information on the city website for public view; • Review roofing standards and develop recommendations for promoting non-combustible roofing; • Encourage installation of double pane windows; • Promote use of sprinkler systems in residential construction; • Maintain awareness of potential city growth into the wildland-urban interface; and • Encourage defensible space creation and use of fire-resistant landscaping. 			
Coordinating Organization:		Community Services	
Internal Partners:		External Partners:	
Parks and Recreation		Clackamas Fire District #1 Fire Prevention Office, Oregon Department of Forestry, Clackamas County Wildfire Coop, State Fire Marshal's Office	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Fire District Funding		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	High		

* - High Priority Action Item

Wildfire #3*

Proposed Action Item:		Alignment with Plan Goals:	
Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan .		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; 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:			
The wildfire mitigation action items provide direction on specific activities that organizations and residents in Happy Valley can take to reduce wildfire hazards. 2018 Status: CWPP updated in 2018.			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
Wildfire Risk Assessment (Ch. 4):			
<ol style="list-style-type: none"> Maintain and update the Fuels Reduction (FR) and Communities at Risk (CAR) maps and databases. Continue to track structure vulnerability data throughout the County through structural triage assessments. Update the Overall Wildfire Risk Assessment as new data becomes available. 			
Hazardous Fuels Reduction and Biomass Utilization (Ch. 5):			
<ol style="list-style-type: none"> Develop and maintain an inventory of potential and successful FR projects by meeting with parks and natural lands managers quarterly. Continue securing funding to implement projects/hire seasonal ODF staff. 			
Emergency Operations (Ch. 6):			
<ol style="list-style-type: none"> Develop and FDB Communications Works Group. Conduct a Conflagration Exercise. 			
Education and Community Outreach (Ch. 7):			
<ol style="list-style-type: none"> Develop Firewise toolkit for CAR's. Create incentives for fuels reduction. Update and distribute the Burn Permitting and Fire Restrictions Brochure. Continue to improve address signage throughout the County. 			
Structural Ignitability Policies and Programs (Ch. 8):			
<ol style="list-style-type: none"> Identify a DTD representative for the WFEP. Improve coordination with Rural Fire Agencies. Integrate WU into Plan Map and include a public outreach strategy. 			
Coordinating Organization:		Clackamas Fire District #1	
Internal Partners:		External Partners:	
Public Works, Economic and Community Development		Clackamas Fire Defense Board, ODF, U.S. Forest Service, public land management agencies	
Potential Funding Sources:		Estimated cost:	Timeline:
ODF, operating budgets		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	High (CWPP identified priority actions listed above)		

* - High Priority Action Item

ATTACHMENT B: PUBLIC INVOLVEMENT SUMMARY

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

To provide the public information regarding the draft NHMP addendum, and provide an opportunity for comment, an announcement (see text below) was provided on the City's [website](#). The opportunity to review the draft plan and to comment was left open from March 8, 2019 through April 24, 2019. No comments were received.

Press Release

PUBLIC INVITED TO REVIEW UPDATED HAZARD MITIGATION PLAN

March 8, 2019

Clackamas County
Pre-Disaster Mitigation Planning

PRESS RELEASE

DATE: March 8, 2019

TO: Stephanie Warneke, Communications Specialist.

FROM: Steve Campbell, Emergency Manager

SUBJECT: Press Release for Happy Valley addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan Update – Notice and Opportunity for Public Comment

For Immediate Release

Happy Valley seeks additional public input on update to Natural Hazard Mitigation Plan

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

A natural hazard mitigation plan provides communities with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities, and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

An electronic version of the updated draft Happy Valley NHMP addendum will be available for formal public comment beginning **March 12, 2019**. To view the draft please visit: www.happyvalleyor.gov

If you have any questions regarding the Happy Valley NHMP addendum or the update process in general, please contact: Steve Campbell, Director of Community Services & Public Safety (503) 783-3818 or stevec@happyvalleyor.gov ; or Michael Howard, Assistant Program Director for the Oregon Partnership for Disaster Resilience at (541) 346-8413 or mrhoward@uoregon.edu.

Happy Valley Addendum DRAFT

City of Johnson City Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan



Photo Credit: Institute for Policy Research and Engagement

March 2019

Volume II: Johnson City Addendum



Prepared for:

City of Johnson City

Prepared by:

**University of Oregon
Institute for Policy Research and Engagement
Oregon Partnership for Disaster Resilience**

Planning grant funding provided by:



FEMA

Federal Emergency Management Agency (FEMA)
Pre-Disaster Mitigation Program
Grant: EMS-2017-PC-0005
Sub-grant Application Reference: PDMC-PL-10-OR-2016-001, and

Additional Support Provided by:



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FEMA

September 25, 2019

The Honorable Jim Bernard
Chair, Clackamas County Commissioners
2020 Kaen Road Suite A
Oregon City, Oregon 97045

Dear Chairman Bernard:

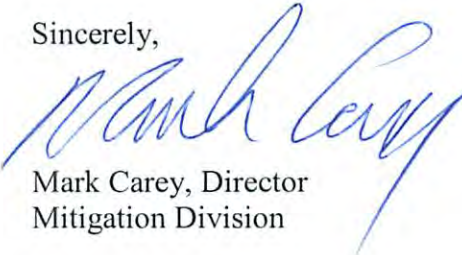
On April 12, 2019, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan* as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance grants through April 11, 2024, through your state.

Clackamas County	City of Estacada	City of Lake Oswego
City of West Linn	City of Wilsonville	City of Johnson City
City of Oregon City	City of Happy Valley	City of Canby
Clackamas Fire District		

The updated list of approved jurisdictions includes the cities of Canby, Happy Valley, Oregon City, Johnson City, and the Clackamas Fire District which recently adopted the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan*. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Joseph Murray, State Hazard Mitigation Planner with Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities.

Sincerely,



Mark Carey, Director
Mitigation Division

Enclosure

JG

Resolution #315

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

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

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

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

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

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

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

Whereas, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *City of Johnson City addendum* to the *Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan* and pre-approved it (dated, July 24, 2019) contingent upon this official adoption of the participating governments and entities;

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


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

Whereas, City of Johnson City adopts the NHMP and directs the Mayor and City Recorder to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.

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

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

Adopted this 19th day of August, 2019



Mayor

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Purpose

This is an update of the Johnson City addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation and Volume III (Appendices) which provide additional information. This addendum meets the following requirements:

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

Updates to Johnson City's addendum are further discussed throughout the NHMP and within Volume III, Appendix B, which provides an overview of alterations to the document that took place during the update process.

Johnson City adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on **August 19, 2019**. FEMA Region X approved the Clackamas County NHMP on **April 12, 2019** and the City's addendum on **September 25, 2019**. With approval of this NHMP the City is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **April 11, 2024**.

Mitigation Plan Mission

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

The City concurs with the mission statement developed during the Clackamas County planning process (Volume I, Section 3):

Promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

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

The City concurs with the goals developed during the Clackamas County planning process (Volume I, Section 3). All NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Below is a list of the NHMP goals:

GOAL #1: PROTECT LIFE AND PROPERTY

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

GOAL #2: ENHANCE NATURAL SYSTEMS

- Balance watershed planning, natural resource management, and land use planning with natural hazards mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

GOAL #3: AUGMENT EMERGENCY SERVICES

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, and business, and industry.
- Coordinate and integrate natural hazards mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL #4: ENCOURAGE PARTNERSHIPS FOR IMPLEMENTATION

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

GOAL #5: PROMOTE PUBLIC AWARENESS

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

NHMP Process, Participation and Adoption

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

Johnson City first developed an addendum to Clackamas County's Natural Hazards Mitigation Plan in 2009. This plan was updated in 2013 and in 2018. The last update of the

Johnson City addendum to the Clackamas County NHMP was approved by FEMA on April 8, 2013.

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

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research, and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM), Clackamas County, and Johnson City to update their NHMP. This project is funded through the Federal Emergency Management Agency's (FEMA) Fiscal-Year 2016 (FY16) Pre-Disaster Mitigation (PDM) Competitive Grant Program EMS-2017-PC-0005 (PDMC-PL-10-OR-2016-001). Members of the Johnson City NHMP Hazard Mitigation Advisory Committee (HMAC) also participated in the County NHMP update process (Volume III, Appendix B).

The Clackamas County NHMP, and Johnson City addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. The Johnson City HMAC guided the process of developing the NHMP.

Convener

The City Recorder of Johnson City serves as the NHMP addendum convener. The convener of the NHMP will take the lead in implementing, maintaining and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the City of Johnson City HMAC met formally and informally, to discuss updates to their addendum (Volume III, Appendix B). The HMAC reviewed and revised the City's addendum, with focus on the NHMP's risk assessment and mitigation strategy (action items).

This addendum reflects decisions made at the designated meetings and during subsequent work and communication with Clackamas County Resilience Coordinator, and the OPDR. The changes are highlighted with more detail throughout this document and within Volume III, Appendix B. Other documented changes include a revision of the City's risk assessment and hazard identification sections, NHMP mission and goals, action items, and community profile.

The Johnson City HMAC was comprised of the following representatives:

- Convener, Judy Davis, City Recorder
- Vincent Ballard, Mayor
- Elizabeth Collins, Planning Commissioner
- Brian Johnson, Johnson Mobile Estates land owner

Public participation was achieved with the establishment of the HMAC, which was comprised of City officials representing different departments and sectors and members of the public. The HMAC served as the local review body for the NHMP's development.

Community members were provided an opportunity for comment via the NHMP review process, and through a survey administered by Clackamas County (Volume III, Appendix G).

NHMP Implementation and Maintenance

The City Council will be responsible for adopting the Johnson City addendum to the Clackamas County NHMP. This addendum designates a HMAC and a convener to oversee the development and implementation of action items. Because the City addendum is part of the County's multi-jurisdictional NHMP, the City will look for opportunities to partner with the County. The City's HMAC will convene after re-adoption of the Johnson City NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The City Recorder will serve as the convener and will be responsible for assembling the HMAC. The HMAC will be responsible for:

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating and training new HMAC members on the NHMP and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement; and
- Documenting successes and lessons learned during the year.

The convener will also remain active in the County's implementation and maintenance process (Volume I, Section 4).

The City will utilize the same action item prioritization process as the County (Volume I, Section 4).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, and Building Codes, as well as the [Clackamas County NHMP](#), and the [State of Oregon NHMP](#).

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the city. Plans and policies already in existence have support from residents, businesses and policy makers. Where possible, Johnson City will implement the NHMP's recommended actions through existing plans and policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Future development without proper planning may result in worsening problems associated with natural hazards. Metro, the regional government for Clackamas, Multnomah, and Washington counties, determines many land use laws for the tri-county region and sets the urban growth boundary. The entire Portland Metro area is subject to tremendous growth pressures due to its desirable location and the restrictions on urban sprawl placed by urban growth boundary requirements.

Johnson City's acknowledged comprehensive plan is the City of Johnson City Comprehensive Plan (1980, updated 1989). The City implements the plan through the Development Code.

Johnson City currently has the following plans, regulations, and projects that relate to natural hazard mitigation.

- [Comprehensive Plan](#) (1980, updated 1989)
Establishes the city's authority to plan for and deal with issues related to the future development of Johnson City.

Other plans:

- [Clackamas County Community Wildfire Protection Plan](#)
 - [Clackamas Fire District #1](#)

Government Structure

The City of Johnson City has a council-manager form of government. The City Council consists of five members; a mayor and four councilors. The mayor presides over Council meetings. The City Council members are elected to two- or four-year terms of office through a general election, and the mayor is appointed from within the elected council members. The City Council is responsible for identifying problems and needs within the community and then addressing those problems through community goals and objectives.

Johnson City has a Planning Commission, which also acts serves as the Johnson City Involvement Committee. All positions are of a voluntary nonprofessional nature. The City Recorder is the only paid city staff member.

Continued Public Participation

An open public involvement process is essential to the development of an effective NHMP. To develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunity for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the NHMP during review.¹ Keeping the public informed of the City's efforts to reduce its risk to future natural hazard events is important for successful NHMP implementation and maintenance. The City is committed to involving the public in the NHMP review and update process (Volume I, Section 4). The City provided a copy the plan update for public review and comment at City Hall before FEMA approval, and after approval will maintain a copy of the plan in City Hall.

¹ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

NHMP Maintenance

The Clackamas County NHMP and City addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the County NHMP update process, the City will also review and update its addendum (Volume I, Section 4). The convener will be responsible for convening the HMAC to address the questions outlined below.

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

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

Mitigation Strategy

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

The City's mitigation strategy (action items) were first developed during the 2009 NHMP planning process and revised during subsequent NHMP updates. During these processes, the HMAC assessed the City's risk, identified potential issues, and developed a mitigation strategy (action items).

During the 2018 update process the City re-evaluated their mitigation strategy (action items). During this process action items were updated, noting what accomplishments had been made and whether the actions were still relevant; any new action items were identified at this time (see Volume III, Appendix B for more information on changes to action items).

Priority Action Items

Table JA-1 presents a list of mitigation actions. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity. High priority actions are shown in **bold** text with grey highlight. The City will focus their attention, and resource availability, upon these achievable, high leverage, activities over the next five-years. Although this methodology provides a guide for the HMAC in terms of implementation, the HMAC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the

committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for detailed information for each action. Full text of the plan goals referenced in Table JA-1 is located on page JA-2.

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Table JA-1 Johnson City Action Items

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
MH #1	Develop and maintain public education programs to inform the public about methods for mitigating the impacts of natural hazards.	City Staff	HMAC, Johnson Mobile Estates	Ongoing	✓		✓	✓	✓
MH #2	Update, maintain, and map records of the locations of all underground utility lines.	City Staff	HMAC, Johnson Mobile Estates	Ongoing	✓		✓	✓	
EQ #1	Encourage and implement appropriate structural and non-structural seismic mitigation.	City Staff	HMAC, Johnson Mobile Estates	Ongoing	✓		✓	✓	✓
FL #1	Coordinate with Clackamas County to keep Kellogg Creek clear of debris.	City Staff	HMAC, Johnson Mobile Estates	Ongoing	✓	✓		✓	

Source: City of Johnson City HMAC, 2018

Note: Full text of the plan goals referenced in this table is located on page JA-2

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Risk Assessment

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

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

The local level rationale for the identified mitigation strategies (action items) is presented herein and within Volume I, Section 3 and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure JA-1. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure JA-1 Understanding Risk



Hazard Analysis

The Johnson City HMA developed their hazard vulnerability assessment (HVA), using their previous HVA and the County’s HVA as a reference. Changes from their previous HVA and the County’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Johnson City, which are discussed throughout this addendum.

Table JA-2 shows the HVA matrix for Johnson City listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response and recovery. The method provides the jurisdiction with a sense of hazard priorities but does not predict the occurrence of a hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake and Crustal earthquake) and one chronic hazard (winter storm) rank as the top hazard threats to the City (Top Tier). Windstorm, flood, and drought comprise the next highest ranked hazards (Middle Tier), while extreme heat, volcanic event, wildfire, and landslide hazards comprise the lowest ranked hazards (Bottom Tier).

Table JA-2 Hazard Analysis Matrix – Johnson City

Hazard	Maximum				Total Threat Score	Hazard Rank	Hazard Tiers
	History	Vulnerability	Threat	Probability			
Earthquake - Cascadia	4	45	100	49	198	#1	Top Tier
Earthquake - Crustal	6	50	100	21	177	#2	
Winter Storm	10	30	70	49	159	#3	
Windstorm	20	15	50	49	134	#4	Middle Tier
Flood	6	20	30	49	105	#5	
Drought	10	10	50	21	91	#6	
Extreme Heat	2	10	40	14	66	#7	Bottom Tier
Volcanic Event	2	15	40	7	64	#8	
Wildfire	6	10	30	14	60	#9	
Landslide	2	5	10	7	24	#10	

Source: Johnson City HMAc, 2018.

Table JA-3 categorizes the probability and vulnerability scores from the hazard analysis for the City and compares the results to the assessment completed by the Clackamas County HMAc. Variations between the City and County are noted in **bold** text within the city ratings.

Table JA-3 Probability and Vulnerability Comparison

Hazard	Johnson City		Clackamas County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Low	Low	High	Low
Earthquake - Cascadia	Moderate	High	Moderate	High
Earthquake - Crustal	Low	High	Low	High
Extreme Heat	Low	Low	Low	High
Flood	Moderate	Moderate	High	Moderate
Landslide	Low	Low	High	Low
Volcanic Event	Low	Low	Low	Moderate
Wildfire	Low	Low	High	Moderate
Windstorm	Moderate	Low	Moderate	Low
Winter Storm	Moderate	Moderate	Moderate	Moderate

Source: Johnson City and Clackamas County HMAc, 2018.

Community Characteristics

Table JA-4 and the following section provides information on City specific demographics and assets. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation.

Considering the City specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation. Between 2010 and 2016 the City population did not change (as of 2018 the population was 560) while median household income increased by about 9%.² The population is forecast to stay stable at 561 by 2040.³ New development has complied with the standards of the [Oregon Building Code](#) and the city's development code. The city is composed entirely of manufactured (mobile) homes.

Transportation/Infrastructure

Johnson City is in the Willamette Valley 5 miles southeast of the City of Portland near the intersection of Highways 224/212 and Interstate 205. Johnson City is laid out into three sections – a main section and two cul-de-sacs separately accessed from Roots Road. The main section, where most of the homes are located, is accessed by two streets off of Roots Road.

Motor vehicles represent the dominant mode of travel through and within Johnson City. The City's public transit is provided by TriMet, which has several stops along SE Roots Road, along the north boundary of the City.

Economy

Johnson City does not have private businesses located within its boundaries besides the Johnson Mobile Estates. Johnson City's proximity to major transportation routes and access to downtown Portland located 9.7 miles away has made it a desirable place for people to live and commute to jobs located outside of the City limits. The city's residents work in a variety of industries, with "office and administrative support occupations" (19% of workforce) and "sales and related occupations" (18%) accounting for the top two occupations.⁴

² Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018 and Social Explorer, Table T57, U.S. Census Bureau, 2012-2016 and 2006-2010 American Community Survey Estimates.

³ Metro, 2040 Distributed Forecast (2016).

⁴ Social Explorer, Table 50, U.S. Census Bureau, 2012-2016 American Community Survey Estimates

Table JA-4 Community Characteristics

Population Characteristics		
2010 Population	565	
2016 Population [2018 Population]	565	[560]
2040 Forecasted Population*	561	
Race (non-Hispanic) and Ethnicity (Hispanic)		
White	96%	
Black/ African American	< 1%	
American Indian and Alaska Native	1%	
Asian	2%	
Native Hawaiian and Other Pacific Islander	0%	
Some Other Race	< 1%	
Two or More Races	1%	
Hispanic or Latino	18%	
Limited or No English Spoken	11%	
Vulnerable Age Groups		
Less than 15 Years	96	18%
65 Years and Over	126	23%
Disability Status		
Total Population	111	20%
Children	2	2%
Seniors	49	39%

Income Characteristics		
Households by Income Category		
Less than \$15,000	74	25%
\$15,000-\$29,999	67	22%
\$30,000-\$44,999	44	15%
\$45,000-\$59,999	53	18%
\$60,000-\$74,999	30	10%
\$75,000-\$99,999	24	8%
\$100,000-\$199,999	7	2%
\$200,000 or more	-	-
Median Household Income	\$33,083	
Poverty Rates		
Total Population	166	31%
Children	48	51%
Seniors	11	9%
Housing Cost Burden		
Owners with Mortgage	26	9%
Renters	4	20%

Source: U.S. Census Bureau, 2012-2016 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018. [Metro, 2040 Distributed Forecast](#). Note: * = Population forecast within Metro UGB

Housing Characteristics		
Housing Units		
Single-Family	34	11%
Multi-Family	0	0%
Mobile Homes	265	89%
Year Structure Built		
Pre-1970	12	4%
1970-1989	159	53%
1990 or later	128	43%
Housing Tenure and Vacancy		
Owner-occupied	279	93%
Renter-occupied	20	7%
Seasonal	0	0%
Vacant	0	0%

Johnson City is unusual among Oregon cities. In phases, beginning in 1960, Johnson Mobile Park, Inc. (JMP) developed a 45 acre (0.07 sq. mi.) mobile home park in Clackamas County near the City of Gladstone. Approximately ten (10) years later, the residents of the mobile home park decided to obtain sewer and other services by annexing to an existing municipality. They unsuccessfully tried to annex to Gladstone. In 1971, the residents of Johnson Mobile Estates voted to incorporate. Johnson City is a planned mobile home park, so there is little opportunity for further development or expansion. The slope along Roots Road is the only area of expansion and is zoned MR1 in the Comprehensive Plan. Most of the land within the city continues to be owned by Johnson Mobile Park, Inc. (JMP), including all residential lots, streets, and the five (5) acre lake. The City owns City Hall, Mordock Park adjacent to Lake Leona, and a sewer flow station.

The city is located at 114 feet above sea level. The city's climate is consistent with the Marine west coast climate zone, with warm summers and cool, wet winters. Johnson City receives most of its rainfall between October and May, and averages 47 inches of rain, and less than one (1) inch of snow, per year.⁵

⁵ "[Monthly Average for Johnson City, OR](#)" AccuWeather, Inc. Retrieved January 15, 2019.

Community Assets

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of Johnson City. It is important to note that the facilities identified as “critical” and “essential” are characterized differently than the structural code that identifies buildings as “essential” and “non-essential.” The structural code uses different language and criteria and therefore have completely different meanings than the buildings identified in this addendum.

Critical Facilities

Facilities that are critical to government response, and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include: 911 Centers, Emergency Operations Centers, Police, and Fire Stations, Public Works facilities, sewer, and water facilities, hospitals, bridges, roads, shelters, and more.

Table JA-5 Critical Facilities in Johnson City

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Facilities									
City Hall		X					X	X	X

Essential Facilities

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public’s ability to recover from the emergency. These facilities may include: City buildings such as the Public Services Building, the City Hall, and other public facilities such as schools.

Johnson City has a generator and a propane tank that serves City Hall, which is considered vulnerable to earthquake and wildfire.

Hazardous Materials:

Facilities that, if damaged, could cause serious secondary impacts may also be considered “critical.” A hazardous material facility is one example of this type of critical facility. Those sites that store, manufacture, or use potentially hazardous materials.

There are no hazardous materials identified at this time within Johnson City limits.

Cultural and Historic Assets

The cultural and historic heritage of a community is more than just tourist charm. For families that have lived in the city for generations and new resident alike, it is the unique places, stories, and annual events that make Johnson City an appealing place to live. The cultural and historic assets are both intangible benefits and obvious quality-of-life-enhancing amenities.

There are no cultural and historic assets identified at this time within Johnson City limits.

Critical Infrastructure:

Infrastructure that provides necessary services for emergency response include:

Table JA-6 Critical Infrastructure in Johnson City

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Infrastructure									
Arterials									
*designates road maintained by others									
Roots Road*		X							
SE 81st		X							
Other Critical Infrastructure									
Water lines		X							
Sewer lines		X							
Power lines		X						X	
Natural gas lines									
Sewer Flow Station		X							

Economic Assets/Population Centers:

Economic assets include businesses that employ large numbers of people and provide an economic resource to the city of Johnson City. If damaged, the loss of these economic assets could significantly affect economic stability, and prosperity. Population Centers usually are aligned with economic centers and are a concern during evacuation/notification during a hazard event.

There are no economic assets/population centers identified at this time within Johnson City limits.

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.

There is no population group that is considered particularly vulnerable within Johnson City.

Environmental Assets:

Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic, and functional ecosystem services for the community include Lake Leona and Mordock Park.

Hazard Characteristics

Drought

The HMAC determined that the City's probability for drought is **low** and that their vulnerability to drought is **low**. *The probability and vulnerability ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent and probability of a potential event. Due to the climate of Clackamas County, past and present weather conditions have shown an increasing potential for drought.

Johnson Mobile Park, Inc (JMP) provides sewer and water services. Payment for these services is included in rent the residents pay to JMP. The city has adequate capacity and infrastructure for current and expected populations.

Vulnerability Assessment

Due to insufficient data and resources, Johnson City is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables JA-5 and JA-6.

Mitigation Activities

The existing drought hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Earthquake (Cascadia Subduction Zone)

The HMAC determined that the City's probability for a Cascadia Subduction Zone (CSZ) earthquake is **moderate** and that their vulnerability to a CSZ earthquake is **high**. *Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake and Crustal earthquake.*

Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent and probability of a potential event. Generally, an event that affects the County is likely to affect Johnson City as well. The causes and characteristics of an earthquake event are appropriately described within the Volume I, Section 2 as well as the location and extent of potential hazards. Previous occurrences are well documented within Volume I, Section 2 and the community impacts described by the County would generally be the same for Johnson City as well.

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Portland Hills Fault Zone, and Gales Creek-Newberg-Mt. Angel Structural Zone (discussed in the crustal earthquake section).

Figure JA-2 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the city is expected to experience very strong shaking (orange) in a CSZ event.

Figure JA-2 Cascadia Subduction Zone Expected Shaking



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

Note: To view detail click the link above to access Oregon HazVu.

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year. Scientists have found evidence that 11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average

occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D.⁶

The city's proximity to the Cascadia Subduction Zone, potential slope instability and the prevalence of certain soils subject to liquefaction and amplification combine to give the city a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places the city predominately within the "Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades). Within the Northwest Oregon region, damage and shaking is expected to be strong and widespread - an event will be disruptive to daily life and commerce and the main priority is expected to be restoring services to business and residents.

Earthquake (Crustal)

The HMAC determined that the City's probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**. *Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Crustal earthquake, and Cascadia Subduction Zone (CSZ) earthquake.*

Volume I, Section 2 describes the causes and characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Johnson City as well. Figure JA-3 shows a generalized geologic map of the Johnson City area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows the areas of greatest concern within the City limits as red and orange (north boundary).

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

There are two potential crustal fault and/or zone near the City that can generate high-magnitude earthquakes. The Portland Hills Fault Zone (discussed in greater detail below) and the Gales Creek-Newberg-Mount Angel Structural Zone. Other nearby faults include the Oatfield and the Damascus-Tickle Creek faults which run to the east and west respectively, Canby-Molalla structural zones located west of the city, and the Mt. Hood Fault in eastern Clackamas County. Historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late

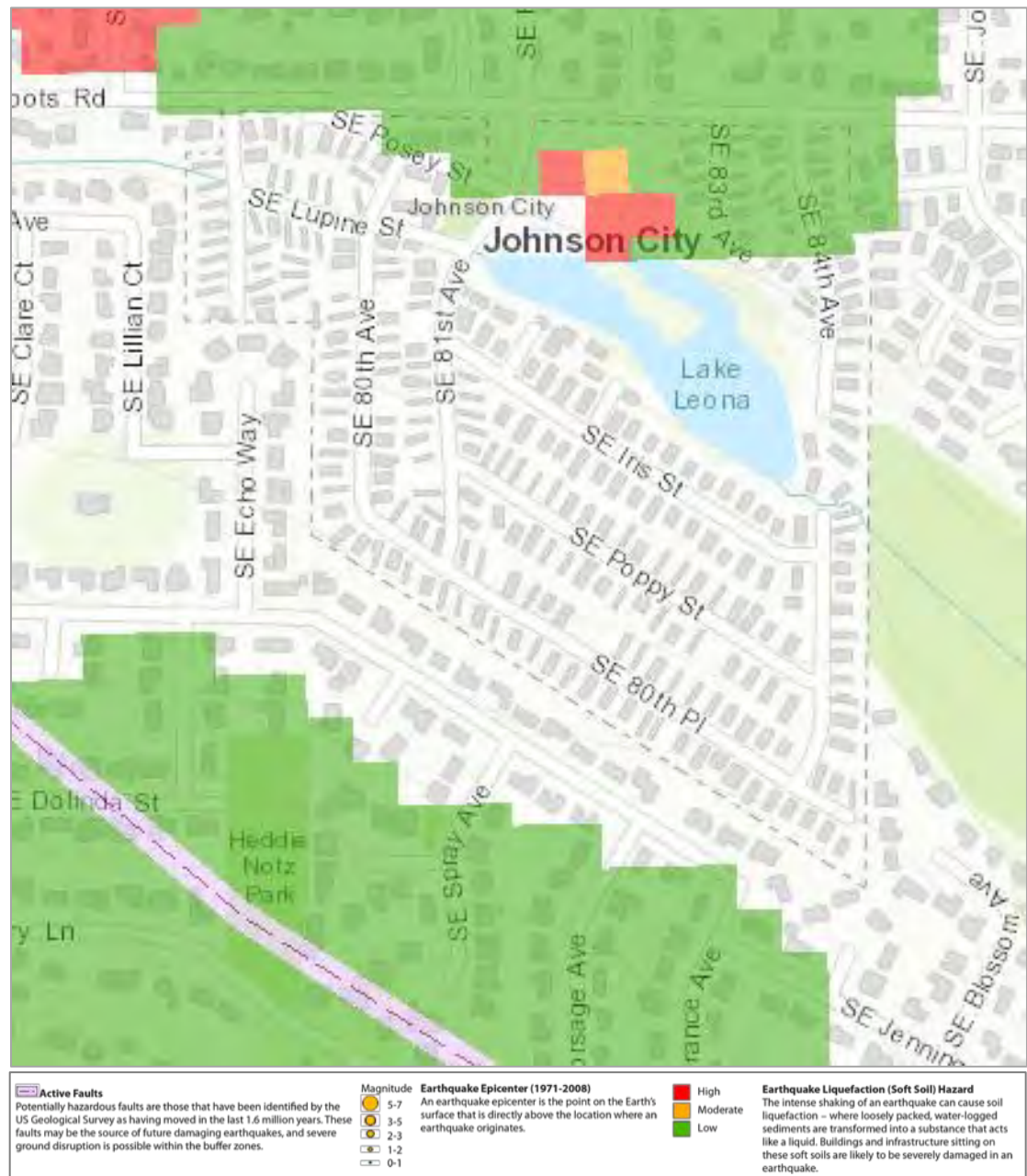
⁶ The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. <http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf>

Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and lies less than one (1) mile south of Johnson City.

Gales Creek-Newberg-Mount Angel Structural Zone

The Gales Creek-Newberg-Mount Angel Structural Zone is a 50-mile-long zone of discontinuous, NW- trending faults. These faults are recognized in the subsurface by vertical separation of the Columbia River Basalt and offset seismic reflectors in the overlying basin sediment.

Figure JA-3 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



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

Note: To view detail click the link above to access Oregon HazVu

Vulnerability Assessment

Due to insufficient data and resources, Johnson City is currently unable to perform a quantitative risk assessment for this hazard.

Even though the hazard maps indicate Johnson City is at a lower risk to earthquakes than many other cities in Clackamas County, earthquakes are the biggest threat to Johnson City. Many of the city's homes (manufacture/mobile homes) are elevated on blocks or situated on dirt and these homes could be shook off their foundations in earthquake events, especially because they are not required to be tied down. Homes in Johnson City are designed to withstand earthquakes and should not collapse, but they could be damaged beyond repair. While this reduces the risk of life loss, the financial burden would be great for many families. Additionally, some utility lines run underneath homes and a broken utility line would be difficult to access for repairs.

For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables JA-5 and JA-6. In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

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

Mitigation Activities

Johnson City has taken mitigation steps to reduce the city's vulnerability in earthquake events. City Hall is situated on a concrete foundation slab, so it should not move off its foundation and will continue to be occupied after a large quake. The old water tower has been removed.

Earthquake Regional Impact Analysis

In 2018 DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)). Their study focused on damage to buildings, and the people that occupy them, and to two key infrastructure sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and night time (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damaged varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood

structures that fare worse in an earthquake. The Portland Hills fault scenario created greater damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios, however, the impact is considerably less than it is to the transportation routes. Additional, capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts.

Table JA-7 shows the permanent resident population that are vulnerable to injury or death (casualty) and the buildings in the City that are susceptible to liquefaction and landslides, it does not predict that damage will occur in specific areas due to either liquefaction or landslide. More population and property are exposed to higher degrees of expected damage or casualty under the Portland Hills Fault “wet” scenario than in any other scenario.

Table JA-7 Expected damages and casualties for the CSZ fault and Portland Hills fault: earthquake, soil moisture, and event time scenarios

	Cascadia Subduction Zone (M9.0)		Portland Hills Fault (M6.8)	
	"Dry" Soil	"Wet" Saturated Soil	"Dry" Soil	"Wet" Saturated Soil
Number of Buildings	275	275	275	275
Building Value (\$ Million)	11	11	11	11
Building Repair Cost	3	4	9	9
Building Loss Ratio	33%	35%	82%	85%
Debris (Thousands of Tons)	5	5	11	11
Long-Term Displaced Population	88	97	319	330
Total Casualties (Daytime)	2	3	7	7
Level 4 (Killed)	0	0	0	0
Total Casualties (Nighttime)	9	9	25	26
Level 4 (Killed)	0	0	0	1

Source: DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8, 12-9, 12-10, and 12-11.

Cascadia Subduction Zone Scenario

The City of Johnson City is expected to have a 33% building loss ratio with a repair cost of \$3 million under the CSZ “dry” scenario, and a 35% building loss ratio with a repair cost of \$4 million under the CSZ “wet” scenario.⁷ The city is expected to have around 2 daytime or 9 nighttime casualties during the CSZ “dry” scenario and 3 daytime or 9 nighttime casualties during the CSZ “wet” scenario. It is expected that there will be a long-term displaced population of around 88 for the CSZ “dry” scenario and 97 for the CSZ “wet” scenario.⁸

Portland Hills Fault Scenario

The City of Johnson City is expected to have a 82% building loss ratio with a repair cost of \$9 million under the CSZ “dry” scenario, and a 85% building loss ratio with a repair cost of \$9

⁷ DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8 and 12-9.

⁸ Ibid, Tables 12-8 and 12-9.

million under the CSZ “wet” scenario.⁹ The long-term displaced population and casualties are greatly increased for all the Portland Hills Fault scenarios. The city is expected to have around 7 daytime or 25 nighttime casualties during the Portland Hills Fault “dry” scenario and 7 daytime or 26 nighttime casualties during the Portland Hills Fault “wet” scenario. It is expected that there will be a long-term displaced population of around 319 for the Portland Hills Fault “dry” scenario and 330 for the Portland Hills Fault “wet” scenario.¹⁰

Recommendations from the report included topics within Planning, Recovery, Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMPs mitigation strategies (Table JA-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and the recommendations see: *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, [O-18-02](#)).

Please review Volume I, Section 2 for additional information on this hazard.

Flood

The HMAC determined that the City’s probability for flood is **moderate** and that their vulnerability to flood is **moderate**. *The probability rating and the vulnerability ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent, and probability of a potential event. Figure JA-4 illustrates the flood hazard area for Johnson City.

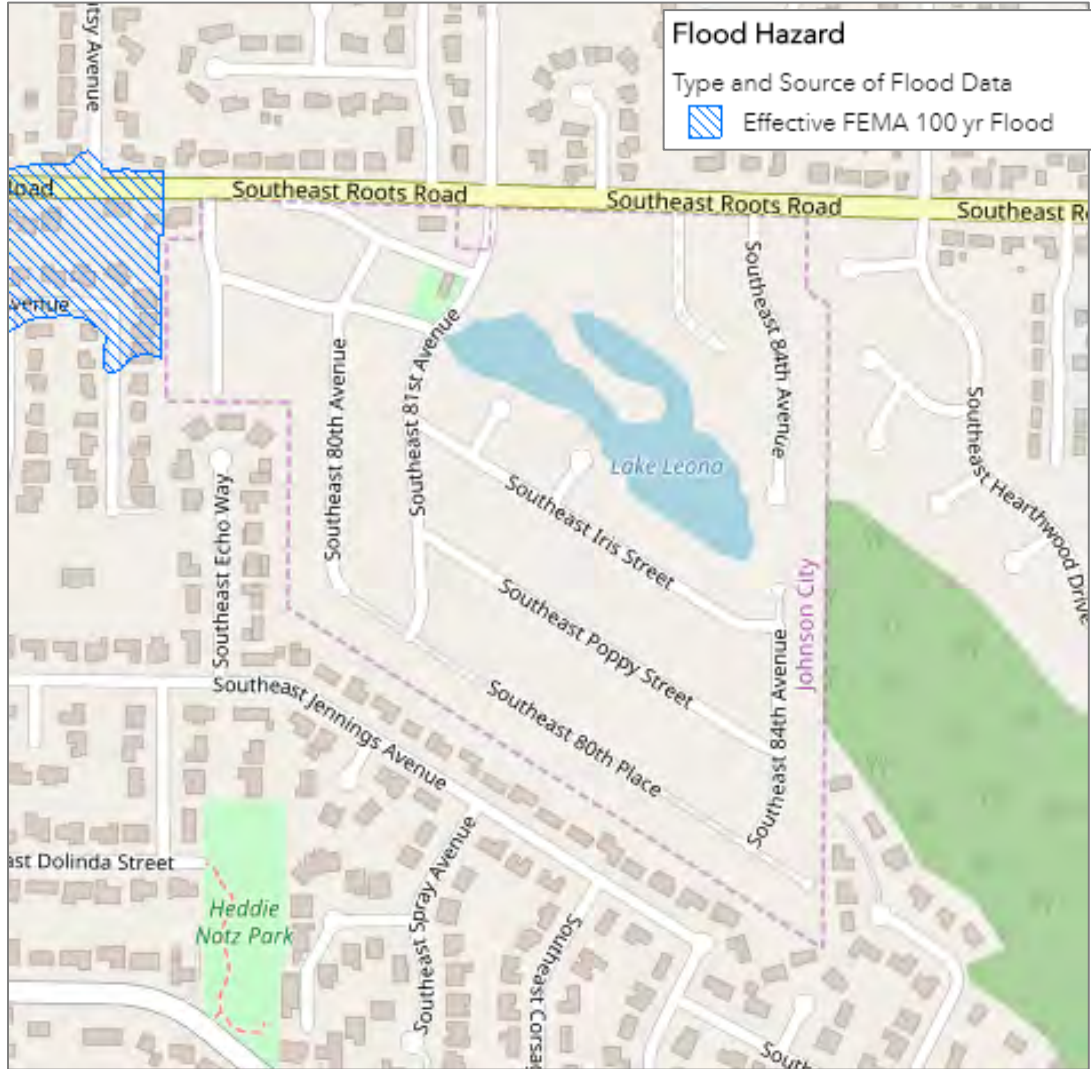
The FEMA NFIP 100-year floodplain stops just west of city limits where Kellogg Creek plunges underground and runs beneath Johnson City, enters Lake Leona, and then continues underground as it exits the City. Lake Leona has never flooded and would require over two feet of additional water before the banks of the lake would be breached. Homes in Johnson City are elevated at least two (2) feet in part to mitigate the flood hazard.

In the past, flooding has occurred on the northwestern border of the city at SE 79th Street. In particularly large events the flood waters continue east towards SE Lupine Street. For example, winter storms and subsequent rainfall in December 2008 and January 2009 caused Kellogg Creek to spill over its banks, causing localized flooding to hit the northwest corner of the City. Flood waters came up to the base of the laundry room on SE 79th Street but did not enter the building. The Johnson City HMAC believes Kellogg Creek overflowed its banks because it was filled with debris and could not drain properly. An action to work with JMP, Inc management used to regularly clear debris from Kellogg Creek, which is under the County’s Water Environment Services Department is included with this addendum to address the debris removal and flooding concern.

⁹ Ibid, Tables 12-10 and 12-11

¹⁰ Ibid, Tables 12-10 and 12-11.

Figure JA-4 Special Flood Hazard Area



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

Note: To view detail click the link above to access Oregon HazVu

Vulnerability Assessment

Due to insufficient data and resources, Johnson City is currently unable to perform a quantitative risk assessment for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables JA-5 and JA-6.

Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage, and economic loss from business interruption. It is important for the City to be aware of flooding impacts and assess its level of risk. The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners, and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of Johnson City outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage.

National Flood Insurance Program (NFIP)

FEMA’s Flood Insurance Study (FIS), and Flood Insurance Rate Maps (FIRMs) are effective as of June 17, 2008. Table JA-8 shows that as of July 2018, Johnson City has zero (0) National Flood Insurance Program (NFIP) policies in force and there has been no paid claims. Johnson City has not received a Community Assistance Visit (CAV) and does not participate in the Community Rating System (CRS). The City complies with the NFIP through enforcement of their flood damage prevention ordinance and their floodplain management program.

Table JA-8 Flood Insurance Detail

	Clackamas County	Johnson City
Effective FIRM and FIS	6/17/2008	6/17/2008
Initial FIRM Date	-	6/17/2008
Total Policies	1,957	0
Pre-FIRM Policies	1,086	0
Policies by Building Type		
Single Family	1,761	0
2 to 4 Family	30	0
Other Residential	58	0
Non-Residential	9	0
Minus Rated A Zone	123	0
Insurance in Force	\$541,833,400	\$0
Total Paid Claims	590	0
Pre-FIRM Claims Paid	450	0
Substantial Damage Claims	83	0
Total Paid Amount	\$20,830,662	-
Repetitive Loss Structures	51	0
Severe Repetitive Loss Properties	4	0
CRS Class Rating	-	NP
Last Community Assistance Visit	-	NP

Source: Information compiled by Department of Land Conservation, and Development, July 2018.

Note: The portion of the cities of Portland and Tualatin that are within Clackamas County are not included in this table.

NP = Not Participating

The Community Repetitive Loss record for Johnson City identifies no Repetitive Loss Properties¹¹ or Severe Repetitive Loss Properties¹².

¹¹ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

¹² A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP, and has incurred flood-related damage for which 4 or more separate

Mitigation Activities

Johnson City employs several mitigation strategies to reduce the city's risk to flood events. The City works to minimize urban flood issues within the City through the clearing of debris. In addition, enclosed pipe sections and catch basins are routinely cleaned and inspected.

Please review Volume I, Section 2 for additional information on this hazard.

Landslide

The HMAC determined that the City's probability for landslide is **low** and that their vulnerability to landslide is **low**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Johnson City does not have a history of landslides. This is due to the City's relatively flat terrain. The Comprehensive Plan states slopes range from 1:100 to 1:10, or 1% grade to 10% grade. The 10% grade area is along the northern banks of Lake Leona between 81st Street and 83rd Street. A recreation vehicle (RV) lot and a few homes are located near this location.

Landslide susceptibility exposure for Johnson City is shown in Figure JA-5. Most of Johnson City demonstrates a low to moderate landslide susceptibility exposure. Approximately 3% of Johnson City has very high or high, and approximately 23% moderate, landslide susceptibility exposure.¹³

Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard, and assets.

Vulnerability Assessment

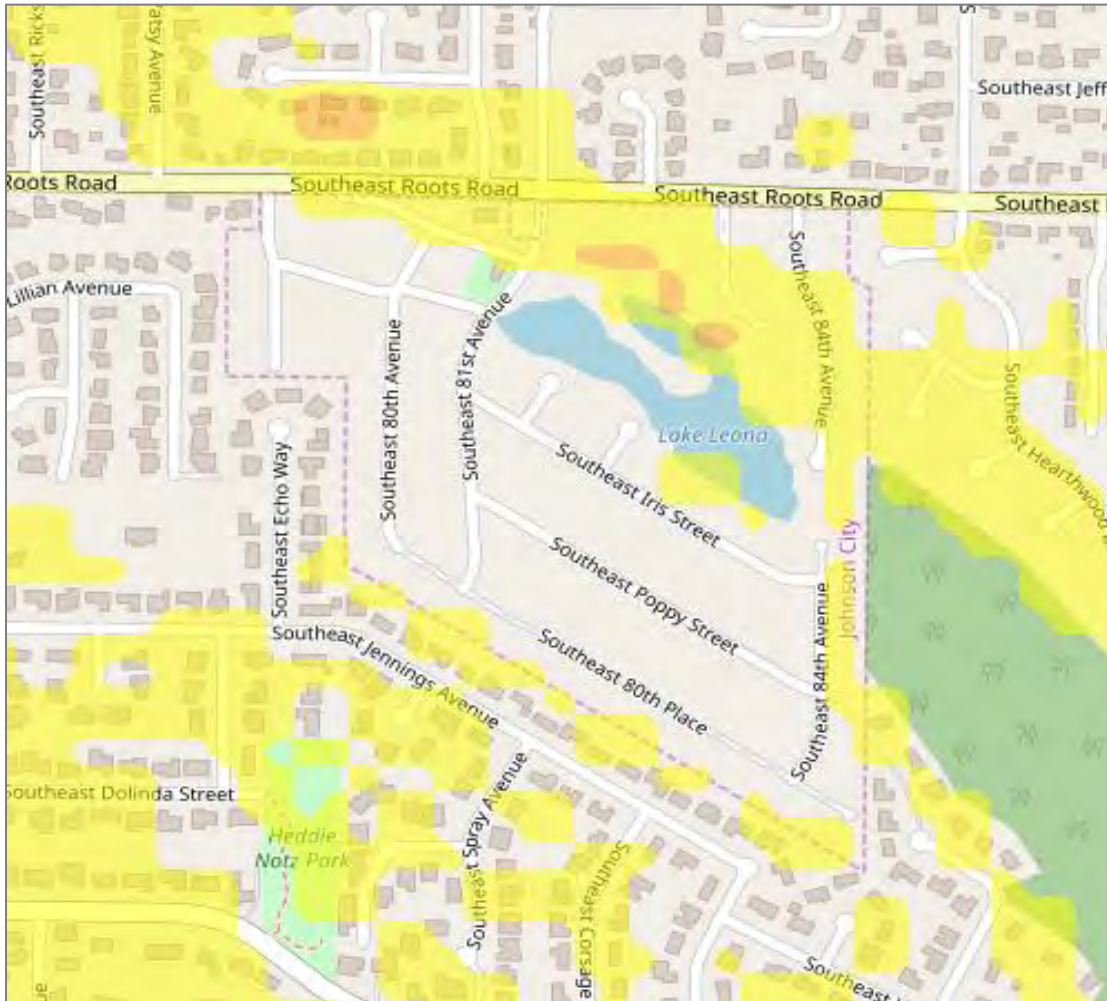
Due to insufficient data and resources, Johnson City is currently unable to perform a quantitative risk assessment for this hazard. However, DOGAMI completed a statewide landslide susceptibility assessment in 2016 ([O-16-02](#)), general findings from that report are provided above and within Figure JA-5.

Potential landslide-related impacts are adequately described within Volume I, Section 2, and include infrastructure damages, economic impacts (due to isolation, and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides, and debris flows can potentially occur during any winter, and thoroughfares beyond City limits are susceptible to obstruction as well. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables JA-5 and JA-6.

claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000, and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

¹³ DOGAMI. [Open-File Report, O-16-02](#), *Landslide Susceptibility Overview Map of Oregon* (2016)

Figure JA-5 Landslide Susceptibility Exposure



Low	Landsliding unlikely. Areas classified as Landslide Density = Low (less than 7%) and areas classified as Slopes Prone to Landsliding = Low.
Moderate	Landsliding possible. Areas classified as Landslide Density = Low to Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = Moderate OR areas classified as Landslide Density = Moderate (7%-17%) and areas classified as Slopes Prone to Landsliding = Low.
High	Landsliding likely. Areas classified as Landslide Density = High (greater than 17%) and areas classified as Slopes Prone to Landsliding = Low and Moderate OR areas classified as Landslide Density = Low and Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = High.
Very High	Existing landslides Landslide Density and Slopes Prone to Landsliding data were not considered in this category. Note: the quality of landslide inventory (existing landslides) mapping varies across the state.

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

Note: To view detail click the link above to access Oregon HazVu

Mitigation Activities

Johnson City works to mitigate future landslide hazards. If a landslide were to occur it could impact water, gas, and power lines. To help minimize the risk of landslides Johnson City maintains vegetation coverage on the slope and encourages planting of native species.

Please review Volume 1, Section 2 for additional information on this hazard.

Severe Weather

Severe weather can account for a variety of intense, and potentially damaging hazard events. These events include extreme heat, windstorms, and winter storms. The following section describes the unique probability, and vulnerability of each identified weather hazard.

Extreme Heat

The HMAC determined that the City's probability for extreme heat events is **low** and that their vulnerability is **low**. *The probability and vulnerability ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the City as well.

A severe heat episode or "heat wave" occurs about every two to three years, and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days with temperatures greater than or equal to 90-degrees, or 100-degrees, Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit, and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The City of Johnson City has not experienced any life-threatening consequences from the few historical extreme heat events, although changes in climate indicate that the area should expect to see more extreme heat events.

Please review Volume I, Section 2 for additional information on this hazard.

Windstorm

The HMAC determined that the City's probability for windstorm is **moderate** and that their vulnerability to windstorm is **low**. *The probability and vulnerability ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent, and probability of a potential event within the region. Because windstorms typically occur during winter months, they are sometimes accompanied by flooding and winter storms (ice, freezing rain, and very rarely, snow). Other severe weather events that may accompany windstorms, including thunderstorms, hail, lightning strikes, and tornadoes are generally negligible for Johnson City.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation, and economic disruptions result as well.

Damage from high winds generally has resulted in downed utility lines, and trees usually limited to several localized areas. Electrical power can be out anywhere from a few hours to several days. Outdoor signs have also suffered damage. If the high winds are accompanied

by rain (which they often are), blowing leaves, and debris clog drainage-ways, which in turn may cause localized urban flooding.

Please review Volume I, Section 2 for additional information on this hazard.

Winter Storm (Snow/Ice)

The HMAP determined that the City's probability for winter storm is **moderate** and that their vulnerability to winter storm is **moderate**. *The probability and vulnerability ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent, and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the City typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

In general, winter storms are worse than windstorms in Johnson City. Several elderly citizens live in Johnson City and snowy conditions make it difficult to travel out of their homes. In winter storms traffic accumulates at the northwest exit on SE 79th Avenue because it is flatter than the SE 81st Avenue exit. Heavy snow loads can damage roofs and awnings. Driveways in Johnson City are located every 30 to 40 feet, so plowing the streets creates snow berms and inhibits access to homes. For this reason, it is best to allow snow to melt where it falls rather than plow it to the sides of streets.

Most winter storms typically do not cause significant damage, they are frequent, and have the potential to impact economic activity. Road closures due to winter weather are an uncommon occurrence but can interrupt commuter, and commercial traffic as noted above. In December 2008, a winter storm caused a few awnings to be damaged because many of the mobile homes are not designed to have that kind of snow load on the roof.

Vulnerability Assessment

Due to insufficient data and resources, Johnson City is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Assets section and Tables JA-5 and JA-6.

Mitigation Activities

Mitigating severe weather can be difficult because storms affect all areas of the city, but Johnson City has made progress to reduce the effects of storms. Johnson City has taken proactive steps in reducing severe storm hazards. Approximately two-thirds of telephone and power lines are underground, and all water, sewer and gas lines are underground, making them less vulnerable in severe storm events. Very few trees threaten Johnson City because JMP management quickly responds to citizen complaints about dangerous trees and cuts them down or requires homeowners to trim them back. Additionally, vegetation on home lots is evaluated before new tenants move in.

Please review Volume I, Section 2 for additional information on this hazard.

Volcanic Event

The HMAC determined that the City's probability for a volcanic event is **low** and that their vulnerability to a volcanic event is **low**. *The probability rating did not change and the vulnerability decreased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of volcanic hazards, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the western portion of the County is likely to affect Johnson City as well. Several volcanoes are located near Johnson City, the closest of which are Mount Hood, Mount Adams, Mount Saint Helens, Mount Rainier, and the Three Sisters.

Vulnerability Assessment

Due to insufficient data and resources, Johnson City is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables JA-5 and JA-6.

Due to Johnson City's relative distance from volcanoes, the city is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Depending on wind patterns and which volcano erupts, however, the city may experience ashfall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city could experience a heavier coating of ash. Tephra can also clog drainage systems and create major debris management problems. Within Johnson City public health would be a primary concern and keeping transportation routes open/accessible would be important as well.

Mitigation Activities

The existing volcano hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Wildfire

The HMAC determined that the City's probability for wildfire is **moderate**, and that their vulnerability to wildfire is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

The [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) was completed in May 2018. The CWPP is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard: <https://www.clackamas.us/dm/CWPP.html>. Information specific to Johnson City is found in the following chapter: [Chapter 10.3: Clackamas Fire District #1](#).

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions. Weather, and urbanization conditions are primarily at cause for the hazard level.

Clackamas County has two major physiographic regions: the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern Clackamas County. The Willamette River Valley, which includes Johnson City, is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range has a relatively small population and is characterized by heavily forested slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to its dense forest land. Human caused fires are responsible for most fires in Clackamas County. In Johnson City most instances of fire have been small enough to contain quickly and easily.

Most of the city (including around Lake Leona) has low wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions.¹⁴ However, conditions vary widely and with local topography, fuels, and local weather (including wind) conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts. Johnson City has not experienced a wildfire within City limits, but the city has dense vegetation coverage on the slope between SE 81st and SE 83rd streets (just outside the eastern city border lies another area of dense vegetation). A fire in this area could impact at least three (3) homes. Figure JA-6 shows overall wildfire risk in Johnson City.

Vulnerability Assessment

Due to insufficient data and resources, Johnson City is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables JA-5 and JA-6.

The potential community impacts, and vulnerabilities described in Volume I, Section 2 are generally accurate for the City as well. Johnson City's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. The City will update the City's wildfire risk assessment if the fire plan presents better data during future updates (an action item is included to participate in future updates to the CWPP).

Property can be damaged or destroyed with one fire as structures, vegetation, and other flammables easily merge to become unpredictable, and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

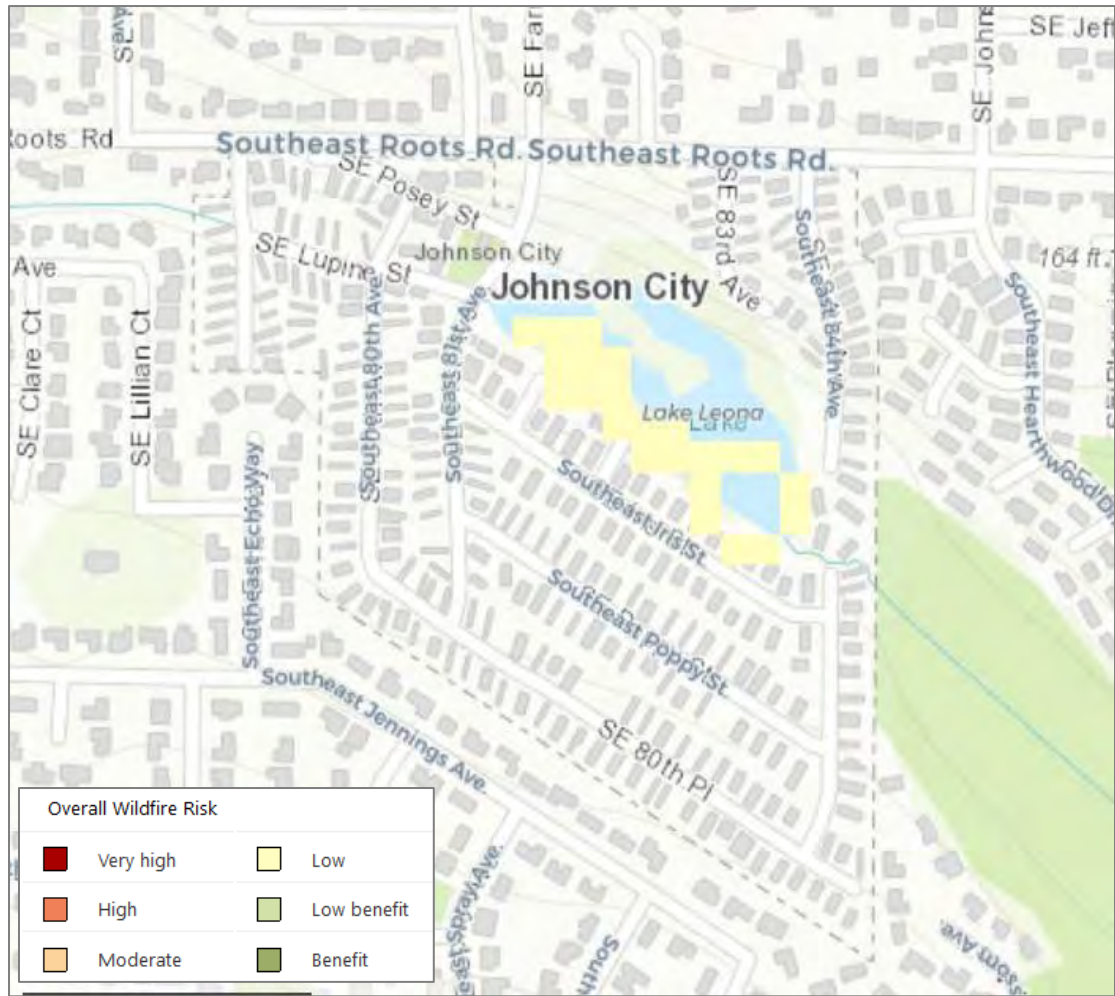
Mitigation Activities

Johnson City uses several mitigation tools to reduce the city's risk to wildfires. Ordinance 33 prohibits the use of fireworks within City limits. Johnson Mobile Park, Inc. rules and regulations require residents to maintain yards. Additionally, JMP requires homes to have visible house numbers for easy identification for emergency responders. Clackamas Fire District #1, the fire protection authority for the City, stays current on issues by participating in the Clackamas County Fire Prevention Cooperative, a group consisting of the fire districts

¹⁴ [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

within the County. The Clackamas Fire District #1 review pre-construction plans and develop fire codes. They recently adopted a district-wide wildland map that governs new construction, and an active public education program for high risk-wildfire areas.

Figure JA-6 Overall Wildfire Risk



Source: [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

The Clackamas Fire District #1 (CFD #1) serves the cities of Happy Valley, Johnson City, Milwaukie, and Oregon City and the unincorporated areas of Barton, Beavercreek, Boring, Carus, Carver, Central Point, Clackamas, Clarkes, Damascus, Eagle Creek, Highland, Hillsview, Holcomb, Kelso, Jennings Lodge, Oak Grove, Redland, South End, Sunnyside, and Westwood. For more information on the fire district see their addendum.

Please review the [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#), Volume I, Section 2, and the Clackamas Fire District #1 Addendum in Volume II for additional information on this hazard.

ATTACHMENT A: ACTION ITEM FORMS

ACTION ITEM FORMS

Multi-Hazard #1	36
Multi-Hazard #2	37
Earthquake #1*	38
Flood #1*	39

* - Priority Action Item

Note: The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity.

Summary of Action Changes

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

Previous NHMP Actions: Completed

No actions were completed.

See 2018 status identified in each action for activities that have been completed since the previous plan.

Previous NHMP Actions: Removed

Multi-Hazard Action #3 (2012): “Identify and pursue funding opportunities to develop and implement hazard mitigation activities” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Multi-Hazard Action #4 (2012): “Continue to update and improve hazard assessments in the Natural Hazards Mitigation Plan as new information becomes available” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Severe Weather Action #1 (2012): “Conduct public outreach campaigns to raise awareness about severe storm hazards, shelter sites, and mitigation actions residents can take to reduce the impact of severe weather in Johnson City” was combined into MH #1 since it was determined by the steering committee that the separate action duplicated the intent of MH #1.

New NHMP Actions (2019):

There were no actions added to the NHMP.

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 NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the County, participating cities, and special districts. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. The City 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, the City 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 several 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 HMAP but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial

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

Internal partner organizations are departments within the City 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.

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:	
Develop and maintain public education programs to inform the public about methods for mitigating the impacts of natural hazards.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Conducting public outreach campaigns raises awareness about natural hazards and helps illustrate what residents and businesses can do to reduce the impact of a natural disaster on their properties, thereby reducing the impact of natural hazards on the City of Estacada. • The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the county's actions to mitigate hazards. • <u>2018 Status</u>: Red Cross brochures were passed around in a councilor's door to door campaign and there was a newsletter article about what to do in the event of a disaster. Johnson City and Clackamas Fire District #1 worked together to put new fire detectors into all the homes. The City provides information regarding natural hazards to residents via a newsletter and at City Hall. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • City Hall is Johnson City's only building. This building is equipped with air conditioning and a backup generator, but residents are unaware that it will be open as either a shelter or cooling center for a natural disaster. Developing and conducting a public outreach program will help notify residents of their option for safety and shelter in times of need. • Conduct public education as hazard seasons approach. These include earthquake awareness month in April, wildfire prevention in summer, and flood and severe storm information in winter; • Partner with Clackamas County and other jurisdictions to develop public education flyers for all hazards; • Include insurance information in public outreach and education materials and promote purchase of appropriate insurance coverage; • Provide hazard information at City Hall; and • Utilize the Johnson City Newsletter to disseminate hazard information. 			
Coordinating Organization:		City Staff	
Internal Partners:		External Partners:	
HMAC, Johnson Mobile Estates		Clackamas Fire District #1, Johnson City Newsletter, Clackamas County, Oregon Emergency Management	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #2

Proposed Action Item:		Alignment with Plan Goals:	
Update, maintain, and map records of the locations of all underground utility lines.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Zoning Ordinance			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating natural hazards plans into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community. Some utility lines, such as water and power, are located beneath homes and access during an emergency situation could be an issue. Knowing the locations of buried utilities will help expedite emergency shut off procedures. <u>2018 Status:</u> The Johnson City Planning Commission is currently in the process of mapping the underground utilities and follows DEQ requirements for storm/sewer systems. The storm line on Lupine Street was adjusted in August 2012 for best drainage into existing lines and catch basins. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Map underground utilities; Inform key city leaders where underground utilities are located; and Teach CERT team members how to shut off utilities in an emergency. 			
Coordinating Organization:		City Staff	
Internal Partners:		External Partners:	
HMAC, Johnson Mobile Estates		Clackamas Fire District #1	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Earthquake #1*

Proposed Action Item:		Alignment with Plan Goals:	
Encourage and implement appropriate structural and non-structural seismic mitigation.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for earthquakes to cause damage can assist a community in mitigating its overall risk to earthquakes. Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. <u>2018 Status:</u> During the city fair, residents receive demonstrations on how to strap down water heaters, build stable decks, and insulate their water heaters. Brochures are distributed during the annual picnic in the park event. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Teach homeowners how to strap down water heaters; Provide information to citizens on nonstructural mitigation techniques including: securing bookcases, filing cabinets, light fixtures, and other objects that can cause injuries and block exits; Educate citizens on earthquake preparedness; Encourage citizens to refer to FEMA's practical guidebook: Reducing the Risks of Nonstructural Earthquake Damage; and Research methods of securing mobile homes and research possible grants for steel bracing of mobile homes. Develop article for the Johnson City newsletter, sharing basic information monthly to remind people about earthquake preparedness. 			
Coordinating Organization:		City Staff	
Internal Partners:		External Partners:	
HMAC, Johnson Mobile Estates		Clackamas Fire District #1, Oregon Occupational Safety and Health Administration	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund, Seismic Rehabilitation Grant Program, Hazard Mitigation Assistance Grants		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High		

* - High Priority Action Item

Flood #1*

Proposed Action Item		Alignment with Plan Goals:	
Coordinate with Clackamas County to keep Kellogg Creek clear of debris.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Kellogg Creek is the only source of flooding for Johnson City. • Culverts continue to not be seasonally cleared, causing backup and potential for a flooding event. • 2012 Status: The City has met with the County several times to discuss the County's involvement and assistance in helping clear debris. The City has a regular clearing of brush. • 2018 Status: Ongoing effort with Clackamas County to clear debris. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Contact the county flood plain manager to discuss the flooding issues on Kellogg Creek; • Discuss debris removal options with the Clackamas County Department of Environmental Quality; and • Partner with local groups to organize cleaning efforts. 			
Coordinating Organization:	City Staff		
Internal Partners:		External Partners:	
HMAC, Johnson Mobile Estates		Clackamas County Planning Department, Clackamas County Department of Environmental Equality	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item.		
Priority:	High		

* - High Priority Action Item

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ATTACHMENT B: PUBLIC INVOLVEMENT SUMMARY

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

The City provided the public information regarding the draft NHMP addendum and an opportunity for comment via an announcement in the city's May electronic newsletter. The public comment period was open from May 6-20 and a copy of the draft plan was provided at City Hall or by e-mail if requested. In addition, the City placed posters in the community bulletin board and on the windows at city hall.

During the public review period there were no comments provided.

Johnson City Natural Hazards Mitigation Plan Updated

A natural hazards mitigation plan provides a community with –

- a set of goals
- action items, and
- resources designed to reduce risk from future natural disaster events.

The process of developing a mitigation plan can also forge new partnerships among community organizations, businesses, and local citizens.

How was the Plan Updated

Johnson City worked with a coordinator to revise its addendum to the county's plan. The plan draft is available for comment at the city office or by e-mail request to johnson.city@hotmail.com. City Council will review it at its May meeting.

Comments can be dropped off at city hall or made by e-mail to johnson.city@hotmail.com by May 20th.

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City of Lake Oswego Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan



Photo Credit: Margaret Bengtson

March 2019

Volume II: Lake Oswego Addendum



Prepared for:

City of Lake Oswego

Prepared by:

**University of Oregon
Institute for Policy Research and Engagement
Oregon Partnership for Disaster Resilience**

Planning grant funding provided by:



FEMA

Federal Emergency Management Agency (FEMA)
Pre-Disaster Mitigation Program
Grant: EMS-2017-PC-0005
Sub-grant Application Reference: PDMC-PL-10-OR-2016-001, and

Additional Support Provided by:



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FEMA

June 18, 2019

The Honorable Jim Bernard
Chair, Clackamas County Commissioners
2020 Kaen Road Suite A
Oregon City, Oregon 97045

Dear Chairman Bernard:

On April 12, 2019, the United States Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10 approved the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan* as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance (HMA) grants through April 11, 2024, through your state.

Clackamas County

| City of Estacada

| City of Lake Oswego

The updated list of approved jurisdictions includes the cities of Estacada and Lake Oswego which recently adopted the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan*. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Joseph Murray, State Hazard Mitigation Planner with Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities.

Sincerely,

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

Mark Carey, Director
Mitigation Division

Enclosure

JG:vl

RESOLUTION 19-34

A RESOLUTION ADOPTING THE CITY OF LAKE OSWEGO ADDENDUM TO THE CLACKAMAS COUNTY MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN

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

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

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

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

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

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

Whereas, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *City of Lake Oswego addendum* to the *Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan* and pre-approved it (dated, April 25, 2019) contingent upon this official adoption of the participating governments and entities;

Whereas, the *Natural Hazard Mitigation Plan* is comprised of comprised of three volumes: Volume I: Basic Plan, Volume II: Jurisdictional Addenda, and Volume III: Appendices, collectively referred to herein as the NHMP; and

Whereas, the *Natural Hazard Mitigation Plan* is in an on-going cycle of development and revision to improve its effectiveness; and

Whereas, City of Lake Oswego adopts addendums to the *Natural Hazard Mitigation Plan* and directs the City Manager to develop, approve, and implement the mitigation strategies and any administrative changes to the *Natural Hazard Mitigation Plan*.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Lake Oswego that:

Section 1. The City of Lake Oswego adopts the Lake Oswego addendum to *the Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan* as an official plan; and

Section 2. The City Council directs that this Adoption Resolution be submitted to the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the *Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan*.

Section 3. Effective Date. This Resolution shall take effect upon passage.


Considered and adopted at the regular meeting of the City Council of the City of Lake Oswego on the 21st day of May, 2019.

AYES: Mayor Studebaker, Manz, O'Neill, LaMotte, Nguyen, Wendland, Kohlhoff

NOES: None


EXCUSED: None

ABSTAIN: None




Kent Studebaker, Mayor

ATTEST:



Anne-Marie Simpson, City Recorder

APPROVED AS TO FORM:



David D. Powell, City Attorney

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Purpose

This is an update of the Lake Oswego addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation, and Volume III (Appendices) which provide additional information. This addendum meets the following requirements:

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

Updates to Lake Oswego's addendum are further discussed throughout the NHMP, and within Volume III, Appendix B, which provides an overview of alterations to the document that took place during the update process.

Lake Oswego adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on **May 21, 2019**. FEMA Region X approved the Clackamas County NHMP on **April 12, 2019** and the City's addendum on **June 18, 2019**. With approval of this NHMP the City is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **April 11, 2024**.

Mitigation Plan Mission

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

The City concurs with the mission statement developed during the Clackamas County planning process (Volume I, Section 3):

Promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

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

The City concurs with the goals developed during the Clackamas County planning process (Volume I, Section 3). All NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Below is a list of the NHMP goals:

GOAL #1: PROTECT LIFE AND PROPERTY

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

GOAL #2: ENHANCE NATURAL SYSTEMS

- Balance watershed planning, natural resource management, and land use planning with natural hazards mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

GOAL #3: AUGMENT EMERGENCY SERVICES

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, and business, and industry.
- Coordinate and integrate natural hazards mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL #4: ENCOURAGE PARTNERSHIPS FOR IMPLEMENTATION

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

GOAL #5: PROMOTE PUBLIC AWARENESS

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

NHMP Process and Participation

This section of the NHMP addendum addresses 44 CFR 201.6(a)(3), *Participation*.

Lake Oswego first developed an addendum to Clackamas County's Natural Hazards Mitigation Plan in 2004. This plan was updated in 2009, 2012, and in 2018. The last update of the Lake Oswego addendum to the Clackamas County NHMP was approved by FEMA on April 8, 2013.

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

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research, and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM), Clackamas County, and Lake Oswego to update their NHMP. This project is funded through the Federal Emergency Management Agency's (FEMA) Fiscal-Year 2016 (FY16) Pre-Disaster Mitigation (PDM) Competitive Grant Program EMS-2017-PC-0005 (PDMC-PL-10-OR-2016-001). Members of the Lake Oswego NHMP Hazard Mitigation Advisory Committee also participated in the County NHMP update process (Volume III, Appendix B).

The Clackamas County NHMP, and Lake Oswego addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. The Lake Oswego Hazard Mitigation Advisory Committee (HMAC) guided the process of developing the NHMP.

Convener and Committee

The Lake Oswego Citizen Information Specialist serves as the NHMP addendum convener. The convener of the NHMP will take the lead in implementing, maintaining, and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the City of Lake Oswego HMAC met formally, and informally, to discuss updates to their addendum (Volume III, Appendix B). The HMAC reviewed, and revised the City's addendum, with focus on the NHMP's risk assessment, and mitigation strategy (action items).

This addendum reflects decisions made at the designated meetings, and during subsequent work, and communication with Clackamas County Resilience Coordinator, and the OPDR. The changes are highlighted with more detail throughout this document, and within Volume III, Appendix B. Other documented changes include a revision of the City's risk assessment, and hazard identification sections, action items, and community profile.

The Lake Oswego HMAC was comprised of the following representatives:

- Bonnie Hirshberger, Citizen Information Coordinator, Convener
- Rob D. Amsberry, Engineering Department
- Jim Bateman, Public Works – Water Superintendent

- Leslie Hamilton, Planning Department
- Megan Phelan, Assistant City Manager/Human Resources Director
- Darryl Wrisley, Police Department - Lieutenant
- Gert Zoutendijk, Fire Department – Fire Marshal

Public Participation

Public participation was achieved, in part, with the establishment of the HMAc, which was comprised of City officials representing different departments, and sectors, and members of the public. The HMAc served as the local review body for the NHMP’s development. Community members were provided an opportunity for comment via the NHMP review process and through a survey administered by Clackamas County (Volume III, Appendix G). During the City public review period (Attachment B) there were no comments provided.

NHMP Implementation, and Maintenance

The City Council will be responsible for adopting the Lake Oswego addendum to the Clackamas County NHMP. This addendum designates the HMAc, and a convener to oversee the development, and implementation of action items. Because the City addendum is part of the County’s multi-jurisdictional NHMP, the City will look for opportunities to partner with the County. The City’s HMAc will convene after re-adoption of the Lake Oswego NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation, and maintenance during their meetings. The Citizen Information Specialist will serve as the convener and will be responsible for assembling the HMAc. The HMAc will be responsible for:

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing, and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating, and training new HMAc members on the NHMP, and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement; and
- Documenting successes, and lessons learned during the year.

The convener will also remain active in the County’s implementation, and maintenance process (Volume I, Section 4).

The City will utilize the same action item prioritization process as the County (Volume I, Section 4).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, and Building Codes, as well as the [Clackamas County NHMP](#), and the [State of Oregon NHMP](#).

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the city. Plans and policies already in existence have support from residents, businesses and policy makers. Where possible, Lake Oswego will implement the NHMP's recommended actions through existing plans and policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Future development without proper planning may result in worsening problems associated with natural hazards. Metro, the regional government for Clackamas, Multnomah, and Washington counties, determines many land use laws for the tri-county region and sets the urban growth boundary. The entire Portland Metro area is subject to tremendous growth pressures due to its desirable location and the restrictions on urban sprawl placed by urban growth boundary requirements.

Lake Oswego's acknowledged comprehensive plan is the City of Lake Oswego Comprehensive Plan (1979, updated March 2014). The Oregon Land Conservation and Development Commission first acknowledged the plan in 1984. The City implements the plan through the Community Development Code.

Lake Oswego currently has the following plans that relate to natural hazard mitigation. For a complete list visit the City's [website](#):

- [Comprehensive Plan](#) (1979, amended 2014)
- [Lake Oswego Community Development Code, and City Code \(revised August 2018\)](#)
 - Section 50.05.010 Sensitive Lands Overlay Districts
 - Section 50.05.011 Flood Management Area
 - Section 50.06.006 Geologic Hazards, and Stormwater Management
 - Article 38.25 Stormwater Management Code
- Building Code, [2017 Oregon State Building Code](#) based on 2015 International Residential Code (IRC), and 2012 International Building Code
- [Capital Improvement Plan](#) (2019, update underway)
- [Clean Streams Plan](#) (2009)
- [Emergency Operations Plan](#) (updated June 2017)
- [2034 Transportation System Plan](#) (2014, amended 2017)
 - [Portland Metro 2014 Regional Transportation Plan](#)

Other plans:

- [Clackamas County Community Wildfire Protection Plan](#) (2018)
 - [Lake Oswego Fire Department](#)

Government Structure

The Lake Oswego City Charter establishes a Council-Manager form of government, which vests policy authority in a volunteer City Council, and administrative authority for day-to-day operations in an appointed, professional City Manager. The Lake Oswego City Council consists of a Mayor and six Councilors who serve four-year terms. At least three Council positions are up for election every two years. Councilors are elected at-large. The three

candidates who receive the highest number of votes are elected to the vacant seats. The Council meets regularly on the first and third Tuesdays of each month at City Hall. The agenda of each meeting includes time for citizen comment.

The City of Lake Oswego currently has the following departments which have a role in natural hazard mitigation:

Building is responsible for plan review and inspections on commercial, industrial and residential developments, as well as fire life and safety plan review.

Engineering manages the design and construction of the City's infrastructure, including surface water, water, wastewater collection, and transportation. In addition, the Engineering Division provides technical support for the Willamette Shore Trolley, oversees the Water Treatment Plant, and provides GIS mapping services.

Fire provides emergency response to more than 50,000 citizens within the City of Lake Oswego and three adjoining contract districts. Emergency services include fire suppression, emergency medical response, hospital ambulance transportation, water and dive rescue operations, hazardous materials incidents, and disaster response. Non-emergency services include fire prevention and inspection services, code enforcement, public safety education services/CPR training, fire extinguisher use, residential safety surveys, home fire escape planning, emergency and disaster preparedness planning and training for citizens (CERT), and fire and life safety education in Lake Oswego schools.

Public Works Operations provides many of the basic urban services to the citizens of Lake Oswego, including water sanitary sewer and storm drainage systems, and their maintenance and repair. The Department is also responsible for streets.

Planning is responsible for all long range and current planning for new development, as well as the City's natural resource, geologic hazard and floodplain overlay zones. It is also responsible for implementation of the Comprehensive Plan.

Police is a full-service law enforcement organization dedicated to the citizens of the City of Lake Oswego. The Department is made up sworn officers and non-sworn personnel.

Continued Public Participation

An open public involvement process is essential to the development of an effective NHMP. To develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunities for the public, neighboring communities, local, and regional agencies, as well as, private, and non-profit entities to comment on the NHMP during review.¹ Keeping the public informed of efforts to reduce its risk to future natural hazard events is important for successful NHMP implementation, and maintenance. As such, the City is committed to involving the public in the NHMP review and update process (Volume I, Section 4). The City posted the plan update for public comment before FEMA approval, and after approval will maintain the plan on the City's website: <https://www.ci.oswego.or.us/maps/natural-hazards-mitigation-plan>.

¹ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

NHMP Maintenance

The Clackamas County NHMP, and City addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the County NHMP update process, the City will also review, and update its addendum (Volume I, Section 4). The convener will be responsible for convening the HMAC to address the questions outlined below.

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

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

Mitigation Strategy

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

The City's mitigation strategy (action items) were first developed during the 2004 NHMP planning process and revised during subsequent NHMP updates. During these processes, the HMAC assessed the City's risk, identified potential issues, and developed a mitigation strategy (action items).

During the 2018 update process the City re-evaluated their mitigation strategy (action items). During this process action items were updated, noting what accomplishments had been made, and whether the actions were still relevant; any new action items were identified at this time (see Volume III, Appendix B for more information on changes to action items).

Priority Action Items

Table LA-1 presents a list of mitigation actions. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity. High priority actions are shown in **bold** text with grey highlight. The City will focus their attention, and resource availability, upon these achievable, high leverage, activities over the next five-years. Although this methodology provides a guide for the HMAC in terms of implementation, the HMAC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the

committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for detailed information for each action. Full text of the plan goals referenced in Table LA-1 is located on page LA-2.

Table LA-1 Lake Oswego Action Items

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
MH#1	Develop, enhance, and implement education programs designed to reduce the losses from natural hazards.	Fire & Public Affairs	Public Works; Engineering	Ongoing	✓		✓	✓	✓
MH#2	Integrate the goals and action items from the Lake Oswego Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	Planning and Engineering	Administration	Ongoing	✓	✓	✓	✓	✓
MH#3	Address wireless communication deficiencies locally and regionally.	Lake Oswego 9-1-1 Communications (LOCOM)		Short Term	✓	✓		✓	
MH#4	Improve vegetation management throughout the city.	Planning and Parks	Watershed Councils	Short Term			✓		✓
MH#5	Upgrade Lake Oswego wastewater system.	Engineering	Public Works	Long Term	✓	✓	✓		
EQ#1	Conduct seismic evaluations on identified critical/essential facilities and infrastructure for implementing appropriate structural and non-structural mitigation strategies.	City Manager's Office	Emergency Management; Administration	Long Term	✓	✓	✓		
FL#1	Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.	Planning and Engineering	Emergency Management; HMAC	Ongoing	✓			✓	

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
LS#1	Improve knowledge of landslide hazard areas and understanding of vulnerability and risk to life and property in hazard-prone areas.	Engineering & Planning	HMAC	Ongoing	✓	✓			
SW#1	Reduce frequency and duration of power outages from the severe wind and winter storm hazards where possible.	Engineering and Planning	Public Works	Ongoing	✓	✓	✓	✓	✓
WF#1	Promote fire-resistant strategies and the use of non-combustible roofing materials by evaluating and making recommendations to current code to encourage noncombustible roofing standards in high fire-hazard areas.	Fire & Planning	Fire Co-op	Long Term	✓	✓	✓		✓
WF#2	Develop and implement an Urban Forest Fire Management Plan.	Fire	Planning	Long Term	✓				
WF#3	Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan	Fire	Planning, Emergency Management	Ongoing	✓	✓		✓	✓

Source: City of Lake Oswego HMAC, 2018.

Note: Full text of the plan goals referenced in this table is located on page LA-2.

Risk Assessment

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

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

The local level rationale for the identified mitigation strategies (action items) is presented herein, and within Volume I, Section 2, and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure LA-1. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure LA-1 Understanding Risk



Hazard Analysis

The Lake Oswego HMA developed their hazard vulnerability assessment (HVA), using their previous HVA, and the County’s HVA as a reference. Changes from their previous HVA and the County’s HVA were made where appropriate to reflect distinctions in vulnerability, and risk from natural hazards unique to Lake Oswego, which are discussed throughout this addendum.

Table LA-2 shows the HVA matrix for Lake Oswego listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with sense of hazard priorities but does not predict the occurrence of a hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake, and a crustal earthquake event such as from the Portland Fault), and two chronic hazards (winter storm, and wildfire) rank as the top hazard threats to the City (Top Tier). The windstorm, drought, flood, and landslide hazards comprise the next highest ranked hazards (Middle Tier), while the volcanic eruption, and extreme heat hazards comprise the lowest ranked hazards (Bottom Tier).

Table LA-2 Hazard Analysis Matrix

Hazard	Maximum				Total Threat Score	Hazard Rank	Hazard Tiers
	History	Vulnerability	Threat	Probability			
Earthquake - Cascadia	4	45	100	49	198	#1	Top Tier
Earthquake - Crustal	6	50	100	21	177	#2	
Winter Storm	10	30	70	56	166	#3	
Wildfire	6	25	70	49	150	#4	
Windstorm	20	20	50	49	139	#5	Middle Tier
Drought	10	20	50	56	136	#6	
Flood	16	20	30	56	122	#7	
Landslide	14	15	20	63	112	#8	
Volcanic Eruption	2	35	50	14	101	#9	Bottom Tier
Extreme Heat	2	20	40	14	76	#10	

Source: Lake Oswego HMAc, 2018.

Table LA-3 categorizes the probability, and vulnerability scores from the hazard analysis for the City and compares the results to the assessment completed by the Clackamas County HMAc. Variations between the City, and County are noted in **bold** text within the city ratings.

Table LA-3 Probability and Vulnerability Comparison

Hazard	Lake Oswego		Clackamas County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	High	Moderate	High	Low
Earthquake - Cascadia	Moderate	High	Moderate	High
Earthquake - Crustal	Low	High	Low	High
Extreme Heat	Low	Moderate	Low	High
Flood	High	Moderate	High	Moderate
Landslide	High	Low	High	Low
Volcanic Eruption	Low	Moderate	Low	Moderate
Wildfire	Moderate	Moderate	High	Moderate
Windstorm	Moderate	Moderate	Moderate	Low
Winter Storm	High	Moderate	Moderate	Moderate

Source: Lake Oswego and Clackamas County HMAc, 2018.

Community Characteristics

Table LA-4 and the following section provides information on City specific demographics, and assets. Many of these community characteristics can affect how natural hazards impact communities, and how communities choose to plan for natural hazard mitigation.

Considering the city specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation. Between 2010 and 2016 the City grew by 1,595 people (4%; as of 2018 the population was 3,8,215) while median household income increased by 1%.² Between 2018 and 2040 the population is forecast to grow by 5% to 40,311.³ New development has complied with the standards of the [Oregon Building Code](#), and the city's development code including their floodplain ordinance.

Transportation/Infrastructure

In the City of Lake Oswego, the town is surrounded by hills on the north, and the south, the Willamette River to the east, and I-5 to the west. Highway 43, a State highway, runs through the eastside of town with Oswego Lake in the center of the City. The current freight railroad system is the Portland, and Western Railroad, which serves local, and regional industry. Lake Oswego's commercial areas developed along primary routes, and residential development followed nearby.

Today, mobility plays an important role in Lake Oswego, and the daily experience of its residents, and businesses. Motor vehicles represent the dominant mode of travel through, and within Lake Oswego. Tri-Met provides local, and regional bus service, to serve the high number of commuters within the Tri-Met region. There are also free or donation-based shuttle services for residents going to the Adult Community Center, medical escorts for doctor appointments, wheelchair, and/or special transportation needs, and services provided by the Tri-Met Lift program.⁴

Economy

Lake Oswego is an inner-urban suburb of the Portland metropolitan region, and has easy access to downtown Portland, and surrounding communities. There is significant economic activity happening within the City of Lake Oswego, making it a desirable place to live, work, and visit. The Kruse Way Corridor, from I-5 to Boones Ferry Road, is a significant economic engine within the City of Lake Oswego, with over 2,700 on-site jobs, and an annual regional economic output of \$1.4 billion (2013).⁵ Lake Oswego residents are mostly employed in professional, and related occupations, with most in management, business, and financial operations occupations.⁶ In 2016, the city's per capita income is \$59,953, and median household income is \$89,979.⁷

² Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018 and Social Explorer, Table T57, U.S. Census Bureau, 2012-2016 and 2006-2010 American Community Survey Estimates..

³ Metro, 2040 Distributed Forecast (2016).

⁴ Transportation Services. City of Lake Oswego website. Visited 10/9/2018:
<https://www.ci.oswego.or.us/acc/transportation-services>

⁵ City of Lake Oswego. (2013). *City of Lake Oswego Draft Economic Opportunities Analysis*. Exhibit 5 Ordinance 2640. <https://tinyurl.com/ycql5o4f>

⁶ Social Explorer, Table T1, U.S. Census Bureau, 2012-2016 American Community Survey Estimates.

⁷ Ibid.

Table LA-4 Community Characteristics

Population Characteristics		
2010 Population	36,620	
2016 Population [2018 Population]	37,425 [38,215]	
2040 Forecasted Population*	40,311	
Race (non-hispanic) and Ethnicity (Hispanic)		
White	86%	
Black/ African American	< 1%	
American Indian and Alaska Native	< 1%	
Asian	6%	
Native Hawaiian and Other Pacific Islander	< 1%	
Some Other Race	0%	
Two or More Races	3%	
Hispanic or Latino	4%	
Limited or No English Spoken	3%	
Vulnerable Age Groups		
Less than 15 Years	6,638	17%
65 Years and Over	7,056	19%
Disability Status		
Total Population	3,060	8%
Children	218	3%
Seniors	1,854	27%

Income Characteristics		
Households by Income Category		
Less than \$15,000	999	6%
\$15,000-\$29,999	1,791	11%
\$30,000-\$44,999	1,384	9%
\$45,000-\$59,999	1,292	8%
\$60,000-\$74,999	1,260	8%
\$75,000-\$99,999	2,044	13%
\$100,000-\$199,999	4,229	26%
\$200,000 or more	3,199	20%
Median Household Income	\$89,979	
Poverty Rates		
Total Population	3,525	9%
Children	816	10%
Seniors	353	5%
Housing Cost Burden		
Owners with Mortgage	3,335	31%
Renters	2,581	49%

Source: U.S. Census Bureau, 2012-2016 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018. [Metro, 2040 Distributed Forecast](#). Note: * = Population forecast within Metro UGB

Housing Characteristics		
Housing Units		
Single-Family	11,997	70%
Multi-Family	5,079	30%
Mobile Homes	5	< 1%
Year Structure Built		
Pre-1970	4,338	25%
1970-1989	7,899	46%
1990 or later	4,844	28%
Housing Tenure and Vacancy		
Owner-occupied	10,884	64%
Renter-occupied	5,314	31%
Seasonal	258	2%
Vacant	625	4%

Lake Oswego is in the northwestern corner of Clackamas County, located in the Tualatin Valley, and within the Metro Portland UGB. There are three major drainage basins: Oswego Lake, the Tualatin River, and the Willamette River. Lake Oswego has a complex geography with many steep, wooded hillsides, and streams that flow from the higher areas to the drainage basins. Oswego Lake is the largest physical feature, and its geographic center.

Lake Oswego's temperatures range from a monthly average low of 35°F in the winter months to a high of 82°F in the summer months. The coldest month is January, and the hottest month is August. The average annual precipitation is about 37 inches.⁸

The City has an educated population with 67% of residents 25 years, and older holding a bachelor's degree or higher.⁹ The Lake Oswego School District has a 92% graduation rate as of 2016-17.¹⁰ Lake Oswego includes commercial development, and light manufacturing but is zoned primarily residential.

⁸ Climate: Average Monthly Weather in Lake Oswego, (2016). United States of America. Weather, and Climate. Last visited 10/10/18. <https://weather-and-climate.com/average-monthly-Rainfall-Temperature-Sunshine,lake-oswego-oregon-us,United-States-of-America>

⁹ Social Explorer, Table T1, U.S. Census Bureau, 2012-2016 American Community Survey Estimates.

¹⁰ Holley, Claire. "Lake Oswego SD grad rate among state's highest at 92.45%". Pamplin Media Group. 01/25/18.

Community Assets

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of Lake Oswego. It is important to note that the facilities identified as “critical” and “essential” are characterized differently than the structural code that identifies buildings as “essential” and “non-essential.” The structural code uses different language and criteria and therefore have completely different meanings than the buildings identified in this addendum.

Critical Facilities

Facilities that are critical to government response, and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include: 911 Centers, Emergency Operations Centers, Police, and Fire Stations, Public Works facilities, sewer, and water facilities, hospitals, bridges, roads, shelters, and more.

Table LA-5 Critical Facilities in Lake Oswego

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Facilities									
City Hall: Dispatch, Law Enforcement		X						X	
Fire Stations: Main Fire Station is the EOC									
Station 210 Westlake Fire Station		X							
Station 211 Jean Rd Fire Station		X							
Station 212 South Shore Fire Station		X					X		
Station 214 Main Fire Station & Admin Office		X							
Other Critical Facilities									
Adult Community Center (short-term shelter)		X			X		X		
Maintenance Center		X							
Water Treatment Plant	X	X							

Hazardous Materials:

Facilities that, if damaged, could cause serious secondary impacts may also be considered “critical.” A hazardous material facility is one example of this type of critical facility. Those sites that store, manufacture, or use potentially hazardous materials include:

Table LA-6 Hazardous Materials in Lake Oswego

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Hazardous Materials									
Biotronics									
Bus Barn School District									
Interstate 5		X							

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Hazardous Materials									
Lakeshore Concrete Co.									
Portland Willamette Railroad*		X			X		X	X	X
Qwest Corporation		X							
State Highway 43		X		X	X		X	X	X
Taylor Made Labels Inc.									
Verizon Northwest Inc.									
Water Treatment Plant (in West Linn)		X		X					

Essential Facilities

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public's ability to recover from the emergency. These facilities may include: City buildings and other public facilities such as schools.

Table LA-7 Essential Facilities in Lake Oswego

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Essential Facilities									
Churches: Shelter Sites		X					X		
Schools: Potential Shelter Sites									
Building (former Marylhurst University)		X		X			X		
Forest Hills Elementary							X		
Hallinan Elementary		X			X		X		
Lake Grove Elementary		X							
Lake Oswego High									
Lake Oswego Junior High		X					X		
Lakeridge High		X							
Lakeridge Junior High									
Oak Creek Elementary (remodeled)		X					X		
Our Lady of the Lake (remodeled)		X							
Palisades Elementary (remodeled)		X							
Park Academy (in Old Armory building)		X							
River Grove Elementary		X							
St Stephen's Academy South Campus									
Uplands Elementary		X					X		
Westridge Elementary		X			X		X		

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Essential Facilities									
City Facilities									
Lake Oswego Library: Shelter									
Lake Oswego Tennis Center: Shelter									
Lake Oswego Municipal Golf Course									

Critical Infrastructure:

Infrastructure that provides necessary services for emergency response include:

Table LA-8 Critical Infrastructure in Lake Oswego

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Infrastructure									
Communications towers		X			X	X	X	X	X
Fiber optic lines		X		X	X				
Highway 43 (State St.), McVey Ave, Stafford Rd.: Regional Emergency Transportation Route		X		X	X		X		
NW Natural gas pipelines and gas substations		X		X					
Oswego Lake dam and headgate		X		X			X		
Oswego Lake sanitary sewer interceptor				X					
Portland & Western Railroad		X			X				
Portland General Electric substations		X		X			X		
Transportation networks, including all major roads and all bridges including Country Club Rd., Boones Ferry Rd., and Kruse Way		X			X				
Tryon Creek Wastewater Treatment Plant, lift stations, and main lines		X		X	X				
Water treatment plant, water pumping stations, major water lines, reservoirs, water intake on Clackamas River		X		X	X				

Economic Assets/Population Centers:

Economic assets include businesses that employ large numbers of people and provide an economic resource to the city of Lake Oswego. If damaged, the loss of these economic assets could significantly affect economic stability, and prosperity. Population Centers usually are aligned with economic centers, and are a concern during evacuation/notification during a hazard event include:

Table LA-9 Economic Assets/Population Centers in Lake Oswego

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Economic Assets/Population Centers									
City Hall		X							
Meadows Rd. and Center Pointe Complex		X							
School District		X					X		
SW Employment Area - Industrial Zone		X					X		

Environmental Assets:

Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic, and functional ecosystem services for the community include:

Table LA-10 Environmental Assets in Lake Oswego

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Environmental Assets									
Bryant Woods Park				X			X	X	X
Canal Acres Natural Area		X		X			X	X	X
Cook's Butte Park							X	X	X
Foothills Park		X		X				X	X
Freepons Park							X	X	X
George Roger Park				X	X		X	X	X
Glenmorrie Park		X						X	X
Hallinan Natural Area							X	X	X
Iron Mountain Park		X		X	X		X	X	X
Lake Grove Swim Park				X			X	X	X
Lake Oswego Hunt Club				X	X		X	X	X
Lake Oswego Swim Park				X	X				
Luscher Farm		X					X	X	X
Millennium Plaza Park				X					
Oswego Lake		X		X					
Oswego Lake Country Club Golf Course								X	X
River Run Park		X		X			X	X	X
Roehr Park		X		X			X		
Rossmann Park		X						X	X
Southwood Park							X	X	X
Springbrook Park							X	X	X
Sundeleaf Park									X

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Environmental Assets									
Tryon Cove Park				X			X	X	X
Tryon Creek State Natural Area		X		X	X		X	X	X
Tualatin River				X					
Waluga Park							X	X	X
Westlake Park									
Willamette River				X					

Vulnerable Populations:

Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, often experience the impacts of natural hazards and disasters more acutely. Populations that have special needs or require special consideration include:

Child Care Facilities

Bethlehem Church Pre-School	Mountain Park Kindercare
Buildings (formerly Touchstone School)	Mountain Park Playschool
Children's Hour Academy	Oswego Play School
Christ Church Episcopal Preschool	Park Academy
Community Arts Pre-School	R D & S Daycare
Exploration Learning School	Rockinghorse Day School
International Leadership Academy	Sonshine Express Preschool
Kiddie Care Child Care	Vermont Hills Family Life Center
Kings Kids	Village Montessori
Lake Oswego Kindercare	West Hills Montessori
Mayam's Preschool	

Adult Care Facilities

Abby's Adult Foster Care	Lake Oswego Care Home
Always Caring	Lake Oswego Comfort Living
Autumn Health Care II	Loving Care Adult Care Home
Best Family Care	Lucky's Home
Cherry Crest Adult Care Home	Mary's Woods
Daniel's Adult Care Home	Oswego Care Home LTD.
Eva & Gabriel Adult Care Home	Oswego Place Assisted Living
Felicia's Adult Care Home	Oswego Pointe Adult Care Home
Green Ridge Estates	Rosewood Inn Adult Foster Care
Greentree Adult Care Home	Sunshine Adult Foster Care
Health for Life	The Pearl at Kruse Way
Hillside Home Adult Care	The Stafford
Hope's Sweet Home	The Springs at Carman Oaks
Indian Springs Adult Care Home	The Springs Living at Lake Oswego

Cultural and Historic Assets

The cultural and historic heritage of a community is more than just tourist charm. For families that have lived in the city for generations and new resident alike, it is the unique places, stories, and annual events that make Lake Oswego an appealing place to live. The cultural and historic assets are both intangible benefits and obvious quality-of-life-enhancing amenities. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important. The following historic resources can be found in the City of Lake Oswego:

Allen House I and II	Iron Furnace	Odd Fellows Hall
Angler's Club	Chimney	Old Mine Trail
Aquinas Hall	Jantzen Estate	Parelius House
Bickner Building	Johnson Barn	Parron House
Black House	Klose House	Peg Tree
Brown-Vose House	Laidlaw House	Pioneer Cemetery
Bryant Home	Lake Grove Fire	Rogers Building I
Marker	Station	and II
Carl House	Lake Oswego	Rogers House
Carman House	Country Club	Rosentreter House
Carter House	Lake Oswego Hunt	Sacred Heart School
Christie School	Club	Shepard House
Clara Weinstein	Lakewood School	Smith House
House	Larson House	St. Catherine's
Cleary House	Log Hoist	Dormitory
Collard House	Lueg House	Sundeleaf House
Conway House	Marylhurst	Trueblood House
Davidson House	Administration	Tualatin-Oswego
Didzun House	Building	Canal
Eastman House	Marylhurst	Tug Masters House
Education Hall	Cemetery/Alter	Twinnings House
Erickson House	McCall House	Van Houten House
F. Davidson House	McWaters House	Vose House
Flavia Hall	Methodist	Waldorf House
Harris House	Episcopal Church	Warren House
Headrick-Carothers	Mulder House	White House
House	Murphy Company	Worker's Cottage
Hofer House	Building	Worthington House
	Noel Dew House	

Hazard Characteristics

Drought

The HMAC determined that the City's probability for drought is **high**, and that their vulnerability to drought is **moderate**. *The probability and vulnerability ratings increased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent, and probability of a potential event. Due to the climate of Clackamas County, past, and present weather conditions have shown an increasing potential for drought.

Lake Oswego draws its main water supply from the Clackamas River intake facility in Gladstone, which is then treated at the Water Treatment Plant in West Linn.¹¹ The West Linn Water Treatment Plant was originally built in unincorporated Clackamas County for the City of Lake Oswego in the 1960s, it now serves multiple jurisdictions-- including Tigard, and Lake Oswego. There was recently a project completed in October 2017 to increase the treated water capacity (to 38 million gallons per day) for residents of Lake Oswego, and Tigard.¹² The treatment plant has two different utility substations on the property for back up electricity, and has agreements with other treatment plants around the region for water use that creates redundancies within the water supply system for residents, and businesses. For more information on the future of Lake Oswego's water supply visit their website: <https://www.ci.oswego.or.us/publicworks/water>.

Vulnerability Assessment

Due to insufficient data and resources, Lake Oswego is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables LA-5 through LA-10.

Mitigation Activities

The existing drought hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

¹¹ Water Source, and System. Lake Oswego Tigard Water Partnership. Last visited 10/9/18.
<http://lotigardwater.org/?p=water-source-and-system>

¹² Lake Oswego-Tigard Water Treatment Plant. Public Works, City of West Linn. Last visited 10/9/18:
<https://westlinnoregon.gov/publicworks/lake-oswego-tigard-water-treatment-plant>

Earthquake (Cascadia Subduction Zone)

The HMAC determined that the City's probability for a Cascadia Subduction Zone (CSZ) earthquake is **moderate** and that their vulnerability to a CSZ earthquake is **high**. *The probability rating decreased, and the vulnerability rating did not change since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake, and Crustal earthquake.*

Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Lake Oswego as well. The causes, and characteristics of an earthquake event are appropriately described within the Volume I, Section 2 as well as the location, and extent of potential hazards. Previous occurrences are well documented within Volume I, Section 2, and the community impacts described by the County would generally be the same for Lake Oswego as well.

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Portland Hills Fault Zone, and Gales Creek-Newberg-Mt. Angel Structural Zone (discussed in the crustal earthquake section).

Cascadia Subduction Zone

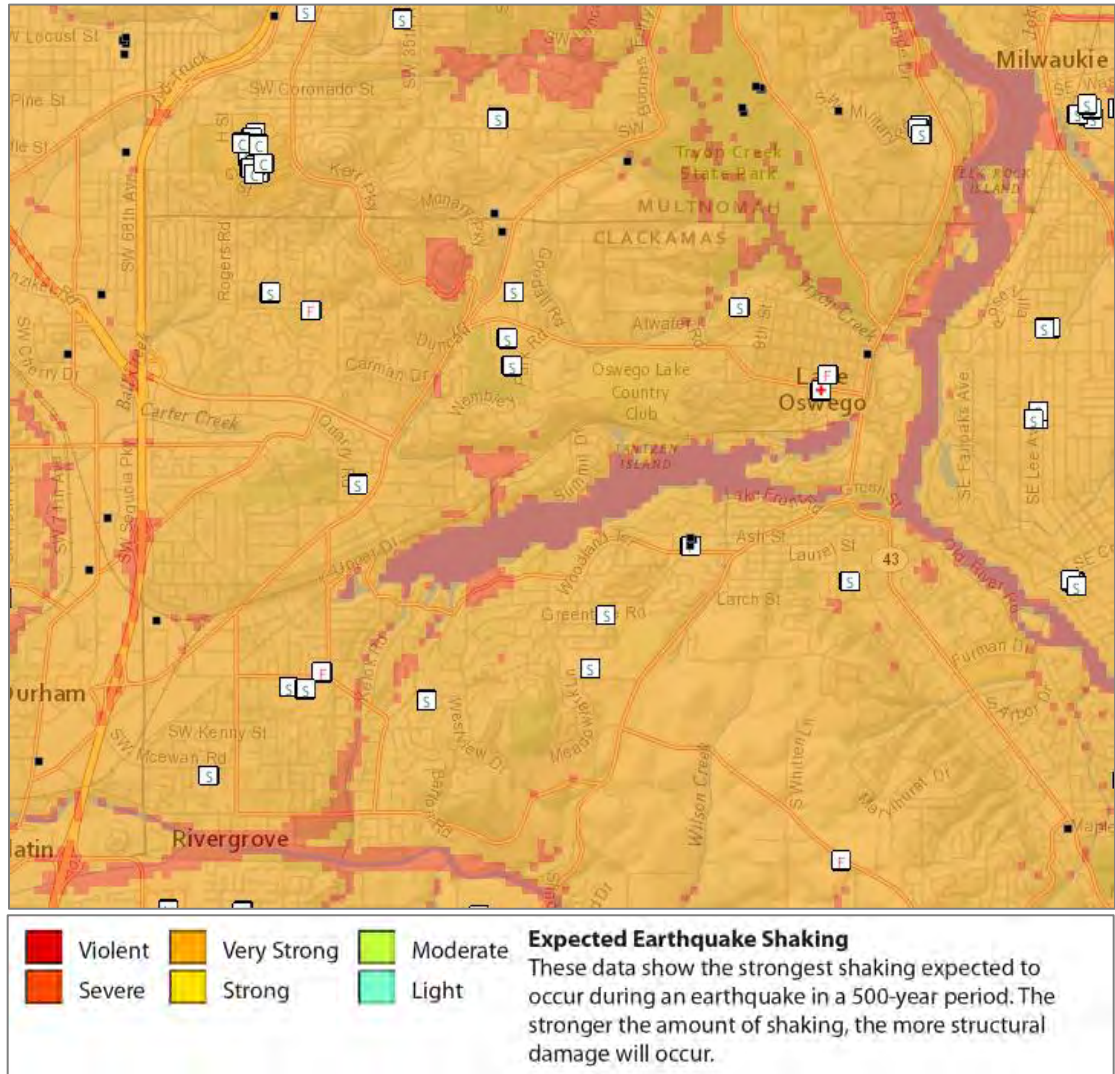
The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year. Scientists have found evidence that 11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D.¹³

The city's proximity to the Cascadia Subduction Zone, potential slope instability, and the prevalence of certain soils subject to liquefaction, and amplification combine to give the City a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones, and places Clackamas County within the "Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades). Within the Northwest Oregon region, damage, and shaking is expected to be strong, and widespread - an event will be disruptive to daily life, and commerce, and the main priority is expected to be restoring services to business, and residents.

Figure LA-2 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the City is expected to experience very strong (orange) shaking, while areas near rivers and streams will experience severe (light red) to violent (dark red) shaking in a CSZ event.

¹³ The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. <http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf>

Figure LA-2 Cascadia Subduction Zone Expected Shaking



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

Note: To view detail click the link above to access Oregon HazVu.

Vulnerability Assessment

Due to insufficient data and resources, Lake Oswego is currently unable to perform a quantitative risk assessment for this hazard. However, the City of Lake Oswego GIS Department completed an analysis, using the best available data, as a component of the vulnerability assessment in 2013 and reviewed and updated it, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing critical and essential facilities and infrastructure with each hazard and identifying where assets and hazards intersected. Additionally, in 2018 the Department of Geology and Mineral Industries (DOGAMI) completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)), findings from that report are provided at the end of the crustal earthquakes hazard section.

City Hall, the Main Fire Station, and the Adult Community Center are critical facilities exposed to relative earthquake hazard Zone A, the highest hazard zone. City Hall, which contains the City's law enforcement and emergency dispatch facilities are not built to current seismic standards. Seismic design standards range by category from Seismic Zone 1 to Seismic Zone 4. Occupancy Category IV is the highest design standard achievable. The Main Fire Station, and the main building of the new Maintenance Center, which houses the Emergency Operations Center (EOC), were built to Occupancy Category IV standards, a step above the required standard for Seismic Zone 3. The Maintenance Center's vehicle barn/motor pool was built to Occupancy Category III standards. The Adult Community Center, which would serve as an emergency short-term shelter, has not had any seismic upgrades and does not meet modern seismic standards.

Several Essential Facilities are in the high earthquake hazard zone. These facilities include the former Marylhurst University building, Westridge Elementary (*proposed to be demolished in rebuilt in 2021, voter approval required*), Lake Grove Elementary (*proposed to be demolished in rebuilt in 2025, voter approval required*), Our Lady of the Lake School, and several churches, which could potentially serve as Red Cross shelter sites.

Operation of and access to exposed infrastructure including the Oswego Lake headgate, City water pumping stations, a PGE substation and the communications towers located at City Hall, could potentially be impacted during an earthquake. Other exposed infrastructure including wastewater main lines, major water lines, natural gas pipeline and fiber optic lines are buried, however they are also vulnerable to damage from earthquake hazards, potentially limiting or delaying access for the purposes of operation or repair. The fiber optic lines located along Highway 43/State Street, McVey Avenue and Stafford Road is a significant communication link for the entire region.

The City's fresh drinking water supply comes from the water treatment plant in West Linn and is in earthquake hazard Zone A (highest hazard), while the water intake located on the Clackamas River in Gladstone is in Zone C. The water line from the West Linn water treatment plant enters Lake Oswego along Highway 43, which crosses through earthquake Zone A. The water treatment plant and the intake have been upgraded to earthquake Zone 4 standards. There are 16 reservoirs serving Lake Oswego.

The three newest reservoirs, Touchstone II, McNary II, and Palisades II were constructed to earthquake Zone 4 standards.

The regional Emergency Transportation Route follows State Highway 43 from the northern City limits, and continues south on State Street to McVey Avenue, and then southwest to and along Stafford Road. The Emergency Transportation Route passes through earthquake hazard Zone A at the northern City limits along State Street, possibly impacting access to and from the City.

Additionally, several the City's environmental assets are exposed to the high earthquake hazard. These include Iron Mountain Park, Canal Acres Natural Area, River Run Park, Glenmorrie Park, Foothills Park, Roehr Park, Rossman Park, and Tryon Creek State Natural Area.

Seismic building codes were implemented in Oregon in the 1970s, however, stricter standards did not take effect until 1991 and early 2000s. As noted in the community characteristics section (Table LA-4), approximately 72% of residential buildings were built

prior to 1990, which increases the City's vulnerability to the earthquake hazard. Information on specific public buildings' (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table LA-11; each "X" represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), none have a very high (100% chance) collapse potential, however, seven (7) schools have a high (greater than 10% chance) collapse potential.

For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables LA-5 through LA-10. In addition to building damages, utility (electric power, water, wastewater, natural gas), and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

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

Mitigation Activities

Earthquake mitigation activities listed here include current mitigation programs and activities that are being implemented by Lake Oswego agencies or organizations.

A primary mitigation objective is to construct or upgrade critical and essential facilities and infrastructure to withstand future earthquake events. The Main Fire Station, a critical facility which serves as the City's Emergency Operations Center (EOC), was constructed to Seismic Zone 4 standards. The South Shore Fire Station recently underwent seismic upgrades, and upgrades have been completed at the West Lake and Jean Road Fire Stations to harden the apparatus bays. Seismic upgrades have also been made to the City's water treatment plant to ensure it remains operational after a magnitude seven earthquake. Additionally, school remodels must now include seismic upgrades and the installation of sprinkler systems. Seismic studies were completed for City Hall and the police station building, City maintenance facilities, and the sewer interceptor system and as a result, the wastewater (sewer) interceptor system was completely rebuilt and seismically upgraded with the LOIS Project, including the overhead mains into the treatment plant.

Table LA-1 I Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
<i>Bryant Elementary (4750 Jean Rd)</i>	<i>Clac_sch03</i>	(X)	<i>Closed in 2013*</i>		
Forest Hills Elementary^^ (1133 Andrews Rd)	Clac_sch04	(X)			
Hallinan Elementary (16800 Hawthorne Dr)	Clac_sch05	X	Seismic retrofit of entire building via 2017 bond.		
Lake Grove Elementary^^ (15777 Boones Ferry Rd)	Clac_sch06	(X)			
Lake Oswego Junior High^ (2500 Country Club Rd)	Clac_sch10	(X)	Seismic retrofit of gym via 2017 bond.		
Lake Oswego High (2501 Country Club Rd)	Clac_sch12	X	Seismic retrofit of gym via 2017 bond.		
Lakeridge Junior High (4700 Jean Rd)	Clac_sch11	(X)	To be rebuilt by 2020 per 2017 bond		
Lakeridge High (1235 Overlook Dr)	Clac_sch13	X	Seismic retrofit of gym via 2017 bond.		
Oak Creek Elementary (55 Kingsgate Rd)	Clac_sch74	(X)	Seismic retrofit of entire building via 2017 bond.		
<i>Palisades Elementary (1500 Greentree Ave)</i>	<i>Clac_sch69</i>		X		
Rivergrove Elementary^ (5850 McEwan Rd)	Clac_sch07	(X)	Seismic retrofit of gym/covered play structure via 2017 bond.		
Uplands Elementary (2055 Wembley Park Rd)	Clac_sch08		Seismic retrofit of gym/covered play structure via 2017 bond.		
Westridge Elementary (3400 Royce Way)	Clac_sch09	X	Seismic retrofit of entire building via 2017 bond.		
Public Safety					
Fire Department Station 210 (4900 Melrose St)	Clac_fir21	X			
Fire Department Station 211 (4555 Jean Rd)	Clac_fir23	X			
Fire Department Station 212 (1880 S Shore Blvd)	Clac_fir07	X			
Fire Department Station 214 Main Station (300 B Ave)	Clac_fir06	X			
Police Dept/ EOC/ City Hall (380 A Ave)	Clac_pol02	X		#	

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#) “*” – Site ID is referenced on the [RVS Clackamas County Map](#)

Note 1: Schools listed in **bold** have proposed remodels that may reduce seismic collapse potential.

Note 2: Collapse potential ratings indicated in parentheses (x) provided in 2008 by Froelich Consulting Engineers.

Note 3: * building being used for students of Lakeridge Junior High

Note 4: ^ Phase 2 (2021) proposes to demolish and rebuild this school (voter approval required)

Note 5: ^^ Phase 3 (2025) proposes to demolish and rebuild this school (voter approval required)

Note 6: # Lake Oswego Police Department/City Hall was determined to have a high collapse potential by the City of Lake Oswego. The City Hall/Police building is scheduled to be rebuilt and is currently in design phase.

City of Lake Oswego Codes Pertaining to Earthquakes

The following Lake Oswego plans, policies, and codes pertain to earthquakes:

1. Lake Oswego Comprehensive Plan, Goal 7 - Areas Subject to Natural Disasters and Hazards, Section 2 Earthquake Hazards. The Goal of Section 2, Earthquake Hazards states: "The City shall protect life and property from earthquake hazards."
2. Lake Oswego Building Code (LOC Chapter 45). Section 45.09 of the Building Code lists the various State of Oregon Codes adopted into the City's Building Code, including, but not limited to:
 - Oregon Structural Specialty Code;
 - UBC Grading Code;
 - Oregon One and Two-Family Dwelling Code;
 - Oregon Manufactured Dwelling Park Rules;
 - Oregon Manufactured Home Installations Rules; and
 - ICBO Uniform Code for the Abatement of Dangerous Buildings.
3. Lake Oswego Emergency Operations Plan and Related Annexes, Earthquake Annex. This plan describes how the City of Lake Oswego's emergency operations system will operate during emergencies involving earthquake conditions within the City and contract districts. The plan is designed to meet Clackamas County, state, and federal government emergency plans.

The plan describes the roles and responsibilities of all local responders within the City of Lake Oswego. It identifies who will be in charge of responding in the event of an incident and how the response will be handled. It provides guidelines for coordinating emergency services. It also describes how Lake Oswego will be in charge of an incident. It provides guidelines for coordinating emergency services

4. Lake Oswego City Building Evacuation Plan. The building evacuation plan is based on the adopted state program. The plan establishes evacuation procedures, including the designation and training of evacuation coordinators.
5. Lake Oswego Bridge Inspections and Records Manual. This manual outlines the City's bridge inspection program that was implemented to better respond in the event of a natural disaster. The intent of the program is to utilize trained City personnel to closely document bridge conditions through visual inspections, establishing baseline condition information to use for comparison to bridge conditions after a disaster. Additionally, the manual outlines a disaster response plan, including identification of disaster response team members and a bridge closure and detour plan.

Preparedness

The City of Lake Oswego has an established [Community Emergency Response Team](#) (CERT) program that has trained members since 1995 in mitigation as well as preparedness and response. The City's Emergency Management Program works with community groups, businesses, residential facilities, and public and private schools in promoting earthquake preparedness and mitigation.

Mitigation Projects

In May 2017, Lake Oswego voters approved a \$187 million bond measure that will make capital investments in all schools to improve earthquake resiliency and other improvements.¹⁴ Lakeridge junior high is scheduled to be demolished and rebuilt by 2020. Seismic rehabilitation of all buildings is included for Hallinan Elementary, Oak Creek Elementary, and Westridge Elementary.

Seismic rehabilitation is included for River Grove Elementary School's gym and covered play structure and the gyms of Lake Oswego Junior High, Lake Oswego High, and Lakeridge High.

Phase 2 (2021, voter approval required) proposes to demolish and replace Lake Oswego Junior High and River Grove Elementary. Phase 3 (2025, voter approval required) proposes to demolish and replace Forest Hills Elementary and Lake Grove Elementary.

The private school Our Lady of the Lake was rebuilt under existing building code in 2012.

Earthquake (Crustal)

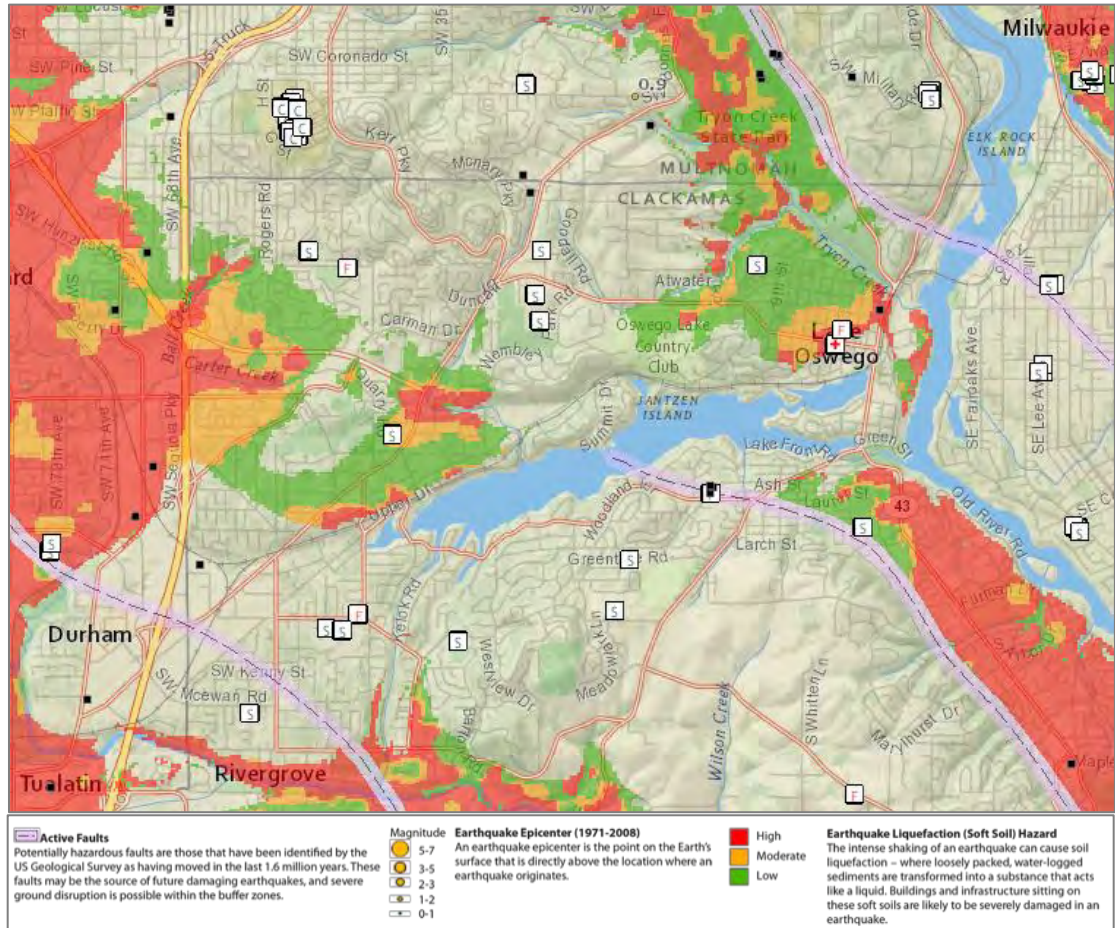
The HMAC determined that the City's probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**. *The probability rating decreased, and the vulnerability rating did not change since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Crustal earthquake, and Cascadia Subduction Zone (CSZ) earthquake.*

Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Lake Oswego as well. The causes, and characteristics of an earthquake event are appropriately described within Volume I, Section 2 as well as the location, and extent of potential hazards. Previous occurrences are well-documented within Volume I, Section 2, and the community impacts described by the County would generally be the same for Lake Oswego as well.

Figure LA-3 shows a generalized geologic map of the Lake Oswego area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows the areas of greatest concern within the City limits as red and orange.

¹⁴ Lake Oswego School District. "LOSD 2021: Building Our Future, Together." <https://www.losdschools.org/Page/2198> (accessed October 18, 2018).

Figure LA-3 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



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

Note: To view detail click the link above to access Oregon HazVu.

There are two potential crustal faults and/or zones near the City that can generate high-magnitude earthquakes. These include the Gales Creek-Mt. Angel Structural Zone (about 15 miles southwest of the city, not pictured) and the Portland Hills Fault Zone (about 3 miles northwest of the city, not pictured). The fault pictured in the southwest is the Canby-Molalla Fault, the Bolton Fault runs through Oswego Lake, and the Oatfield Fault is pictured in the northeast. More distant is the Mt. Hood Fault in eastern Clackamas County which has potential to impact Lake Oswego. Historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and lies about 11 miles northeast of Wilsonville.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics.

Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

Earthquake Regional Impact Analysis

In 2018 DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)). Their study focused on damage to buildings, and the people that occupy them, and to two key infrastructure sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and night time (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damaged varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood structures that fare worse in an earthquake. The Portland Hills fault scenario created greater damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios, however, the impact is considerably less than it is to the transportation routes. Additional, capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts.

Table LA-12 shows the permanent resident population that are vulnerable to injury or death (casualty) and the buildings in the City that are susceptible to liquefaction and landslides, it does not predict that damage will occur in specific areas due to either liquefaction or landslide. More population and property are exposed to higher degrees of expected damage or casualty under the Portland Hills Fault “wet” scenario than in any other scenario.

Cascadia Subduction Zone Scenario

The City of Lake Oswego is expected to have a 5% building loss ratio with a repair cost of \$337 million under the CSZ “dry” scenario, and an 8% building loss ratio with a repair cost of \$523 million under the “wet” scenario.¹⁵ The city is expected to have around 174 daytime or 50 nighttime casualties during the CSZ “dry” scenario and 258 daytime or 130 nighttime casualties during the “wet” scenario. It is expected that there will be a long-term displaced population of around 220 for the CSZ “dry” scenario and 1,207 for the “wet” scenario.¹⁶

¹⁵ DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8 and 12-9.

¹⁶ Ibid, Tables 12-8 and 12-9.

Portland Hills Fault Scenario

The City of Lake Oswego is expected to have a 28% building loss ratio with a repair cost of \$1.877 billion under the Portland Hills Fault “dry” scenario, and a 35% building loss ratio with a repair cost of \$2.377 billion under the “wet” scenario.¹⁷ The long-term displaced population and casualties are greatly increased for all the Portland Hills Fault scenarios. The city is expected to have around 965 daytime or 418 nighttime casualties during the “dry” scenario and 1,194 daytime or 659 nighttime casualties during the “wet” scenario. It is expected that there will be a long-term displaced population of around 3,243 for the “dry” scenario and 6,391 for the “wet” scenario.¹⁸

Table LA-12 Expected damages and casualties for the CSZ fault and Portland Hills fault: earthquake, soil moisture, and event time scenarios

	Cascadia Subduction Zone (M9.0)		Portland Hills Fault (M6.8)	
	"Dry" Soil	"Wet" Saturated Soil	"Dry" Soil	"Wet" Saturated Soil
Number of Buildings	13,770	13,770	13,770	13,770
Building Value (\$ Million)	6,805	6,805	6,805	6,805
Building Repair Cost (\$ Million)	337	523	1,877	2,377
Building Loss Ratio	5%	8%	28%	35%
Debris (Thousands of Tons)	134	184	552	685
Long-Term Displaced Population	220	1,207	3,243	6,391
Total Casualties (Daytime)	174	258	965	1,194
Level 4 (Killed)	8	12	53	65
Total Casualties (Nighttime)	50	130	418	659
Level 4 (Killed)	2	4	14	21

Source: DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8, 12-9, 12-10, and 12-11.

Recommendations from the report included topics within Planning, Recovery, Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMPs mitigation strategies (Table LA-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and the recommendations see: *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, [O-18-02](#)).

Please review Volume I, Section 2 for additional information on this hazard.

¹⁷ Ibid, Tables 12-10 and 12-11

¹⁸ Ibid, Tables 12-10 and 12-11.

Flood

The HMAP determined that the City's probability for flood is **high** and that their vulnerability to flood is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent, and probability of a potential event. Portions of Lake Oswego have areas of floodplains (special flood hazard areas, SFHA). These include areas include along Willamette River, Tualatin River, Oswego Canal, and Oswego Lake (Figure LA-4). Furthermore, other portions of Lake Oswego, outside of the mapped floodplains, are also subject to flooding from local storm water drainage.

Oswego Lake and Canal

Oswego Lake is three and a half miles long, with the main portion covering 385 acres, and an additional seven acres in West Bay and 28 acres in Lakewood Bay. The Lake is a reservoir and is privately owned and managed by the Lake Oswego Corporation, commonly known as The Lake Corporation. The Lake Corporation has owned and maintained the Lake since 1942. In addition to its natural resource values, Oswego Lake is a multiple-use facility that serves the community in a variety of roles. It is a hydroelectric reservoir at the center of a 7,400-acre drainage basin. The lake receives most of its water from streams, storm drain outfalls, and surface runoff. Also, there is a City sanitary sewer interceptor below the lake's normal surface water elevation that has been constructed at an engineered grade to convey sewage to the Tryon Creek Sewage Treatment Plant. A spillover dam was completed in 1921 that raised the lake and greatly increased its size, creating Blue Heron Bay and West Bay on the west end of the lake, and Lakewood Bay on the east end.¹⁹

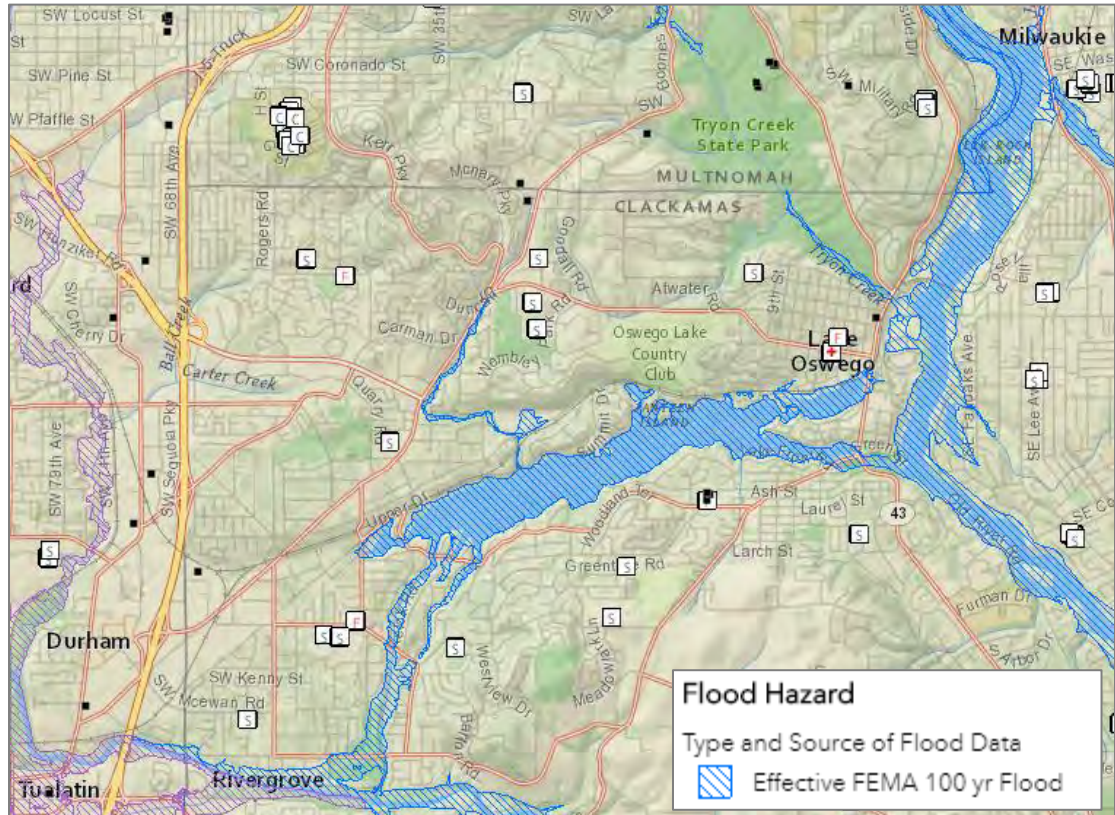
Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage, and economic loss from business interruption. It is important for the City to be aware of flooding impacts and assess its level of risk. The City has been proactive in mitigating flood hazards by purchasing floodplain property.

The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners, and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of Lake Oswego outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage.

¹⁹ Comprehensive Plan of the City of Lake Oswego. Adopted December, 1994

Figure LA-4 Special Flood Hazard Area



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

Note: To view detail click the link above to access Oregon HazVu.

The City of Lake Oswego has been impacted by floods several times since incorporating in 1910. There have been at least six events in the past fifty years which have caused widespread damage. Flooding within the City has been caused by the Willamette River, Tualatin River, Oswego Canal, and Oswego Lake. The [FEMA Flood Insurance Study \(June 17, 2008\)](#) has a brief history of flooding in Clackamas County, and Lake Oswego (Volume I, Section 2).

The highest recorded flood levels on the Tualatin River were recorded on February 10, 1996. The period of record on this river only extends back to 1928. As measured from the Oswego Canal Inlet gage, this record flood reached an elevation of 120.12 feet (National Geodetic Vertical Datum of 1929, NGVD) as measured at the Oswego Canal Inlet gage. Waters that normally flow from the Tualatin River into the Oswego Canal are regulated by the canal headgate structure which has a top of headgate height of 113.6 feet. Once Tualatin River levels exceeded the top of headgate, the water flows unimpeded into the canal, and northward to Oswego Lake. When the river reaches a level of 117.5 feet, water begins to leave the north banks of the Tualatin near the 5400 block of Dogwood Drive, and then migrates across Sycamore Avenue eventually rejoining the main Oswego Canal near Childs Road, and Bryant Woods Park.

In 2011-2012 the Oswego Lake Corporation completed a dam spillway modification project funded by a FEMA Flood Mitigation Assistance grant via the City of Lake Oswego. The project involved the installation of new, larger, spillway gates, sized to allow the passage to

the 100-year flood flows. The project resulted in the lowering of the base flood elevation (BFE) by 3.5 feet (to 99.7 feet NGVD of 1929), which is below the top of the seawall on the main lake, Lakewood Bay, Westlake, and Blue Heron Canal. The Letter of Map Revision (LOMR) covering the entirety of Oswego Lake is effective as of [August 31, 2012](#). Before the flood project the Lake Corporation's ability to release water at the east end of Oswego Lake was outstripped by the flows entering the lake from the Oswego Canal, and the lake level would rise uncontrollably. Dozens of homes, businesses, and boathouses were damaged by these floodwaters. Properties along Dogwood Drive, Melissa Drive, Canal Road, Pioneer Court, Bryant Road, Cardinal Drive, Kelok Road, Sarah Hill Lane, Lake Haven Drive, Canal Circle, many homes surrounding Oswego Lake (including all bays, and canals), businesses along State Street from the railroad crossing south to North Shore Road, plus many apartments, businesses, and carports in the Oswego Pointe area all experienced severe water, and structural damage. With the completion of the dam spillway modification project flooding is no longer expected to happen to the homes surrounding Oswego Lake (including all bays, Blue Heron canal), businesses along State Street from the railroad crossing south to North Shore Road, plus many apartments, businesses, and carports in the Oswego Pointe area, with the exception that there might be some minor roadway flooding (less than a foot deep) on North Shore at North Shore Circle, Eena Road, and perhaps at South Shore Boulevard near the Gerber Pond.

Heavy rains following a severe winter storm from January 1 to 2, 2009 contributed to a sewer interceptor overflow on Cardinal Drive near Oswego Canal. Approximately 226,000 gallons of wastewater were sent out of the sewer system. Maintenance crews were able to capture about 75% of the discharge using vacuum trucks.

Record flooding is usually accompanied by low elevation snows in the Coast, and Cascade Mountain foothills. Often snow is on the ground at the 1,000' elevation, and sometimes it is even present all the way down to sea level. Larger than normal snow depths in the middle, easily melted, elevations such as 2000' to 3,500' are another major source of water runoff. These depths are frequently observed at the Saddle Mountain Snowtel station located at 3,250' in the Coast range of western Washington County. Both the 1964, and 1996 floods were preceded by a period of sub-freezing temperatures that caused the soils of the drainage basins to solidify and become relatively impervious.

Finally, there is a rainfall pattern known as the "Pineapple Express" which brings very heavy, and warm rains from the southwest. These warm rains begin their journey from parts of the Pacific near Hawaii, holding their heat, and moisture until making landfall along the Oregon coast. As an example, at 1 A.M. on the morning of February 8, 1996, the temperature had risen to 61°F with a driving rain following a period of freezing conditions. This warm rain storm preceded the flood crest on the Willamette River by 2.5 days.

Vulnerability Assessment

Due to insufficient data and resources, Lake Oswego is currently unable to perform a quantitative risk assessment for this hazard. However, the City of Lake Oswego GIS Department completed an analysis, using the best available data, as a component of the vulnerability assessment in 2013 and reviewed and updated it, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing critical and essential facilities and infrastructure with each hazard and identifying where assets and hazards intersected.

While no essential or critical facilities are in the floodplain, several critical infrastructure and environmental assets are exposed to the flood hazard. Exposed critical infrastructure includes Tryon Creek Wastewater Treatment Plant, Oswego Lake sanitary sewer interceptor, Oswego Lake dam and headgate, Highway 43, McVey Avenue, wastewater main lines, water lines, NW Natural gas pipelines, the fiber optic line along Highway 43, several wastewater lift stations, and the Foothills power substation. Exposed environmental assets include Bryant Woods Park, Canal Acres Natural Area, Foothills Park, George Rogers Park, Iron Mountain Park, Lake Grove Swim Park, Lake Oswego Hunt Club, Lake Oswego Swim Park, Millennium Park, River Run Park, Roehr Park, and Tryon Creek State Park.

The Tryon Creek Wastewater Treatment Plant, located in the Foothills area, is located on a parcel that is affected by the Flood Management Area. In off-peak hours, the facility is remotely operated, reducing potential life safety issues from a flood hazard. However, flood conditions that result in a change in hydraulics could affect the operation of the facility.

The water transmission main from the intake on the Clackamas River in Gladstone is susceptible to flooding hazards. The transmission main is buried in the peninsula but can be exposed in a large flood, making it susceptible to damage. Additionally, prolonged periods of rain can cause the sewer interceptor system to back up and flow out of manholes and into Oswego Lake or onto streets near the lake. Such spills violate the Federal Clean Water Act.

The three wastewater main lines located in the Foothills area are elevated above ground level, potentially increasing susceptibility to flood damage. Other exposed infrastructure including wastewater main lines, natural gas pipeline and fiber optic lines are buried, decreasing their vulnerability to damage from flood hazards. However, these service lines and pipes could be exposed in large flooding events and become susceptible to damage. Hazardous flood conditions could potentially limit or delay access for the purposes of operation or repair. The fiber optic line located in Highway 43/State Street, McVey Avenue and Stafford Road is a significant communication link for the entire region.

The regional Emergency Transportation Route follows State Highway 43 from the northern City limits, and continues south on State Street to McVey Avenue, and then southwest along Stafford Road. This route crosses a bridge on McVey Road (Oswego Lake Outlet/McVey Ave. Bridge) that could be potentially affected during flood conditions. Culverts located along the Emergency Transportation Route could also be affected during hazardous conditions as flood waters could exceed the hydraulic capacity of the facility. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables LA-5 through LA-10.

National Flood Insurance Program (NFIP)

FEMA's Flood Insurance Study (FIS), and Flood Insurance Rate Maps (FIRMs) are effective as of June 17, 2008. Table LA-13 shows that as of July 2018, Lake Oswego has 222 National Flood Insurance Program (NFIP) policies in force. Of those, 122 are for properties that were constructed before the initial FIRMs. The last Community Assistance Visit (CAV) for Lake Oswego was on August 28th, 2003. Lake Oswego does not participate in the Community Rating System (CRS). The table shows that the majority of flood insurance policies are for residential structures, primarily single-family homes. There has been a total of 54 paid claims for \$3,587,489. The City complies with the NFIP through enforcement of their flood damage prevention ordinance and their floodplain management program.

The Community Repetitive Loss record for Lake Oswego identifies no Repetitive Loss Properties²⁰ or Severe Repetitive Loss Properties²¹.

Table LA-13 Flood Insurance Detail

	Clackamas County	Lake Oswego
Effective FIRM and FIS	6/17/2008	6/17/2008
Initial FIRM Date	-	8/4/1987
Total Policies	1,957	222
Pre-FIRM Policies	1,086	122
Policies by Building Type		
Single Family	1,761	174
2 to 4 Family	30	5
Other Residential	58	35
Non-Residential	9	1
Minus Rated A Zone	123	15
Insurance in Force	\$541,833,400	\$65,279,400
Total Paid Claims	590	54
Pre-FIRM Claims Paid	450	41
Substantial Damage Claims	83	3
Total Paid Amount	\$20,830,662	\$3,587,489
Repetitive Loss Structures	51	0
Severe Repetitive Loss Properties	4	0
CRS Class Rating	-	NP
Last Community Assistance Visit	-	8/28/2003

Source: Information compiled by Department of Land Conservation, and Development, July 2018.

Note: The portion of the cities of Portland and Tualatin that are within Clackamas County are not included in this table.

NP = Not Participating

Mitigation Activities

Flood mitigation activities listed here include current mitigation programs and activities that are being implemented by Lake Oswego agencies or organizations.

Lake Oswego Codes Pertaining to Flooding

The following Lake Oswego codes, plans, and policies pertain to flooding:

1. Lake Oswego Comprehensive Plan, Goal 7 - Areas Subject to Natural Disasters and Hazards, Section 1, Flood Hazards. The Goal of Section 1, Flood Hazards states: "The City shall protect life and property from flood hazards."

²⁰ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

²¹ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP, and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000, and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

The Federal Emergency Management Agency (FEMA) provides the City with mapped floodplain information which identifies floodplain elevations and areas subject to flooding. Lake Oswego participates in the National Flood Insurance Program, which is administered by FEMA. This program allows residents of Lake Oswego to obtain federally subsidized flood insurance. To be eligible to participate in this program, the City adopted floodplain development standards in 1988 that met FEMA standards. In June 2008, the City adopted revised floodplain management standards and adopted updated FEMA Flood Insurance Rate Maps (FIRM) as well as the updated Flood Insurance Study (FIS) in compliance with FEMA, state, and Metro standards.

2. Lake Oswego Community Development Code, Article 50.44 Flood Management Area. This portion of the Community Development Code implements the Goal 7 policies of the Comprehensive Plan and regulates development within the floodplain. The purpose of Article 50.44 is to:

- Promote the public health, safety and general welfare;
- Minimize public and private losses due to flood conditions in specific areas; and
- Maintain eligibility of properties within the City to participate in the National Flood Insurance Program.

3. Lake Oswego City Code and Charter, Chapter 52 - This chapter aims to control erosion at its source as a means of maintaining and improving water quality and minimizing water pollution, downstream flooding, and wildlife habitat damage.

4. Lake Oswego Bridge Inspections and Records Manual - This manual outlines the City's bridge inspection program that was implemented to better respond in the event of a natural disaster. The intent of the program is to utilize trained City personnel to closely document bridge conditions through visual inspections, establishing baseline condition information to use for comparison to bridge conditions after a disaster. Overall, bridges throughout the City are old and in need of upgrading. Additionally, the manual outlines a disaster response plan, including identification of disaster response team members and a bridge closure and detour plan.

Flooding Response Activities

During past flood events, the City's response included notification of property owners of impending flooding. Generally, the City has provided 24 to 36 hour notice. Notices have been followed by evacuations of people and, to a limited extent, personal property. Since 2006 the City has used a reverse 911 emergency notification system called Public Alerts to notify citizens of emergency incidents.²⁰

Attempts at sandbagging have been only partially effective. In areas where a good initial plan is communicated to volunteers, adequate supplies are available, and waters do not exceed 2 feet in depth, sandbagging can help. City staff members sandbag critical facilities and provide access to sand and sandbags for the public.

Flood Mitigation Projects

Lake Oswego is in the final design stages of the Lake Oswego Interceptor System (LOIS), and work has already begun on the out of lake work. The LOIS system will replace the interceptor sewer line located in Oswego Lake. The existing interceptor is undersized, resulting in overflows during heavy rains, and is vulnerable during an earthquake. Replacement of the interceptor is critical to ensuring the environmental protection of

Oswego Lake and maintaining sewer service for residents. This project represents the completion of an action that was identified in Lake Oswego's 2004 mitigation plan addendum. The LOIS project was completed in winter of 2011- 2012. Additionally, the City constructed seismic upgrades to the elevated wastewater main pipes that lead into the Tryon Creek Wastewater Treatment Plant.

Lake Oswego has currently been working with a consultant to incrementally model the flood levels of the Tualatin River. The final product of this effort will be the production of a series of flood inundation area maps that will be based upon the level of the river as measured at the USGS "West Linn" gage station. The city will use these maps to provide critical information to the Emergency Operation Center and crews in the field in an effort to better manage flood response. The maps will allow for strategic allocation of resources necessary to evacuate specific areas, close threatened roads, set up detours and deploy sand bagging materials.

The Engineering Division is developing a drainage improvement plan for the First Addition Neighborhood. Currently, due to a lack of designed neighborhood-wide drainage system, rainwater does not drain properly and streets can flood in this neighborhood. The improvements include the design and construction of new storm drainage systems throughout the neighborhood. The new drainage systems will help to reduce the amount of roadway sediments and pollutants entering into the drainage system, by utilizing various methods such as pollution control manholes and catch basins, infiltration swales, and compost filters. The FAN drainage plan was completed and identifies several projects. The projects have been included in the city CIP Plan, currently listed as unfunded.

In 2003, Lake Oswego commissioned a study, "Evaluation of Flood Management Alternatives for Oswego Lake and Canal" (Pacific Water Resources, Inc., June, 2003) which detailed strategies to help alleviate flooding of Oswego Lake. In the fall of 2009, the City completed a surface water master plan called the "Clean Streams Plan," a completed action item from the 2004 mitigation plan.

After the 1996 flood event the City of Lake Oswego commissioned a study, "Lakewood Bay Flood Protection at North Shore Road Bridge" (Pacific Water Resources, June 30, 2000), to evaluate the event of the 1996 flood and what impacts would be experienced by the main part of Oswego Lake if Lakewood Bay were isolated during a similar flood event. During a flood event, blocking the inlet of Lakewood Bay would stop flood waters from filling the bay and overtopping State Street (Highway 43), as occurred in 1996. During the 1996 flood, State Street was flooded and blocked for over a day, affecting emergency access to the eastern part of Lake Oswego. With improvements to the dam spillway in 2011-2012, the city will no longer need to consider blocking the flow path into Lakewood Bay. All flood flows (up to the 100-yr event) will spill over the dam.

During the flood event in 1996, the primary cause of the flooding in the Foothills Road area was due to two sources. Both sources have since been mitigated, as described below:

5. A low point in the levy behind (north of) the Tryon Creek Treatment Plant allowed flood waters from the Tryon Creek/Willamette River to overtop the levy and enter the Foothills Road area. The City of Portland has since made repairs and improvements to address the problem.

6. A large diameter storm drain pipe that receives runoff from an area of downtown (200+ acres) drains through the Toklat Industries parking lot and discharges into Tryon Creek. Flood waters from the Tryon Creek/Willamette River system backed up through this storm system, surcharging the manholes and catch basins, contributing to the flooding in the Foothills Road area. Subsequently, this problem has been rectified. Redundant check valves have been installed on the storm pipes to prevent back up, and two pump stations have been designed and built that will accept the runoff generated in the upstream drainage basin and “force” it into the drain pipe and through the submerged outlet.

The smaller pump station is an electric submersible pump, designed to handle runoff that accumulates at the Lakeshore Concrete site. Should power fail during a flood event, the pump is positioned so a trailer-mounted portable generator can be plugged into the control panel to provide backup power.

The other pump station is located at the north end of Toklat Industries parking lot. These are two variable speed pumps with a combined capacity of 5,000 GPM. Each pump is powered by a Ford six-cylinder engine, fueled with natural gas. In the event of a loss of supply of natural gas, the backup power source is a power take-off (PTO) drive that is mounted on the vertical drive shaft of the pumps. City Maintenance staff would then mobilize a piece of equipment that employs hydraulics (such as a back-hoe, tractor, or dump truck,) and plug in the quick-connect hoses (stored on site) into the PTO and the piece of mobile equipment.

These pumps were installed in the late 1990’s and City Maintenance staff is familiar with their operation. These systems are inspected and exercised on a regular basis.

In 2011-2012 the Oswego Lake Corporation completed a dam spillway modification projected funded by a FEMA Flood Mitigation Assistance grant via the City of Lake Oswego (see above for more information).

Please review Volume I, Section 2 for additional information on this hazard.

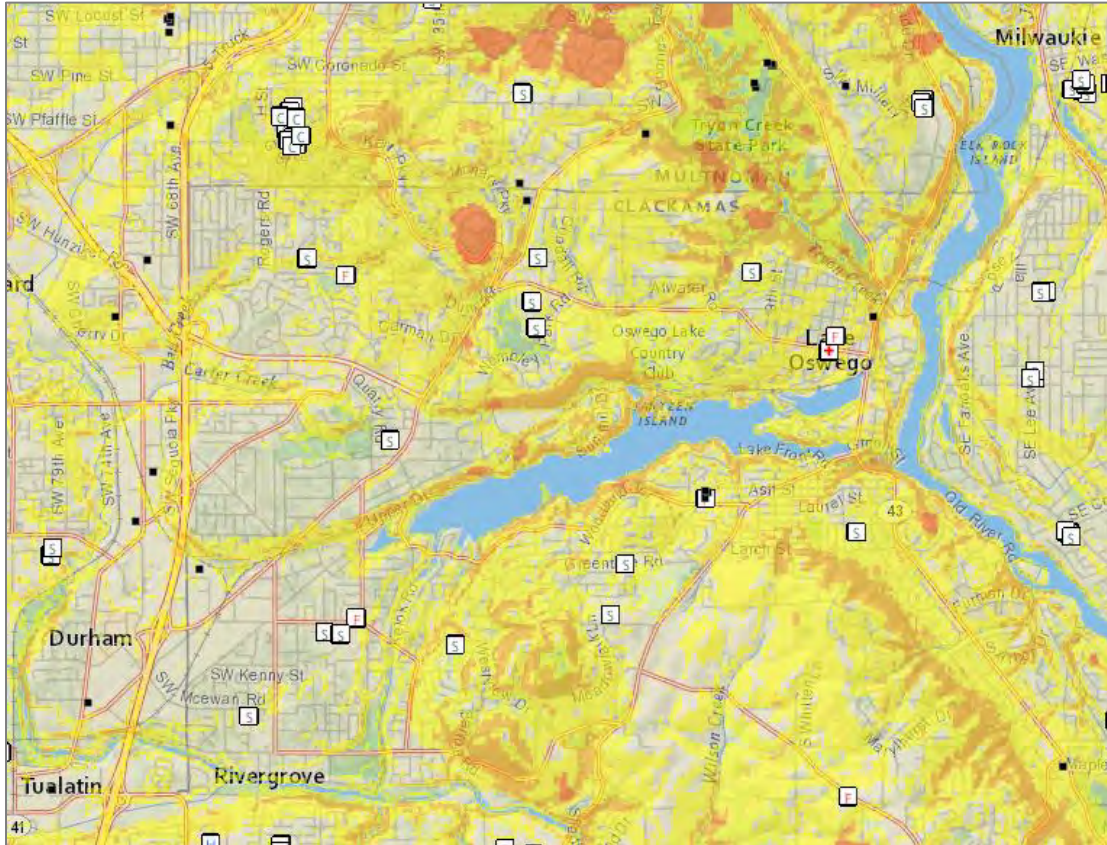
Landslide

The HMAC determined that the City’s probability for landslide is **high** and that their vulnerability to landslide is **low**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Landslide susceptibility exposure for Lake Oswego is shown in Figure LA-5. Most of Lake Oswego demonstrates a low to moderate landslide susceptibility exposure, with an area of high exposure around Mountain Park. Approximately 14% of Lake Oswego has very high or high, and approximately 44% moderate, landslide susceptibility exposure.²² The City’s wastewater main lines, major water lines, and fiber optic lines are identified as being especially vulnerable.

²² DOGAMI. [Open-File Report, O-16-02](#), *Landslide Susceptibility Overview Map of Oregon* (2016)

Figure LA-5 Landslide Susceptibility Exposure



Low	Landsliding unlikely. Areas classified as Landslide Density = Low (less than 7%) and areas classified as Slopes Prone to Landsliding = Low.
Moderate	Landsliding possible. Areas classified as Landslide Density = Low to Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = Moderate OR areas classified as Landslide Density = Moderate (7%-17%) and areas classified as Slopes Prone to Landsliding = Low.
High	Landsliding likely. Areas classified as Landslide Density = High (greater than 17%) and areas classified as Slopes Prone to Landsliding = Low and Moderate OR areas classified as Landslide Density = Low and Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = High.
Very High	Existing landslides Landslide Density and Slopes Prone to Landsliding data were not considered in this category. Note: the quality of landslide inventory (existing landslides) mapping varies across the state.

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

Note: To view detail click the link above to access Oregon HazVu.

Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard, and assets.

The City's fresh drinking water supply comes from the West Linn Water Treatment Plant, which was originally built in unincorporated Clackamas County for the City of Lake Oswego in the 1960s. It now serves multiple jurisdictions-- including Tigard, and Lake Oswego. There was recently a project completed in October 2017 to increase the treated water capacity (to

38 million gallons per day) for residents of Lake Oswego, and Tigard.²³ The treatment plant has two different utility substations on the property for back up electricity, and has agreements with other treatment plants around the region for water use that creates redundancies within the water supply system for residents. The water line from the City's water treatment plant located in West Linn enters the City along Highway 43, and runs north through George Rogers Park, an area vulnerable to landslide hazards. The fiber optic line located in Highway 43/State Street, McVey Avenue, and Stafford Road is a significant communication link for the entire region.

The last major landslide event occurred in 2009 when a large landslide originated from the slopes above Green Bluff Drive in the Marylhurst area and slid into a home on Woodhurst Place just after 1:00am. Twenty-one homes, and twenty-eight people were evacuated, while five people were transported to the hospital. The Adult Community Center was opened to accommodate families in need of shelter. A second slide down the hill from Green Bluff damaged another home, and the right of way. A third slide on Oak Street deposited earth onto the road and diverted runoff to the properties downhill. Additional landslide events occurred on February 2, 2008 in George Rogers Park, leading to the closure of the pathway between George Rogers Park and Old River Road for five months; in 2008 on Green Street; in December 2007, a rain event led to three slides on Iron Mountain Boulevard and Green Bluff; in 2007 on Eagle Crest Drive and Glenmorrie Drive.; in 2006 on Royce Way, Oak Street, and Laurel Street; and in 2004 on Kerr Parkway, Del Prado Street, and Oak Terrace.

Potential landslide-related impacts are adequately described within Volume I, Section 2, and include infrastructure damages, economic impacts (due to isolation, and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides, and debris flows can potentially occur during any winter, and thoroughfares beyond City limits are susceptible to obstruction as well. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables LA-5 through LA-10.

The most common type of landslides are slides caused by erosion. Slides move in contact with the underlying surface, are generally slow moving, and can be deep. Rainfall-initiated landslides tend to be smaller; while earthquake induced landslides may be quite large. All soil types can be affected by natural landslide triggering conditions.

Vulnerability Assessment

Due to insufficient data and resources, Lake Oswego is currently unable to perform a quantitative risk assessment for this hazard. However, the City of Lake Oswego GIS Department completed an analysis, using the best available data, as a component of the vulnerability assessment in 2013 and reviewed and updated it, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing critical and essential facilities and infrastructure with each hazard and identifying where assets and hazards intersected. Additionally, DOGAMI completed a statewide landslide susceptibility assessment in 2016 ([O-16-02](#)), general findings from that report are provided above and within Figure LA-5.

²³ Lake Oswego-Tigard Water Treatment Plant. Public Works, City of West Linn. Last visited 10/9/18: <https://westlinnoregon.gov/publicworks/lake-oswego-tigard-water-treatment-plant>

The Adult Community Center, a critical facility, is within a potential landslide area and is exposed to landslide hazards. However, the portion of the parcel that contains the Adult Community Center is relatively flat, while the undeveloped rear portion of the parcel is at the top of a steep slope leading down to Tryon Creek, thereby minimizing risks of the facility to the landslide hazard. The Hallanan School and Westridge Elementary are essential facilities exposed to the landslide hazard.

Exposed infrastructure including wastewater main lines, major water lines and fiber optic lines are buried, decreasing their vulnerability to damage from landslide hazards. However, hazardous landslide conditions could potentially damage the infrastructure and limit or delay access for the purposes of operation or repair. The City's fresh drinking water supply comes from the water treatment plant in West Linn, with the water intake located on the Clackamas River in Gladstone. The water line from the City's water treatment plant located in West Linn enters the City along Highway 43 and runs north through George Rogers Park, an area vulnerable to landslide hazards.

The fiber optic line located in Highway 43/State Street, McVey Avenue and Stafford Road is a significant communication link for the entire region. Exposed environmental assets include George Rogers Park, Iron Mountain Park, Lake Oswego Hunt Club, Lake Oswego Swim Park, and Tryon Creek State Natural Area.

The regional Emergency Transportation Route follows State Highway 43 from the north City limits, and continues south on State Street to McVey Avenue, and then southwest along Stafford Road. At the northern City limits, the Emergency Transportation Route along State Street passes through a potential landslide area, possibly impacting access to and from the City.

The portion of Lake Oswego in Multnomah County, primarily the northern part of the Mountain Park neighborhood, contains steep slopes that are potentially susceptible to landslide hazards. Additionally, a communications tower that is used for emergency communications is in this area on Mt. Sylvania.

Mitigation Activities

Landslide mitigation activities listed here include current mitigation programs and activities that are being implemented by the City of Lake Oswego agencies or organizations.

City of Lake Oswego Codes Pertaining to Landslides

The following Lake Oswego codes, plans, and policies pertain to landslides:

1. Lake Oswego Comprehensive Plan, Goal 7 – Areas Subject to Natural Disasters and Hazards, Section 3, Landslides, Erosion and Unstable Soils. The Goal of Section 3, Landslides, Erosion and Unstable Soils states: "The City shall protect life and property from hazards associated with landslides, soil erosion, and unstable soils".
2. The following portions of the Community Development Code and City Code implement the Goal 7, Section 3 policies of the Comprehensive Plan, regulating development on steep slopes, erosion control, and earthwork control:
 - Community Development Code, Article 50.40 Drainage Standard for Minor Development;

- Community Development Code, Article 50.41 Drainage Standard for Major Development;
- Community Development Code, Article 50.42 Weak Foundation Soils;
- Community Development Code, Article 50.43 Hillside Protection;
- Lake Oswego Code, Chapter 52 Erosion Control; and
- Lake Oswego Building Code (LOC Chapter 45), Article 45.16 Earthwork Control.

Additionally, Article 50.16 of the Community Development Code, Sensitive Lands Overlay Districts, manages the impacts of development on lands with environmental and natural resource significance in order to protect the functions and values of wetlands, stream corridors, and tree groves within the Lake Oswego City limits. Many of these significant resources are associated with hillsides, ravines, and ridge lines.

3. Lake Oswego City Code and Charter, Chapter 52 – This chapter aims to minimize the amount of sediment and other pollutants reaching the surface water management system because of construction, grading, excavating, clearing and any other activity which causes or accelerates erosion

4. Lake Oswego Bridge Inspections and Records Manual. This manual outlines the City’s bridge inspection program that was implemented to better respond in the event of a natural disaster. The intent of the program is to utilize trained City personnel to closely document bridge conditions through visual inspections, establishing baseline condition information to use for comparison to bridge conditions after a disaster. Additionally, the manual outlines a disaster response plan, including identification of disaster response team members and a bridge closure and detour plan.

Landslide Mitigation Projects

City of Lake Oswego staff has been tracking recent research by DOGAMI and related state legislation regarding rapidly moving landslide hazards. The City now has LIDAR data and maps from DOGAMI. The City will be reviewing and evaluating the results of this mapping and modeling, and will update City codes and ordinances, if appropriate.

In 2005 the Engineering Department solicited proposals from qualified geotechnical engineering firms to provide an analysis of the slide area in Rockinghorse Lane and to make recommendations for alternatives to improve drainage in the area. The city is currently working on a Capital Project to improve the surface water drainage in the area.

After the George Rogers Park slide in 2008, private property owners above the pathway built a steel gabion retaining wall to stabilize the slope. A temporary debris catchment basin was built on Green Bluff and the City worked with the property owners to stabilize the embankment and roadway where the lower slide on Green Bluff occurred.

Please review Volume I, Section 2 for additional information on this hazard.

Severe Weather

Severe weather can account for a variety of intense, and potentially damaging hazard events. These events include extreme heat, windstorms, and winter storms. The following section describes the unique probability, and vulnerability of each identified weather hazard.

Extreme Heat

The HMAC determined that the City's probability for extreme heat events is **low** and that their vulnerability is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the City as well.

A severe heat episode or "heat wave" occurs about every two to three years, and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days with temperatures greater than or equal to 90-degrees, or 100-degrees, Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit, and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The City of Lake Oswego has not experienced any life-threatening consequences from the few historical extreme heat events, although changes in climate indicate that the area should expect to see more extreme heat events.

Please review Volume I, Section 2 for additional information on this hazard.

Windstorm

The HMAC determined that the City's probability for windstorm is **moderate** and that their vulnerability to windstorm is **moderate**. *The probability rating decreased, and the vulnerability rating did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent, and probability of a potential event within the region. Because windstorms typically occur during winter months, they are sometimes accompanied by flooding and winter storms (ice, freezing rain, and very rarely, snow). Other severe weather events that may accompany windstorms, including thunderstorms, hail, lightning strikes, and tornadoes are generally negligible for Lake Oswego.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation, and economic disruptions result as well.

Damage from high winds generally has resulted in downed utility lines, and trees usually limited to several localized areas. Electrical power can be out anywhere from a few hours to several days. Outdoor signs have also suffered damage. If the high winds are accompanied by rain (which they often are), blowing leaves, and debris clog drainage-ways, which in turn may cause localized urban flooding.

Please review Volume I, Section 2 for additional information on this hazard.

Winter Storm (Snow/Ice)

The HMAC determined that the City's probability for winter storm is **high** and that their vulnerability to winter storm is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent, and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the City typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

Major winter storms can, and have occurred in the Lake Oswego area, including in December 2008 with the largest winter storm in forty years. The storm led to significant power outages, eight water main breaks, and hazardous road conditions. The City contracted forces to assist in snow removal efforts. Additional recent winter storm (including wind) events occurred in December 2016/January 2017, January 2016, December 2015 (DR-4258), February 2014 (snow/ice), January 2009, December 2008, and December 2007. Most winter storms typically do not cause significant damage, they are frequent, and have the potential to impact economic activity. Road, and rail closures due to winter weather are an uncommon occurrence but can interrupt commuter, and commercial traffic.

Vulnerability Assessment

Due to insufficient data and resources, Lake Oswego is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Assets section and Tables LA-5 through LA-10.

While severe weather data is not available to illustrate hazard areas, City staff has noted several areas in Lake Oswego that are particularly vulnerable. In the past, falling trees, downed power lines, and icy roads have caused problems in the downtown, Palisades, Mountain Park, and Lake Grove areas, and along South Shore Road. Primarily, these areas have tall trees that present problems. Additionally, in Mountain Park, the combination of steep roads and icy conditions hampered emergency response efforts.

In the event of a severe winter storm, the City uses identified sanding routes to coordinate response activity and concentrate resources during an event.

Mitigation Activities

Severe wind and winter storm mitigation activities listed here include current mitigation programs and activities that are being implemented by Lake Oswego agencies or organizations. The existing extreme heat mitigation activities are conducted at the county level and are described in the Clackamas County NHMP.

City of Lake Oswego Codes Pertaining to Severe Wind and Winter Storms

The following Lake Oswego codes, plans, and policies pertain to severe wind and winter storms:

1. Lake Oswego Emergency Operations Plan and Related Annexes, Severe Weather Emergency Annex. This plan describes how the City of Lake Oswego's emergency operations system will operate during emergencies involving severe storm conditions within the City and contract districts. The plan is designed to meet Clackamas County, state, and federal government emergency plans.

The plan describes the roles and responsibilities of all local responders within the City of Lake Oswego. It identifies who will oversee response efforts in the event of an incident and how the response will be handled. It provides guidelines for coordinating emergency services. It also describes how Lake Oswego will coordinate with:

- Adjacent jurisdictions;
- Mutual aid in some areas;
- State agencies;
- Federal agencies; and
- Industry (snow removal).

2. Lake Oswego City Building Evacuation Plan. The building evacuation plan is based on the adopted state program. The plan establishes evacuation procedures, including the designation and training of evacuation coordinators.

3. Lake Oswego Bridge Inspections and Records Manual. This manual outlines the City's bridge inspection program that was implemented to better respond in the event of a natural disaster. The intent of the program is to utilize trained City personnel to closely document bridge conditions through visual inspections, establishing baseline condition information to use for comparison to bridge conditions after a disaster. Additionally, the manual outlines a disaster response plan, including identification of disaster response team members and a bridge closure and detour plan.

Severe Wind and Winter Storm Mitigation Projects

Undergrounding utilities is required for all new development. The primary step taken for severe wind or winter storm events is preparedness. Lake Oswego CERT teams are trained in how to assist in severe storm events. Each year, the City of Lake Oswego Public Works Operations conducts the following activities:

- New weather stations and a webcam were installed to monitor storm systems;
- Inventories existing stockpile of sanding materials and replenishes as necessary;
- Performs routine maintenance and inspection of all sanders, plows, dump trucks, loaders, and chain saws;
- Provides training on sander/snowplow operations; and
- Provides training on:
 - Winter driving safety;
 - Chain saw safety – operation and personal protective equipment; and
 - Working around downed power lines.

Once a storm hits, Lake Oswego has designated sanding and plowing routes that give priority to arterials and emergency response routes. Local streets have the lowest priority because they serve the fewest citizens. The Public Alerts reverse 911 system can be used to inform citizens of hazard areas resulting from severe storms and encourage citizens to stay sheltered inside. The City website and public information line provide citizens with up to date information about the storm.

Please review Volume 1, Section 2 for additional information on this hazard.

Volcanic Event

The HMAC determined that the City's probability for a volcanic event is **low** and that their vulnerability to a volcanic event is **moderate**. *The probability rating did not change, while the vulnerability increased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of volcanic hazards, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the western portion of the County is likely to affect Lake Oswego as well. Several volcanoes are located near Lake Oswego, the closest of which are Mount Hood, Mount Adams, Mount Saint Helens, Mount Rainier, and the Three Sisters.

Due to Lake Oswego's relative distance from volcanoes, the city is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Although the City of Lake Oswego is unlikely to experience lahars or lava flows, tephra (sand- sized or finer particles of volcanic rock that is ejected rapidly into the air from volcanic vents) drifts downwind from the explosions and can form a blanket-like deposit of ash. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city could experience a heavier coating of ash. Tephra is a public health threat, and can damage agriculture and transportation systems (i.e., aircraft and on- the-ground vehicles). Tephra can also clog drainage systems and create major debris management problems. Within Lake Oswego, public health would be a primary concern, and keeping transportation routes open/accessible would be important as well.

Vulnerability Assessment

Due to insufficient data and resources, Lake Oswego is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables LA-5 through LA-10.

Mitigation Activities

The existing volcano hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

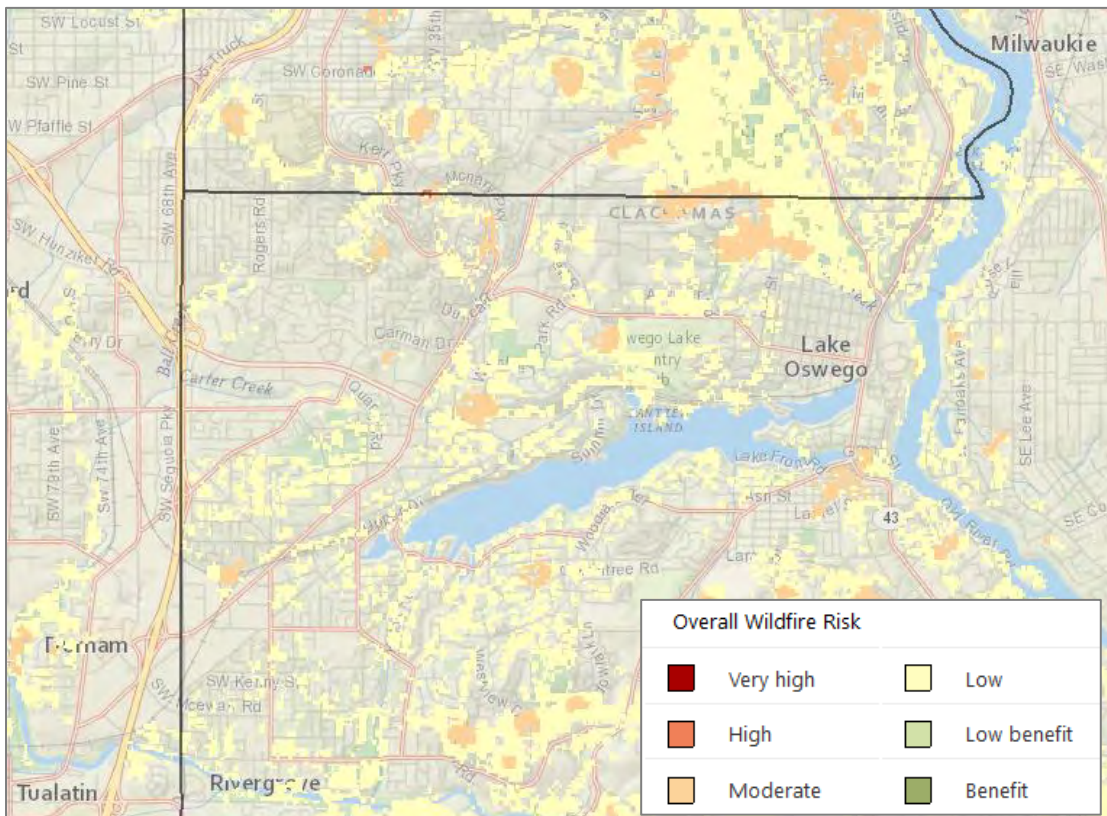
Wildfire

The HMAC determined that the City’s probability for wildfire is **moderate**, and that their vulnerability to wildfire is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

The [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](https://www.clackamas.us/dm/CWPP.html) was completed in May 2018. The CWPP is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard: <https://www.clackamas.us/dm/CWPP.html>. Information specific to Lake Oswego is found in the following chapter: [Chapter 10.8: Lake Oswego Fire Department](#).

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions. Weather, and urbanization conditions are primarily at cause for the hazard level. Lake Oswego has not experienced a wildfire within City limits, but the city has abundant wooded areas that are a concern in the case of a wildfire event. Figure LA-6 shows overall wildfire risk in Lake Oswego.

Figure LA-6 Overall Wildfire Risk



Source: [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

The forested hills within, and surrounding Lake Oswego are interface areas. High Priority Communities at Risk (CARs) include: Iron Mountain Bluff, Palisades, Cooks Butte Park, and Mountain Park. Medium priority CARs include: Tryon Creek State Park, Springbrook Park,

and Waluga Park.²⁴ These areas are characterized by varying housing structures (often large houses on small lots, some with shake roofs), natural, and ornamental vegetation, and topography that may increase the risk for wildfire spreading.²⁵

Most of the city has less severe (moderate or less) wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions.²⁶ However, conditions vary widely and with local topography, fuels, and local weather (including wind) conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts.

The potential community impacts, and vulnerabilities described in Volume I, Section 2 are generally accurate for the City as well. Lake Oswego's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. Priority fuels reduction areas include: Iron Mountain Bluff, Springbrook Park, Waluga Park, Cooks Butte Park, and Tryon Creek. The City will update the City's wildfire risk assessment if the fire plan presents better data during future updates (an action item is included to participate in future updates to the CWPP).

Property can be damaged or destroyed with one fire as structures, vegetation, and other flammables easily merge to become unpredictable, and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

Vulnerability Assessment

Due to insufficient data and resources, Lake Oswego is currently unable to perform a quantitative risk assessment for this hazard. However, the City of Lake Oswego GIS Department completed an analysis, using the best available data, as a component of the vulnerability assessment in 2013 and reviewed and updated it, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing critical and essential facilities and infrastructure with each hazard and identifying where assets and hazards intersected. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables LA-5 through LA-10.

The Adult Community Center, a critical facility, is exposed to a high hazard wildfire area. The rear (northern) portion of the parcel is covered with trees, and slopes steeply down to Tyron Creek, potentially exposing the facility and limiting its availability as an emergency short-term site in the event of a wildfire. The South Shore Fire Station is another critical facility in the high wildfire hazard zone. Essential facilities exposed to high wildfire hazard include Oak Creek Elementary, Westridge Elementary, Hallinan Elementary, Uplands Elementary, Forest Hills Elementary, the area west of Lake Oswego Jr. High, portions of the former Marylhurst University campus, and several churches, which could potentially serve as Red Cross shelter sites.

²⁴ Clackamas County Community Wildfire Protection Plan, *Lake Oswego Fire Department* (2018), Table 10.8-1.

²⁵ Ibid.

²⁶ [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

Exposed infrastructure including wastewater main lines, major water lines, natural gas pipeline and fiber optic lines are buried, decreasing their vulnerability to damage from wildfire hazards. However, wildfire conditions could potentially limit or delay access for the purposes of operation or repair. The City's fresh drinking water supply comes from a water treatment plant in West Linn, with the water intake located on the Clackamas River in Gladstone. The water line from the City's water treatment plant in West Linn enters the City along Highway 43/State Street and runs north through George Rogers Park. This alignment includes areas that could be vulnerable to wildfire hazards. The fiber optic line located along Highway 43/State Street, McVey Avenue and Stafford Road is a significant communication link for the entire region. Operation of and access to other exposed infrastructure including the Oswego Lake headgate, several water pumping stations and reservoirs, a PGE substation in the Mountain Park area and communications towers used for emergency communications located on Cook's Butte and Mt. Sylvania, could be potentially impacted during a wildfire hazard.

The regional Emergency Transportation Route follows State Highway 43 from the northern City limits, and continues south on State Street to McVey Avenue, and then southwest to and along Stafford Road. The Emergency Transportation Route passes through several high wildfire hazard areas, at the northern City limits along State Street and McVey Avenue to the south, possibly impacting access to and from the City.

Not surprising, several Lake Oswego's parks and open spaces are considered high wildfire hazards. These include Bryant Woods Park, Canal Acres Natural Area, **Cooks Butte Park**, Freepons Park, George Rogers Park, Hallinan Natural Area, **Iron Mountain Park**, River Run Park, Roehr Park, Lake Grove Swim Park, Southwood Park, **Springbrook Park**, and **Waluga Park** (parks and open spaces denoted in **bold** are consider high or moderate priority CARs within the CWPP, see above for more information).

For the portion of Lake Oswego in Multnomah County, primarily the northern part of the Mountain Park neighborhood, Lake Oswego Fire Department staff has determined that due to the steep slopes and wooded character of this neighborhood, the wildfire hazard ranges from moderate to high.

Mitigation Activities

The City of Lake Oswego Fire Department works to mitigate problems regarding wildfire issues when they arise. Wildfire mitigation activities listed here include current mitigation programs and activities that are being implemented by Lake Oswego agencies or organizations.

City of Lake Oswego Codes Pertaining to Wildfires

The following Lake Oswego codes, plans, and policies pertain to wildfires:

1. The City of Lake Oswego Community Development Code (LOC Chapter 50) specifies site development standards, such as lot setback, coverage, depth, and corner vision; landscape and tree planting and removal standards; and structure height.
2. The City of Lake Oswego Building Code (LOC Chapter 45) regulates building materials and fire flow and sprinkler requirements.
3. The Uniform Fire Code and City Code regulate the removal of fuels that could be a fire hazard and regulate burning with permits and burning bans when needed due to high fire hazard.

Local Fire Prevention/Education Programs

The Lake Oswego Fire Department participated in creating the County's Community Wildfire Protection Plan. Fire prevention staff also works with the Clackamas County Fire Prevention Co-op that includes the U.S. Forest Service and Oregon Department of Forestry as members. The Lake Oswego Fire Department fire prevention staff conducts a range of public education activities, including wildland fire education programs. Additionally, the City of Lake Oswego's Community Emergency Response Team (CERT) program includes wildland fire prevention in its training program.

The City of Lake Oswego has a hydrant system that covers most of the area Lake Oswego Fire Department protects. The Fire Department continues to look for locations that will enhance wildland urban interface protection. For example, the City recently added hydrants to the Iron Mountain Bluff area after firefighters determined the need for increased protection from wildfire. Additionally, school remodels must now include the installation of sprinkler systems upgrades. Lastly, the City works to eradicate non-native plant species and manages invasive species, reducing the fuel load in the City's open spaces.

Please review the [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) and Volume I, Section 2 for additional information on this hazard.

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ATTACHMENT A: ACTION ITEM FORMS

ACTION ITEM FORMS

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* - Priority Action Item

Note: The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity.

Summary of Action Changes

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

Previous NHMP Actions: Completed

Multi-Hazard Action #7 (2012): “Obtain funding for implementing recommendations for improving infrastructure outlined in the updated Clean Streams Plan” is considered complete. The Clean Streams Plan recommendations are implemented through the city’s capital improvement plan on an ongoing basis.

Multi-Hazard Action #8 (2012): “Maintain and implement the Wastewater Master Plan” is considered complete. Wastewater Master Plan actions are implemented through the city’s capital improvement plan on an ongoing basis. The plan is routinely updated and the HMAC does not consider it necessary to retain the action in the mitigation plan.

Flood Action #3 (2012): “Implement alternatives for reducing the flooding hazard for properties along Oswego Lake and canals” is considered complete. In 2011-2012 the Oswego Lake Corporation completed a dam spillway modification project funded by a FEMA Flood Mitigation Assistance grant via the City of Lake Oswego. The project involved the installation of new, larger, spillway gates, sized to allow the passage to the 100-year flood flows. The project resulted in the lowering of the base flood elevation (BFE) by 3.5 feet (to 99.7 feet NGVD of 1929), which is below the top of the seawall on the main lake, Lakewood Bay, Westlake, and Blue Heron Canal. See discussion on p. LA-33 for more information.

See 2018 status identified in each action for activities that have been completed since the previous plan.

Previous NHMP Actions: Removed

Multi-Hazard Action #4 (2012): “Continue to update and improve the hazard assessment in the Lake Oswego Natural Hazards Mitigation Plan” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Multi-Hazard Action #5 (2012): “Identify and pursue funding opportunities to develop and implement hazard mitigation activities” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Flood Action #2 (2012): “Reduce the vulnerability in the Foothills area to the flooding hazard” was removed from the list of actions. The city discussed solutions for the area but determined they will not proceed with the action until development options have been explored. As such the action is not currently applicable.

Note: 2012 Actions MH #6 and MH #9 were renumbered to 2019 Actions MH # 4 and MH #5

New NHMP Actions (2019):

- Flood Action #2
- Wildfire Action #3

See action item forms below for detail.

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 NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the County, participating cities, and special districts. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. The City 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, the City 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 several 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 HMAAC but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and/or resources toward completion of the action items.

Internal partner organizations are departments within the City 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.

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:	
Develop, enhance, and implement education programs designed to reduce the losses from natural hazards.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Before hazard seasons articles have been written for “Hello LO,” the official City newsletter mailed monthly to all households and business within City limits, and the “LO Down,” an online newsletter published twice a month. The NHMP is posted online and the Fire Department brings a copy to events they attend. The Fire Department offers CERT classes and delivers hazard presentations to neighborhood associations. Red Cross publications are disseminated by the Fire Department. Lake Oswego partners with Clackamas County to produce the “Emergency Preparedness Calendar,” which provides information about the hazards most likely to occur each month. • Lake Oswego continues its efforts to implement emergency preparedness and hazard mitigation educational programs, which include neighborhood association presentations, community forums, and the annual public safety fair in August. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Gather hazard related information and public information materials, and disseminate to public through local publications; • Identify property owners in the hazard zones, and conduct a target mailing to disseminate hazard information; • Conduct public education as hazard seasons approach; • Target Neighborhood Associations to sponsor CERT teams; • Include hazard information on the City website; and • Include insurance information in public outreach and education materials. 			
Coordinating Organization:		Fire and Public Affairs	
Internal Partners:		External Partners:	
Public Works; Engineering			
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Multi-Hazard #2*

Proposed Action Item		Alignment with Plan Goals:	
Integrate the goals and action items from the Lake Oswego Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Zoning Ordinance			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The City updated areas of the development code that protect natural resources, updated the flood plain ordinance with the adoption of the new maps and FEMA studies, and is in the process of completing a new sensitive lands ordinance. The Planning and Engineering Departments were designated as the new coordinating organizations. The second “idea for implementation” now refers to development standards, not Capital Improvement Plans. Comprehensive plan was updated in 2013. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Use the mitigation plan to help the City’s Comprehensive Land Use Plan meet 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; Educate and inform citizens on development standards and ensure development does not encroach on hazard areas without prior mitigation; 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:		Planning and Engineering	
Internal Partners:		External Partners:	
Administration		Department of Land Conservation and Development, Department of Geology and Mineral Industries	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High		

* - High Priority Action Item

Multi-Hazard #3*

Proposed Action Item		Alignment with Plan Goals:	
Address wireless communication deficiencies locally and regionally.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The City has received grants and is pursuing additional grants to purchase, install, and maintain communications equipment and infrastructure. All radio towers have been turned on. • The action item has been expanded to include all wireless communications, not just 800 MHz. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Assess current deficiencies and identify appropriate technologies to address deficiencies; and • Obtain funding for purchasing and installing necessary equipment and infrastructure. 			
Coordinating Organization:		Lake Oswego 9-1-1 Communications (LOCOM)	
Internal Partners:		External Partners:	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Medium	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High		

* - High Priority Action Item

Multi-Hazard #4

Proposed Action Item:		Alignment with Plan Goals:	
Improve vegetation management throughout the city.		Augment Emergency Services; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The city's Fire, Parks and Planning Departments are working closely together to address fuels reduction and non-native vegetation. One project being discussed involves removing invasive species (and flammable materials) and doing a demonstration project at Iron Mountain, involving more than a fire break. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Partner with rail entities and ODOT to control vegetation along transportation corridors; Identify appropriate practices for eliminating English ivy and other invasive species; Maintain healthy urban canopy; Maintain vegetative coverage for slope stability; and Coordinate with watershed councils and others 			
Coordinating Organization:		Planning and Parks	
Internal Partners:		External Partners:	
		Watershed Councils	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #5

Proposed Action Item:		Alignment with Plan Goals:	
Upgrade Lake Oswego wastewater system.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Palisades pump station now has permanent backup power. The Lake Oswego Interceptor System project is underway. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Research and obtain more robust backup power systems to reduce the chance of pump station failures; Obtain adequate funding for wastewater system replacement costs; Acquire easements; and Identify and obtain funding for addressing hazard potentials 			
Coordinating Organization:		Engineering	
Internal Partners:		External Partners:	
Public Works			
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Earthquake #1*

Proposed Action Item		Alignment with Plan Goals:	
Conduct seismic evaluations on identified critical/essential facilities and infrastructure for implementing appropriate structural and non-structural mitigation strategies.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services	
Alignment with Existing Plans/Policies:			
Emergency Operations Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • 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. <p><u>2018 Status:</u></p> <ul style="list-style-type: none"> • City Hall was evaluated. All fire stations have been evaluated and had retrofit work done to apparatus bays. The roof diaphragm of the South Shore Fire Station was tied into walls. Water tanks and communications equipment were hardened and/ or secured. • Seismic upgrades were incorporated into a new City Hall, Police Department, Maintenance Facility (formerly Public Works), and new Water Treatment Plant. • Schools have been evaluated and a 2017 bond passed to retrofit/replace the majority of at risk school buildings within the district (see earthquake section for more information) 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Obtain funding to perform evaluations; • Perform FEMA 154 seismic evaluations on all buildings not included in the recent DOGAMI inventory. • Gain funding to retrofit/replace City Hall (currently in design phase) as a model project for other critical facilities in Lake Oswego; and • Prioritize seismic upgrades based on criticality of need and population served. 			
Coordinating Organization:		City Manager's Office	
Internal Partners:		External Partners:	
Emergency Management, Administration		Infrastructure Finance Authority, School district, colleges, utilities, water districts	
Potential Funding Sources:		Estimated cost:	Timeline:
SRGP, HMA (PDM, HMGP), General Fund		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	High		

* - High Priority Action Item

Flood #1

Proposed Action Item:		Alignment with Plan Goals:	
Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Flood Ordinance; Zoning Code			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> In 2011-2012 the Oswego Lake Corporation completed a dam spillway modification projected funded by a FEMA Flood Mitigation Assistance grant via the City of Lake Oswego. The project involved the installation of new, larger, spillway gates, sized to allow the passage to the 100-year flood flows. The project resulted in the lowering of the base flood elevation (BFE) by 3.5 feet (to 99.7 feet NGVD of 1929), which is below the top of the seawall on the main lake, Lakewood Bay, Westlake, and Blue Heron Canal. The Letter of Map Revision (LOMR) covering the entirety of Oswego Lake is effective as of August 31, 2012. Flooding is no longer expected to happen to these areas, with the exception that there might be some minor roadway flooding (less than a foot deep) on North Shore at North Shore Circle, Eena Road, and perhaps at South Shore Boulevard near the Gerber Pond. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Actively participate with DLCD and FEMA during Community Assistance Visits; Community Assistance Visits (CAV) are scheduled visits to communities participating in the NFIP for: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. Assess the floodplain ordinance to ensure it reflects current flood hazards and situations, and meets NFIP requirements; and Coordinate with the County to ensure that floodplain ordinances and NFIP regulations are maintained and enforced. 			
Coordinating Organization:		Planning and Engineering	
Internal Partners:		External Partners:	
Emergency Management, HMAAC		Department of Land Conservation and Development; Association of State Floodplain Managers; Oregon Solutions	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item (added in 2009)		
Priority:	Medium		

Landslide #1

Proposed Action Item:		Alignment with Plan Goals:	
Improve knowledge of landslide hazard areas and understanding of vulnerability and risk to life and property in hazard-prone areas.		Protect Life and Property; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> 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. In 2016 the landslide hazard and susceptibility analysis and maps were updated (O-16-02). The City encourages citizens to look at the hazard maps and talk with geotechnical experts for new developments. In some instances, landowners are required to have a geotechnical expert inspect the property. The City also now has LIDAR information. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Adopt and integrate the 2016 DOGAMI landslide hazard and susceptibility maps into the county's planning process (O-16-02). 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 Lake Oswego roadways, including appropriate mitigation strategies; and Identify existing mechanisms for public outreach (e.g., NRCS, watershed councils, etc.). 			
Coordinating Organization:		Engineering and Planning	
Internal Partners:		External Partners:	
HMAC		Department of Geology and Mineral Industries, Portland State University, Watershed Councils, Natural Resources Conservation Service	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Risk MAP		Low to Medium	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Severe Weather #1

Proposed Action Item:		Alignment with Plan Goals:	
Reduce frequency and duration of power outages from the severe wind and winter storm hazards where possible.		Protect Life and Property; Enhance Natural Systems	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Three new portable generator stations have been purchased, and all fire stations and city hall have back-up generators. • Many lift stations have built in power generators and the remainders use portable generators. • Undergrounding utilities is required for all new building, and • A private business on Boones Ferry voluntarily undergrounded utilities. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Partner with Portland General Electric, or subsequent electrical utility, to continue hazardous tree inventory and mitigation programs; • Where possible, during redevelopment construction, promote under grounding of utilities; • Identify strategies to establish redundant access to the utility grid to increase the reliability of critical infrastructure; and • Identify critical facilities for backup power generation 			
Coordinating Organization:		Engineering and Planning	
Internal Partners:		External Partners:	
Public Works		Utilities, private landowners	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Wildfire #1

Proposed Action Item:		Alignment with Plan Goals:	
Promote fire resistant strategies and the use of non-combustible roofing materials by evaluating and making recommendations to current code to encourage noncombustible roofing standards in high fire-hazard areas.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The City and Fire Department already encourage the use of non-combustible roofing materials. They also encourage neighborhood associations to stop requiring cedar shake roofs. • Programs focus on fuel reduction and defensible space. • This action item is not supported with code. • The Lake Oswego Fire Marshal continues to meet regularly with neighborhood associations to discuss mitigation activities residents can take part in. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Encourage property owners to use noncombustible roofing materials; • Require street design that facilitates the movement of fire fighting equipment; • Promote use of sprinkler systems in residential construction; and • Maintain awareness of potential City growth into the wildland urban interface. 			
Coordinating Organization:		Fire and Planning	
Internal Partners:		External Partners:	
		Fire Co-op	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Wildfire #2

Proposed Action Item:		Alignment with Plan Goals:	
Develop and implement an Urban Forest Fire Management Plan.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Clackamas County Community Wildfire Protection Plan (2018), Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The City has an Urban Forest Annex in their Emergency Operations Plan and it is updated when the EOP is updated. The City works with the Portland Fire Bureau to plan for Trillium Creek. Work has been done to remove non-native species in City parks. Several hydrants were installed to assist in structural and wildfire fighting efforts. Lake Oswego is looking to add fire hydrants to Iron Mountain, as well as addressing the non-native vegetation issue. The city continues to meet with the county's parks department to combine fuels reduction initiatives. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Develop a vegetation inventory for areas believed to be at risk of wildfire. Target areas of brush and implement management strategies that are consistent with habitat protection requirements; Replace flammable non-native vegetation with native plants that are less flammable; and Enhance water storage facilities and water distribution systems (including hydrants) to serve the wild land/urban interface. 			
Coordinating Organization:		Fire	
Internal Partners:		External Partners:	
Planning			
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to Medium	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Wildfire #3*

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 Lake Oswego can take to reduce wildfire hazards.			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
<u>Wildfire Risk Assessment (Ch. 4):</u>			
<ol style="list-style-type: none"> Maintain and update the Fuels Reduction (FR) and Communities at Risk (CAR) maps and databases. Continue to track structure vulnerability data throughout the County through structural triage assessments. Update the Overall Wildfire Risk Assessment as new data becomes available. 			
<u>Hazardous Fuels Reduction and Biomass Utilization (Ch. 5):</u>			
<ol style="list-style-type: none"> Develop and maintain an inventory of potential and successful FR projects by meeting with parks and natural lands managers quarterly. Continue securing funding to implement projects/hire seasonal ODF staff. 			
<u>Emergency Operations (Ch. 6):</u>			
<ol style="list-style-type: none"> Develop and FDB Communications Works Group. Conduct a Conflagration Exercise. 			
<u>Education and Community Outreach (Ch. 7):</u>			
<ol style="list-style-type: none"> Develop Firewise toolkit for CAR's. Create incentives for fuels reduction. Update and distribute the Burn Permitting and Fire Restrictions Brochure. Continue to improve address signage throughout the County. 			
<u>Structural Ignitability Policies and Programs (Ch. 8):</u>			
<ol style="list-style-type: none"> Identify a DTD representative for the WFEP. Improve coordination with Rural Fire Agencies. Integrate WU into Plan Map and include a public outreach strategy. 			
Coordinating Organization:		Fire	
Internal Partners:		External Partners:	
Planning, Emergency Management		Clackamas Fire Defense Board, Oregon Department of Forestry, U.S. Forest Service, U.S. Bureau of Land Management, public land management agencies	
Potential Funding Sources:		Estimated cost:	Timeline:
ODF, operating budgets		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item/ Wildfire Planning Executive Committee (2018)		
Priority:	High (CWPP identified priority actions listed above)		

* - High Priority Action Item

ATTACHMENT B: PUBLIC INVOLVEMENT SUMMARY

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

To provide the public information regarding the draft NHMP addendum, and provide an opportunity for comment, an announcement (see text below) was provided in the city's newsletter [HelloLO in March 2019](#). The opportunity to review the draft plan and to comment was left open from December 27, 2018 through January 15, 2019.

During the public review period there were no formal comments provided.

March 2019 HelloLO Article:

Natural Hazard Mitigation Plan Update

The City of Lake Oswego is in the process of updating their existing Natural Hazard Mitigation Plan (NHMP). This work is being performed in cooperation with the University of Oregon's Institute for Policy Research and Engagement - Oregon Partnership for Disaster Resilience and the Oregon Military Department's Office of Emergency Management utilizing funds obtained from the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation Grant Program. With re-adoption of the plan, Lake Oswego will maintain its eligibility to apply for federal funding towards natural hazard mitigation projects.

A natural hazard mitigation plan provides communities with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides jurisdictions with a number of benefits, including:

- Reduced loss of life, property, essential services, critical facilities, and economic hardship.
- Reduced short-term and long-term recovery and reconstruction costs.
- Increased cooperation and communication within the community through the planning process.
- Increased potential for state and federal funding for recovery and reconstruction projects.

The updated plan, as with the current plan, will be included as an addendum to Clackamas County's Natural Hazards Mitigation Plan

To review the updated draft Lake Oswego NHMP addendum, please visit www.ci.oswego.or.us/citymanager/emergency-management-program.

As part of the update process, the City is asking residents to complete a brief survey regarding their preparedness for natural hazards. Please take the survey at: www.surveymonkey.com/r/LONHMP. The survey closes on January 15.

If you have any questions regarding the Lake Oswego NHMP addendum or the update process in general, please contact: Bonnie Hirshberger, Citizen Information Specialist, at 503-675-3992 or hirshberger@ci.oswego.or.us; or Michael Howard, Assistant Program

Director for the Oregon Partnership for Disaster Resilience, at 541-346-8413 or mrhoward@uoregon.edu.

City of Milwaukie Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan



March 2019

Volume II: Milwaukie Addendum



Prepared for:

City of Milwaukie

Prepared by:

**University of Oregon
Institute for Policy Research and Engagement
Oregon Partnership for Disaster Resilience**

Planning grant funding provided by:



FEMA

Federal Emergency Management Agency (FEMA)
Pre-Disaster Mitigation Program
Grant: EMS-2017-PC-0005
Sub-grant Application Reference: PDMC-PL-10-OR-2016-001, and

Additional Support Provided by:



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FEMA

January 27, 2020

The Honorable Jim Bernard
Chair, Clackamas County Commissioners
2020 Kaen Road Suite A
Oregon City, Oregon 97045

Dear Chairman Bernard:

On April 12, 2019, the United States Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance grants through April 11, 2024, through your state.

Clackamas County	City of Estacada	City of Lake Oswego
City of West Linn	City of Wilsonville	City of Johnson City
City of Oregon City	City of Happy Valley	City of Canby
Clackamas Fire District	City of Gladstone	City of Sandy
City of Milwaukie	City of Molalla	

The updated list of approved jurisdictions includes the cities of Milwaukie and Molalla which recently adopted the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval, please contact Joseph Murray, State Hazard Mitigation Planner with the Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities. If you have questions regarding FEMA's mitigation grant programs, please contact Amie Bashant, State Hazard Mitigation Officer with the Oregon Military Department, Office of Emergency Management, at 503-378-4660.

Sincerely,

Mark Carey, Director
Mitigation Division

Enclosure

JG

COUNCIL RESOLUTION No. 8-2020**A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF MILWAUKIE, OREGON, ADOPTING UPDATES TO THE CITY'S ADDENDUM TO THE CLACKAMAS COUNTY MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN.**

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

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

WHEREAS, an adopted Natural Hazards Mitigation Plan (NHMP) is required as a condition of future funding for mitigation projects under multiple Federal Emergency Management Administration (FEMA) disaster mitigation grant programs; and

WHEREAS, the city has participated in the FEMA prescribed mitigation planning process to prepare the Clackamas County Multi-Jurisdictional NHMP, which has established a comprehensive, coordinated planning process to eliminate or minimize these vulnerabilities; and

WHEREAS, the city has identified natural hazard risks and prioritized several proposed actions and programs needed to mitigate the impacts of future disasters within the Clackamas County Multi-Jurisdictional NHMP; and

WHEREAS, these proposed projects and programs have been incorporated into the Clackamas County Multi-Jurisdictional NHMP that has been prepared for consideration and implementation by the cities of Clackamas County; and

WHEREAS, the Oregon Office of Emergency Management and FEMA Region X officials have reviewed the city's addendum to the Clackamas County Multi-Jurisdictional NHMP and have pre-approved it contingent upon this official adoption of the participating governments and entities; and

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


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

Now, therefore, be it resolved, by the City Council of the City of Milwaukie, Oregon, that the city's updated addendum to the Clackamas County Multi-Jurisdictional NHMP is adopted as an official plan; and the city manager is directed to develop and implement the mitigation strategies and administrative changes related to the NHMP.

Be it further resolved, that the city will submit this adoption resolution to the Oregon Office of Emergency Management and FEMA Region X officials to enable final approval of the Clackamas County Multi-Jurisdictional NHMP.

Introduced and adopted by the City Council on **January 21, 2020.**

This resolution is effective immediately.



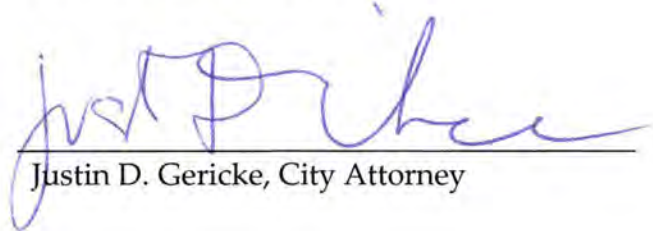
Mark F. Gamba, Mayor

ATTEST:

APPROVED AS TO FORM:



Scott S. Stauffer, City Recorder



Justin D. Gericke, City Attorney

Purpose

This is an update of the Milwaukie addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). This addendum supplements information contained in Volume I (Basic Plan), which serves as the NHMP foundation, and Volume III (Appendices), which provide additional information. This addendum meets the following requirements:

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

Updates to Milwaukie’s addendum are further discussed throughout the NHMP and within Volume III, Appendix B, which provides an overview of alterations to the document that took place during the update process.

Milwaukie adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on **January 21, 2020**. FEMA Region X approved the Clackamas County NHMP on April 12, 2019 and the City’s addendum on **January 27, 2020**. With approval of this NHMP the City is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act’s hazard mitigation project grants through **April 11, 2024**.

Mitigation Plan Mission

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

The city concurs with the mission statement developed during the Clackamas County planning process (Volume I, Section 3):

Promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

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

The city concurs with the goals developed during the Clackamas County planning process (Volume I, Section 3). All NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Below is a list of the NHMP goals:

GOAL #1: PROTECT LIFE AND PROPERTY

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

GOAL #2: ENHANCE NATURAL SYSTEMS

- Balance watershed planning, natural resource management, and land use planning with natural hazards mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

GOAL #3: AUGMENT EMERGENCY SERVICES

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, and business, and industry.
- Coordinate and integrate natural hazards mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL #4: ENCOURAGE PARTNERSHIPS FOR IMPLEMENTATION

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

GOAL #5: PROMOTE PUBLIC AWARENESS

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

NHMP Process, Participation and Adoption

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

Milwaukie first developed an addendum to Clackamas County's Natural Hazards Mitigation Plan in 2003. This plan was updated in 2009, 2012/2013, and 2018/2019. The most recent update of the Milwaukie addendum to the Clackamas County NHMP was approved by FEMA on April 8, 2013.

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

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM), Clackamas County and Milwaukie to update their NHMP. This project is funded through the Federal Emergency Management Agency's (FEMA) Fiscal-Year 2016 (FY16) Pre-Disaster Mitigation (PDM) Competitive Grant Program EMS-2017-PC-0005 (PDMC-PL-10-OR-2016-001). Members of the Milwaukie NHMP Hazard Mitigation Advisory Committee (HMAC) also participated in the County NHMP update process (Volume III, Appendix B).

The Clackamas County NHMP, and Milwaukie addendum, are the result of a collaborative effort between community members, public agencies, non-profit organizations, the private sector, and regional organizations. The Milwaukie HMAC guided the process of developing the NHMP.

Convener

The Milwaukie police chief served as as the NHMP addendum convener during the 2018/2019 update process; the city's emergency manager will serve as the convener during the implementation and maintenance phase, as well as the next plan update. The convener of the NHMP will take the lead in implementing, maintaining and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the City of Milwaukie HMAC met formally and informally to discuss updates to their addendum (Volume III, Appendix B). The HMAC reviewed and revised the city's addendum with focus on the NHMP's risk assessment and mitigation strategy (action items).

This addendum reflects decisions made at the designated meetings and during subsequent work and communication with the Clackamas County Resilience Coordinator and the OPDR. The changes are highlighted with more detail throughout this document and within Volume III, Appendix B. Other documented changes include a revision of the city's risk assessment and hazard identification sections, NHMP mission and goals, action items, and community profile.

The Milwaukie HMAC was comprised of the following representatives:

- Convener, Steve Bartol, police chief (*retired*)
- Luke Strait, police chief
- Mark Dye, police captain
- Damien Farwell, fleet and facilities supervisor
- Steve Hoffeditz, emergency manager
- Nick Lindekugel, GIS coordinator
- Peter Passarelli, public works director
- Samantha Vandagriff, building official

Public participation was achieved by posting the NHMP publicly and providing community members the opportunity to make comments and suggestions during the review process. Community members were also provided an opportunity for comment through a survey administered by Clackamas County (Volume III, Appendix G). The HMAC served as the local review body for the NHMP's development and was comprised of city officials representing different departments and sectors.

NHMP Implementation and Maintenance

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

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating and training new HMAC members on the NHMP and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement; and
- Documenting successes and lessons learned during the year.

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

The city will use the same action item prioritization process as the county (Volume I, Section 4).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city

plans and programs including the Comprehensive Plan, Capital Improvements Plan, and building codes, as well as the [Clackamas County NHMP](#), and the [State of Oregon NHMP](#).

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the city. Plans and policies already in existence have support from residents, businesses and policy makers. Where possible, Milwaukie will implement the NHMP's recommended actions through existing plans and policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Future development without proper planning may result in worsening problems associated with natural hazards. Metro, the regional government for Clackamas, Multnomah and Washington counties, determines many land use laws for the tri-county region and sets the urban growth boundary. The entire Portland Metro area is subject to tremendous growth pressures due to its desirable location and the restrictions on urban sprawl placed by urban growth boundary requirements.

Milwaukie's acknowledged comprehensive plan is the City of Milwaukie Comprehensive Plan (1989, *update expected in December 2019*). The city implements the plan through its development code.

Milwaukie currently has the following plans, regulations and projects that relate to natural hazard mitigation. For a complete list, visit the city's [website](#) and [General City Maps page](#):

- [Comprehensive Plan](#) (1989, [2019 Update](#))
 - [Land Use Map \(Additional Planning Documents\)](#)
- [Municipal Code](#) (Ord. 1686, July 9, 2018)
 - Title 13: Public Services
 - Title 15: Buildings and Construction
 - Title 16: Environment
 - Title 17: Land Division
 - Title 18: Flood Hazard Areas (SFHA and 1996 flood inundation area)
 - Title 19: Zoning
 - Title 21: Utility Service
- [Capital Improvement Plan](#) (2017-2022; 2019-2024)
- [Disaster Debris Management Plan](#) (Metro)
- [Milwaukie Community Climate Action Plan](#)
- Emergency Operations Plan
- [Transportation Systems Plan](#)
 - [Portland Metro 2014 Regional Transportation Plan](#)
- [Stormwater Master Plan](#)
- [Urban Forest Plan](#)
- [Wastewater Master Plan](#)
- [Water System Master Plan](#)

Other plans:

- [Clackamas County Community Wildfire Protection Plan](#)
 - [Clackamas Fire District #1](#)

Government Structure

The City of Milwaukie has a council-manager form of government. City Council consists of five members—a mayor and four councilors. The mayor presides over City Council meetings. The mayor and City Council members are elected to four-year terms of office through a general election. City Council is responsible for identifying problems and needs within the community, then addressing those problems through community goals and objectives.

The City of Milwaukie currently has the following departments that have a role in natural hazard mitigation:

City Manager's Office is responsible for taking charge of the daily supervision of city affairs.

Community Development oversees the planning and building departments.

The **planning department** regulates growth and development in Milwaukie by administering the city's Comprehensive Plan and Municipal Code related to zoning and land division. Tasks range from implementing existing zoning regulations to assisting City Council with land use and growth planning policy development. Planning is also responsible for regulating development impacts in natural resource areas.

The **building division** is responsible for plan review and inspections on commercial, industrial and residential developments, as well as fire life and safety plan review.

The **Public Works Department** provides many of the essential urban services to the community members of Milwaukie, including:

The **stormwater division** continues regular sewer line cleaning and inspection. The stormwater division maintains the components comprising the Milwaukie's stormwater infrastructure, valued at more than \$6 million. These components include 1,190 catch basins, 548 manholes, 62 sedimentation-manholes, 197 drywells, 37 miles of pipe and open ditches, and five detention ponds. The division uses information from inspections for ongoing analysis of the sewer system components and capital needs assessment, and on-the-spot pipe rehabilitation to minimize sewer back-ups. It also ensures that the city complies with the National Discharge Elimination System (NPDES) permit. The division also monitors pollutants in surface water.

The wastewater division maintains the components that comprise the city's wastewater infrastructure, valued at more than \$7 million. This includes 75 miles of sanitary sewer, five lift stations, and 1,607 manholes.

The **water division** is responsible for the supply and distribution of drinking water, maintaining all the components comprising the city's infrastructure, valued at more than \$16.5 million. The various components include 100 miles of water main, 964 fire hydrants, 6,911 water services, seven well houses, three storage reservoirs and four pump stations. The division ensures that the city's water storage and distribution systems comply with all state and federal regulations.

The **streets division** maintains the components that comprise the city's infrastructure, valued at more than \$38.7 million. These include 75 miles of road surface as well as signage and street pavement markings.

The **fleet division** maintains the city's vehicles and equipment, including police cars, sweepers, excavators, dump trucks and 150 pieces of small equipment and generators. And, the **Facilities Division** is responsible for maintaining all city facilities.

The **Engineering Department** provides quality engineering services to ensure that all city utilities, including wastewater collection, water, streets and storm water infrastructure, meet all municipal code requirements, are efficiently managed at the lowest cost to ratepayers, and serve the long-term needs of the community. In addition, the Engineering Department provides floodplain management and regulation for the city.

Public safety is committed to providing quality services to the Milwaukie community. Police services are provided by the Milwaukie **Police Department**, and fire services are provided by **Clackamas Fire District #1**. **Code enforcement** is responsible for neighborhood preservation, code compliance and nuisance abatement.

Continued Public Participation

An open public involvement process is essential to the development of an effective NHMP. To develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunity for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the NHMP during review.¹ Keeping the public informed of the city's efforts to reduce its risk to future natural hazard events is important for successful NHMP implementation and maintenance. The city is committed to involving the public in the NHMP review and update process (Volume I, Section 4). The city posted the plan update for public comment before FEMA approval, and after approval will maintain the plan on the City's website: hwww.milwaukieoregon.gov.

NHMP Maintenance

The Clackamas County NHMP and City of Milwaukie addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the county NHMP update process, the city will also review and update its addendum (Volume I, Section 4). The convener will be responsible for convening the HMAC to address the questions outlined below.

- Are there new partners that should be brought to the table?
- Are there new local, regional, state or federal policies influencing natural hazards that should be addressed?
- Has the community successfully implemented any mitigation activities since the NHMP was last updated?
- Have new issues or problems related to hazards been identified in the community?
- Are the actions still appropriate given current resources?
- Have there been any changes in development patterns that could influence the effects of hazards?
- Have there been any significant changes in the community's demographics that could influence the effects of hazards?

¹ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

- Are there new studies or data available that would enhance the risk assessment?
- Has the community been affected by any disasters? Did the NHMP accurately address the impacts of this event?

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

Mitigation Strategy

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

The city's mitigation strategy (action items) were first developed during the 2003 NHMP planning process and revised during subsequent NHMP updates. During these processes, the HMAC assessed the city's risk, identified potential issues, and developed a mitigation strategy (action items).

During the 2018 update process the city reevaluated their mitigation strategy (action items). During this process action items were updated, noting what accomplishments had been made and whether the actions were still relevant; any new action items were identified at this time (see Attachment A for more information on changes to action items).

Priority Action Items

Table MA-1 presents a list of mitigation actions. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity. High priority actions are shown in **bold** text with grey highlight. The City of Milwaukie will focus their attention and resource availability upon these achievable, high leverage activities over the next five years. Although this methodology provides a guide for the HMAC in terms of implementation, the HMAC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for detailed information for each action. Full text of the plan goals referenced in Table MA-1 is located on page MA-2.

Table MA-I Milwaukie Action Items

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
MH #1	Ensure that there are adequate shelter facilities in hazard-free zones to serve Milwaukie residents.	Emergency Management	CERT Volunteer, CFD#1	Ongoing	✓		✓	✓	✓
MH #2	Improve network of communications during a disaster.	Information Systems Technology	Public Works, CERT	Short Term	✓		✓	✓	✓
MH #3	Increase outreach and education for hazard awareness and natural disaster preparedness, especially for low-income, elderly, non-English speaking, and other vulnerable populations.	Emergency Management	Public Works, Community Services, CFD#1, CERT	Ongoing	✓		✓	✓	✓
MH #4	Maintain and promote CERT program activity in the area and recruit new members for training.	CFD#1	Emergency Management (EM), CERT	Ongoing	✓		✓	✓	✓
MH #5	Maintain and enhance strategies for debris management for all hazards.	Public Works	Metro	Ongoing	✓	✓	✓	✓	
MH #6	Improve and obtain resources and equipment essential for responding to and recovering from disasters.	Public Works	Emergency Management	Long Term	✓		✓	✓	
MH #7	Integrate the goals and mitigation actions from the Milwaukie Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	Planning	Engineering	Ongoing	✓	✓	✓	✓	✓
MH #8	Coordinate natural hazard related climate change action items through the Milwaukie Community Climate Action Plan.	Public Works	Planning, CFD#1, EM, Community Services	Ongoing	✓	✓	✓	✓	✓

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
DR #1	Develop public brochures to raise awareness about drought hazards and mitigation actions residents can take to reduce the impact of drought.	Neighborhood Services	Emergency Management	Ongoing	✓			✓	✓
EQ #1	Conduct seismic evaluations on identified critical and essential facilities and infrastructure and implement appropriate structural and non-structural mitigation strategies.	Facilities	Building	Ongoing	✓		✓	✓	
FL #1	Evaluate alternatives for reducing the flooding hazard for properties along Kellogg Creek, Johnson Creek, Mount Scott Creek area, and the Willamette River.	Engineering	Planning, Public Works	Long Term	✓	✓	✓	✓	✓
FL #2	Ensure continued compliance with the National Flood Insurance Program through enforcement of local floodplain management ordinances.	Engineering	Planning, Building	Ongoing	✓	✓		✓	✓
SW #1	Bury vulnerable critical infrastructure, such as power lines, to lessen potential failures during severe weather.	Public Works	Engineering	Ongoing	✓	✓	✓	✓	
WF #1	Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan.	CFD#1	Public Works, Building, Planning	Ongoing	✓	✓	✓	✓	✓

Source: City of Milwaukie HMAC, 2018.

Note: Full text of the plan goals referenced in this table is located on page MA-2.

Risk Assessment

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

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

The local level rationale for the identified mitigation strategies (action items) is presented herein and within Volume I, Section 3 and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure MA-1. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure MA-1 Understanding Risk



Hazard Analysis

The Milwaukie HMA developed the city’s hazard vulnerability assessment (HVA), using the city’s previous HVA and the county’s HVA as a reference. Changes from their previous HVA and the county’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Milwaukie, which are discussed throughout this addendum. For detailed information on the methodology see Volume I, Section 2.

Table MA-2 shows the HVA matrix for Milwaukie listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response and recovery. The method provides the jurisdiction with sense of hazard priorities but does not predict the occurrence of a hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake and Crustal earthquake) and two chronic hazards (flood, winter storm) rank as the top hazard threats to the city (Top Tier). Extreme heat and windstorm comprise the next highest ranked hazards (Middle Tier), while the drought, wildfire, volcanic event and landslide hazards comprise the lowest ranked hazards (Bottom Tier).

Table MA-2 Hazard Analysis Matrix – Milwaukie

Hazard	Maximum				Total Threat Score	Hazard Rank	Hazard Tiers
	History	Vulnerability	Threat	Probability			
Earthquake - Cascadia	4	45	100	49	198	#1	Top Tier
Earthquake - Crustal	6	50	100	21	177	#2	
Flood	16	20	40	56	132	#3	
Winter Storm	14	30	70	56	170	#4	
Extreme Heat	16	40	60	42	158	#5	Middle Tier
Windstorm	14	15	50	42	121	#6	
Drought	10	10	50	28	98	#7	Bottom Tier
Wildfire	6	15	50	21	92	#8	
Volcanic Event	2	10	40	14	66	#9	
Landslide	6	15	20	21	62	#10	

Source: Milwaukie HMAc, 2018.

Table MA-3 categorizes the probability and vulnerability scores from the hazard analysis for the city and compares the results to the assessment completed by the Clackamas County HMAc. Variations between the city and county are noted in **bold** text within the city ratings.

Table MA-3 Probability and Vulnerability Comparison

Hazard	Milwaukie		Clackamas County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Low	High	Low
Earthquake - Cascadia	Moderate	High	Moderate	High
Earthquake - Crustal	Low	High	Low	High
Extreme Heat	Moderate	High	Low	High
Flood	High	High	High	Moderate
Landslide	Low	Low	High	Low
Volcanic Event	Low	Low	Low	Moderate
Wildfire	Low	Low	High	Moderate
Windstorm	Moderate	Low	Moderate	Low
Winter Storm	High	Moderate	Moderate	Moderate

Source: Milwaukie and Clackamas County HMAc, 2018.

Future Climate Variability

Human-caused climate change is impacting the natural systems and environmental health of regional and local communities. The City of Milwaukie recognizes the effects that climate change will have on the city and its residents, including changes to the frequency, severity, and impacts of natural hazards from historical norms. According to the [Intergovernmental Panel on Climate Change Fourth National Climate Assessment](#), the Pacific Northwest region will see impacts to drought risk, water quality, wildfires and air quality, human health and more due to climate change. Even with these challenges, the Pacific Northwest and Milwaukie will shelter a growing population seeking livability and refuge from more extreme climates in the nation.

Climate models for Oregon suggest future regional climate changes include increases in temperature around 0.2-1°F per decade in the 21st century, along with warmer and drier summers, and some evidence that extreme precipitation will increase in the future.² Increased droughts may occur in the Willamette Valley under various climate change scenarios because of various factors, including reduced snowpack, rising temperatures and likely reductions in summer precipitation. Climate models suggest that as the region warms, winter snow precipitation will likely shift to higher elevations and snowpack will diminish as more precipitation falls as rain altering surface flows.

Acknowledging the city's responsibility to be a leader in the climate crisis, Milwaukie adopted a [Climate Action Plan](#) detailing 53 city-led actions to mitigate and adapt to climate change. Along with reducing the city's greenhouse gas emissions and contribution to climate change, the Climate Action Plan calls for increasing the community's resiliency and preparedness for natural hazards through policy, advocacy, outreach and education.

Milwaukie is committed to planning and preparing for the immediate and future threats that climate change will have on the community. By addressing the climate crisis through the actionable goals of the Climate Action Plan, Milwaukie hopes to reduce the risk and impact of climate change related natural hazards on residents of Milwaukie and the region while encouraging others to take climate action.

² Oregon Climate Change Research Institute (OCCRI), [Fourth Oregon Climate Assessment Report](#) (2019) and [Fourth National Climate Assessment, Chapter 23: Northwest](#) (2019). <http://www.occri.net/publications-and-reports/publications/>

Community Characteristics

Table MA-4 and the following section provides information on city-specific demographics and assets. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation.

Considering the city specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation. Between 2010 and 2016, the Milwaukie grew by 220 people (1%; as of 2019 the population was 20,535) and median household income increased by about 8%.³ Between 2019 and 2040, the population is forecast to grow by 13% to 23,149.⁴ New development has complied with the standards of the [Oregon Building Code](#) and the city's development code.

Transportation/Infrastructure

Milwaukie is accessible by two state highways, OR-99E (or SE McLoughlin Boulevard), running north to south in the western part of the city, and Highway 224, running west to east through the central part of the city. Milwaukie is also bisected by the Union Pacific Railroad main line, which travels northwest to southeast carrying both passengers and freight.

The responsibility and authority, as well as the financial capability, to maintain an adequate level of service for the highways rests with Metro and Oregon Department of Transportation (ODOT) authorities. Congestion can result in the diversion of traffic onto Milwaukie streets.

The city's public transit is provided by Portland's TriMet transit system. Eleven bus routes go through the downtown Milwaukie transit center daily. The [MAX Orange Line](#) provides service to Milwaukie. The availability and quality of pedestrian and bicycling facilities (sidewalks, bike lanes, and pathways) is inconsistent, generally newer neighborhoods have facilities. [Base Maps](#) are found on the city's website.

Economy

Milwaukie is a major industrial center in the Portland metropolitan area, containing one of the largest concentrations of warehousing and distribution industries in the region. The North Milwaukie Industrial/Innovation Area, Omark Industrial Park and Johnson Creek industrial area comprise more than 300 acres of industrial land within the city. These areas are nearing capacity and very little land within the city is currently available for new industrial development.

Milwaukie's commercial lands are largely built up. New commercial development along Highway 224, McLoughlin Boulevard, and 82nd Avenue has lured many people away from downtown Milwaukie for purchasing comparison goods, such as clothes, furniture and appliances. Downtown Milwaukie, however, has continued to attract commercial investment in the form of commercial service uses including banks, insurance, professional offices, and a residential mixed-use development. The city has identified areas for commercial, office, or mixed use development: [map](#).

The city, school district and smaller employers (retail, offices and other professional services) provide for most of Milwaukie's employment.

³ Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018 and Social Explorer, Table T57, U.S. Census Bureau, 2012-2016 and 2006-2010 American Community Survey Estimates.

⁴. Metro, 2040 Distributed Forecast (2016).

Table MA-4 Community Characteristics

Population Characteristics		
2010 Population	20,290	
2016 Population [2019 Population]	20,510 [20,535]	
2040 Forecasted Population*	23,149	
Race (non-Hispanic) and Ethnicity (Hispanic)		
White	84%	
Black/ African American	1%	
American Indian and Alaska Native	1%	
Asian	3%	
Native Hawaiian and Other Pacific Islander	< 1%	
Some Other Race	< 1%	
Two or More Races	2%	
Hispanic or Latino	9%	
Limited or No English Spoken	2%	
Vulnerable Age Groups		
Less than 15 Years	3,088	15%
65 Years and Over	3,388	16%
Disability Status		
Total Population	2,741	13%
Children (under 18)	134	4%
Seniors (65 and older)	1,100	33%
Income Characteristics		
Households by Income Category		
Less than \$15,000	777	9%
\$15,000-\$29,999	1,275	14%
\$30,000-\$44,999	1,113	12%
\$45,000-\$59,999	1,112	12%
\$60,000-\$74,999	1,126	12%
\$75,000-\$99,999	1,338	15%
\$100,000-\$199,999	2,035	22%
\$200,000 or more	325	4%
Median Household Income	\$63,421	
Poverty Rates		
Total Population	2,236	11%
Children	411	11%
Seniors	250	8%
Housing Cost Burden		
Owners with Mortgage	1,295	24%
Renters	1,562	43%

Source: U.S. Census Bureau, 2014-2018 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2019. [Metro, 2040 Distributed Forecast](#). Note: * = Population forecast within Metro UGB

Housing Characteristics		
Housing Units		
Single-Family	6,476	67%
Multi-Family	3,061	32%
Mobile Homes	82	1%
Year Structure Built		
Pre-1970	5,375	56%
1970-1989	2,795	29%
1990 or later	1,449	15%
Housing Tenure and Vacancy		
Owner-occupied	5,466	57%
Renter-occupied	3,635	38%
Seasonal	48	< 1%
Vacant	470	5%

Milwaukie has grown substantially since its incorporation in 1903 and has an area today of about 5 square miles. Between 1940 and 1980, the population grew from about 2,000 to just under 18,000 residents. Since then the growth in population has slowed.

The city is located within the southern bounds of the Portland metropolitan area (about six miles from downtown Portland). The city is within the Willamette River basin and has two major creeks flowing through it, Johnson Creek in the northern part of the city and Kellogg Creek in the southern part.

Milwaukie's climate is consistent with the Marine west coast climate zone, with warm summers and cool, wet winters. Milwaukie receives most of its rainfall between October and May, and averages 43 inches of rain, and less than one (1) inch of snow, per year.⁵

Elevations in the city range from 205 feet near 59th Avenue and Monroe Street to a low of 43 feet on the shores of the Willamette River. Milwaukie is characterized by flat or gently hilly topography.

⁵ ["Monthly Average for Milwaukie, OR"](#) The Weather Channel Interactive, Inc. Retrieved March 22, 2019.

Community Assets -

This section outlines the resources, facilities and infrastructure that, if damaged, could significantly impact the public safety, economic conditions and environmental integrity of Milwaukie. The community assets below were identified by the City of Milwaukie. The tables identify which hazards each asset may be exposed to based upon both a GIS analysis as well as HMAC member knowledge. Additional information is needed to fully understand the extent of risk to each asset. It is important to note that the facilities identified as “critical” and “essential” are characterized differently than the structural code that identifies buildings as “essential” and “non-essential.” The structural code uses different language and criteria and therefore have completely different meanings than the buildings identified in this addendum.

Critical Facilities

These facilities are critical to government response and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include 911 centers, emergency operations centers, police and fire stations, public works facilities, sewer and water facilities, hospitals, bridges, roads, shelters, and more.

Law Enforcement/Fire Stations:

City Facilities:

- Public Safety Building: Milwaukie Police Department/[CFD #2](#) (3200 SE Harrison St.)

Facilities Not in Milwaukie:

- [Town Center Station](#) (CFD #1, not in city)
- [Oak Grove Station](#) (CFD #3, not in city)
- [Lake Road Station](#) (CFD #4, not in city)
- Clackamas County Sheriff (not in city)
- Oregon State Police (not in city)

Hospitals:

- Providence Milwaukie Hospital (10150 SE 32nd Ave)
- Kaiser Permanente Hospital (not in city)
- Willamette Falls Hospital (not in city)

Essential Facilities

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public’s ability to recover from the emergency. These facilities may include city buildings, such as the public safety building and City Hall, as well as other public facilities, such as schools.

City Buildings:

- Ledding Library
- Milwaukie Center
- Milwaukie City Hall
- 40th & Harvey
- Johnson Creek Building

- Public Safety Building

County Buildings:

- Kellogg Treatment Plant

Schools:

- Ardenwald Elementary (new)
- Clackamas Community College (Milwaukie Campus)
- Hector Campbell Elementary (closed)
- Linwood Elementary
- Milwaukie Elementary
- Milwaukie High School (new)
- Portland Waldorf School (private)
- Rowe Middle School
- Seth Lewelling Elementary
- St. John's School (private)
- School Transportation Center
- Wichita Center for Family and Community (not in city)

Potential Red Cross Shelter Sites:

- Milwaukie Center (5440 SE Kellogg Creek Dr)
- Eagles Wings Ministries (10902 SE Garrett Dr)
- Milwaukie Presbyterian Church (2416 SE Lake Rd)
- Clackamas Park Friends Church (8120 SE Thiessen Rd, Oak Grove)
- King of Kings Lutheran Church (5501 SE Thiessen Rd, Oak Grove)

Essential Infrastructure

Infrastructure that provide necessary services that supplement response efforts:

Bridges:

City

- 17th Avenue across Johnson Creek
- Milport Road across Johnson Creek
- Do you need to note Milwaukie Bay Bridge for WES?

County

- 55th Avenue across Johnson Creek
- 60th Avenue across Johnson Creek
- Linwood Avenue across Johnson Creek
- Stanley Avenue across Johnson Creek
- Oatfield Road across Kellogg Creek
- Rusk Road across Mount Scott Creek

Portland

- Johnson Creek Boulevard across Johnson Creek
- Ochoco Street across Johnson Creek

TriMet

- OR-99E (McLoughlin Boulevard)
- Kellogg Creek
- Ochoco (elevated portion)

State of Oregon

- McLoughlin Boulevard across Johnson Creek, north of the city
- McLoughlin Boulevard across Kellogg Creek
- McLoughlin off-ramp to Hwy. 224 across Johnson Creek
- Hwy. 224 across Johnson Creek, McLoughlin Boulevard and Main Street
- Hwy. 224 across railroad tracks and 26th Avenue
- Hwy. 224 across Mount Scott Creek
- Hwy. 224 across MAX Light Rail Orange Line tracks

Transportation Corridors:

- 17th Ave
- 32nd Ave
- 55th Ave
- Harrison St/42nd Ave/King Rd.
- Highway 224
- Johnson Creek Blvd
- King Rd
- Lake Rd
- Linwood Ave
- Max Orange Line
- McLoughlin Blvd/Highway 99E
- Oatfield Rd
- River Rd
- MAX Orange Line and Bus Lines

Water Treatment Facilities

- Eight City Wells
- Aeration Packed Towers – 5 @ two locations
- Concrete Storage Tank – 40th & Harvey
- Elevated Water Storage Tank – 40th & Harvey
- Ground Level Metal Tank – Stanley & Harlow
- Sewerage Pump Stations – 5

Other Utilities

- NW Natural pipelines
- PGE Substations (One is at edge of Lake / Harmony; a second is on the East end of Johnson Creek; a third is on the border between Milwaukie and Oak Grove)

Vulnerable Populations:

Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, often experience the impacts of natural hazards and disasters more acutely. Populations that have special needs or require special consideration include:

- Lockdown Facility (9200 SE McBrod Ave.)
- Hillside Manor
- Johnson Creek Treatment Facility
- Prestige Post-Acute and Rehab Center
- Royal Marc Retirement Residence
- Annie Ross House (transitional family housing)
- Milwaukie Center (daytime programs)
- ElderPlace Providence (daytime programs, Providence Milwaukie)
- Senior Center on Rusk Road near North Clackamas Park (in development)

Hazardous Materials:

Facilities that, if damaged, could cause serious secondary impacts may also be considered “critical.” A hazardous material facility is one example of this type of critical facility. Those sites that store, manufacture, or use potentially hazardous materials include: International Way, North Milwaukie Innovative Area, and Precision Cast Parks.

Economic Assets/Population Centers:

Economic assets include businesses that employ large numbers of people and provide an economic resource to the City. If damaged, the loss of these economic assets could significantly affect economic stability, and prosperity. Population Centers usually are aligned with economic centers and are a concern during evacuation/notification during a hazard event. These assets include: Downtown, McLoughlin Commercial Areas, and North Milwaukie Innovative Area .

Environmental Assets:

Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic, and functional ecosystem services for the community. These environmental assets include: Ball-Michel Park, Dogwood Park, Elk Rock Island, Homewood Park, North Clackamas Park, Milwaukie Bay Park, Stanley Park, Water Tower Park, and Wichita Park.

Cultural or Historical Assets:

These assets include those facilities that augment or help define community character, and if lost, would represent a significant loss for the community.

Historic Inventory: see State Historic Preservation Office for more information: [Link](#)

- More than 500 houses
- Five commercial buildings
- Three schools
- One cemetery
- One church
- One city hall
- One water works

Community Attractions:

- 17th Avenue Bike/Pedestrian Path
- Bob’s Red Mill
- Carefree Sundays
- Dark Horse Comics Corporate Headquarters
- First Friday (May-October)
- Milwaukie Bay Park
- Milwaukie Farmers Market
- Milwaukie Museum
- Sara Hite Memorial Rose Garden
- Spring Park and Elk Rock Island
- Springwater Trail
- Trolley Trail
- Winter Solstice Event
- Umbrella Parade and Tree Lighting
- Carefree Sunday

Hazard Characteristics

Drought

The HMAC determined that the city's probability for drought is **moderate** and that their vulnerability to drought is **low**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent and probability of a potential event. Due to the climate of Clackamas County, past and present weather conditions have shown an increasing potential for drought.

Milwaukie currently obtains its potable water from the Troutdale Aquifer through eight operating wells located throughout the city. Interties to the City of Portland and Clackamas River Water systems are maintained for emergency water supplies. The network of three water reservoirs provide a storage volume of six million gallons.⁶ The [Water System Master Plan](#) was last updated in 2010 to provide long-term guidance for the development of the city's water system, which is a supporting document for the Comprehensive Plan. The document also includes recommended capital improvement projects and a map documenting the water infrastructure placement within the city.

Vulnerability Assessment

Due to insufficient data and resources, Milwaukie is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard.

Mitigation Activities

Milwaukie has a drought action item that addresses public awareness. The existing drought hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Earthquake (Cascadia Subduction Zone)

The HMAC determined that the city's probability for a Cascadia Subduction Zone (CSZ) earthquake is **moderate** and that their vulnerability to a CSZ earthquake is **high**. *The probability and vulnerability ratings did not change since the previous version of this NHMP addendum. Note: Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake and Crustal earthquake.*

Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent and probability of a potential event. Generally, an event that affects the county is likely to affect Milwaukie as well. The causes and characteristics of an earthquake event are appropriately described within the Volume I, Section 2 as well as the location and extent of potential hazards. Previous occurrences are well documented within Volume I,

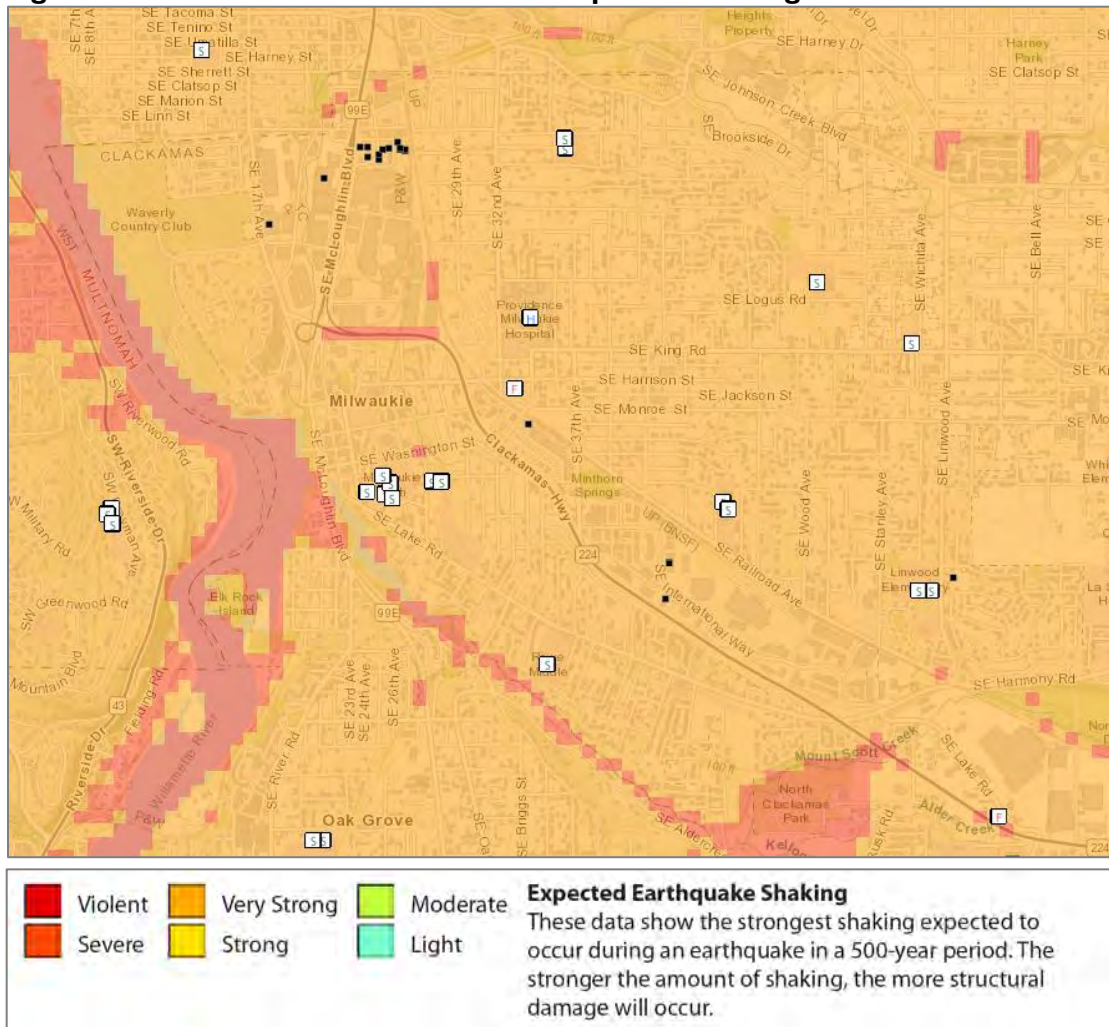
⁶ [Milwaukie Municipal Code Chapter 5](#). Comprehensive Plan, City of Milwaukie. Last Viewed March 27, 2019.

Section 2 and the community impacts described by the county would generally be the same for Milwaukie as well.

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Portland Hills Fault Zone, Gales Creek-Newberg-Mt. Angel Structural Zone (discussed in the crustal earthquake section).

Figure MA-2 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the city is expected to experience very strong shaking (orange), while areas near rivers and streams will experience severe (light red) to violent (dark red) shaking in a CSZ event.

Figure MA-2 Cascadia Subduction Zone Expected Shaking



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

Note: To view detail click the link above to access Oregon HazVu

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year. Scientists have found evidence that 11 large, tsunami-producing

earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D.⁷

The city's proximity to the Cascadia Subduction Zone, potential slope instability and the prevalence of certain soils subject to liquefaction and amplification combine to give the city a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places the city predominately within the "Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades). Within the Northwest Oregon region, damage and shaking is expected to be strong and widespread - an event will be disruptive to daily life and commerce and the main priority is expected to be restoring services to business and residents.

Earthquake (Crustal)

The HMAC determined that the city's probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**. *The probability rating decreased while the vulnerability rating did not change since the previous version of this NHMP addendum. Note: Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Crustal earthquake, and Cascadia Subduction Zone (CSZ) earthquake.*

Volume I, Section 2 describes the causes and characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the county is likely to affect Milwaukie as well. Figure MA-3 shows a generalized geologic map of the Milwaukie area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows the areas of greatest concern within the city limits as red and orange.

There are two potential crustal faults and/or zones near Milwaukie that can generate high-magnitude earthquakes. These include the Gales Creek-Mt. Angel Structural Zone and Portland Hills Fault Zone (discussed in greater detail below). Other faults include the Oatfield fault (just to the east of the city on the eastern side of the Willamette River) and the Damascus-Tickle Creek fault to the east of the city, and the Mt. Hood Fault in eastern Clackamas County. Historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

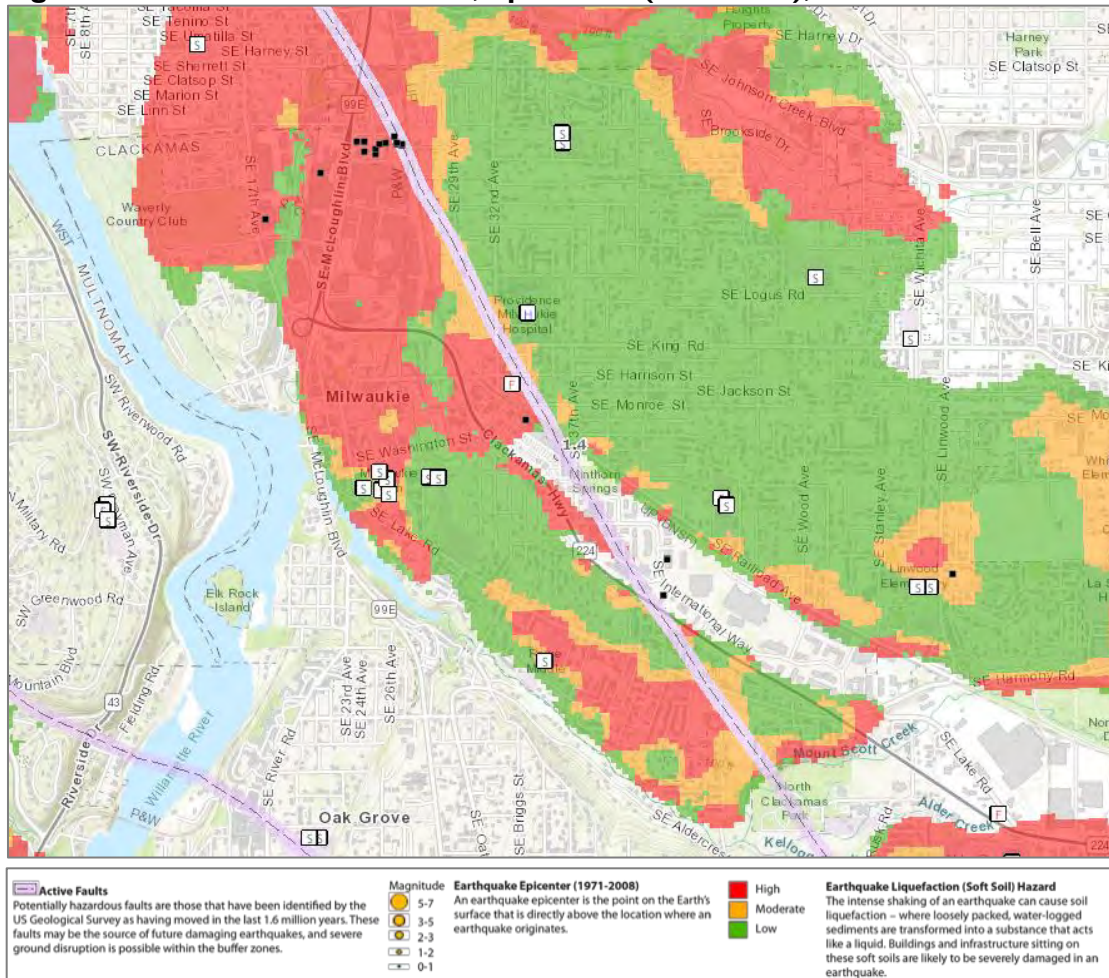
Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and runs through the western side of Milwaukie.

⁷ The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. <http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf>

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

Figure MA-3 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



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

Note: To view detail click the link above to access Oregon HazVu

Vulnerability Assessment

Due to insufficient data and resources, Milwaukie is currently unable to perform a quantitative risk assessment for this hazard. However, the city completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected. Additionally, in 2018 the Department of Geology and Mineral Industries (DOGAMI) completed a regional impact analysis for earthquakes originating from the Cascadia

Subduction Zone and Portland Hills faults ([O-18-02](#)), findings from that report are provided at the end of the crustal earthquakes hazard section.

Community assets located in the highest hazard zone for earthquakes include the Public Safety Building (Milwaukie Police Department and Clackamas Fire District Station 2), Providence Milwaukie Hospital, and the North Milwaukie Innovative Area. Milwaukie's infrastructure is particularly vulnerable to earthquake damage, especially Highway 224 and OR-99E. Of the city's eight wells, two of them are along the fault line, with others in the moderate to high hazard zones for earthquakes. During a major earthquake, emergency responders may have difficulty performing their duties because their buildings could be impacted by the event. The Public Safety Building is in the moderate to high hazard zones. Areas near the Willamette River and various creeks around Milwaukie are likely comprised of softer soils prone to liquefaction. This can be very destructive to underground utilities such as water and sewer lines. Buildings and water lines can sink into the liquefied ground while sewer pipes, manholes and pump stations (assets partially filled with air) may float to the surface. After the earthquake, the liquefied soil will re-solidify, locking tilted buildings and broken pipe connections into place.

Vulnerable populations such as children could be significantly impacted, as many schools lie in the highest two hazard zones. The data gathered from the statewide DOGAMI inventory should be used to prioritize school buildings in Milwaukie for seismic hazard retrofitting.

Seismic building codes were implemented in Oregon in the 1970s, however, stricter standards did not take effect until 1991 and early 2000s. As noted in the community profile, approximately 86% of residential buildings were built prior to 1990, which increases the City's vulnerability to the earthquake hazard. Information on specific public buildings' (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table MA-5; each "X" represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), three (3) have very high (100% chance) collapse potential, while two (2) have a high (greater than 10% chance) collapse potential. *Note: one school has been retrofitted and one is scheduled to be retrofitted.*

In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

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

Table MA-5 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Alder Creek Middle (13801 SE Webster Rd)	Clac_sch83	X			
Ardenwald Elementary (8950 SE 36th Ave)	Clac_sch14	Retrofitted per a 2008 bond.			
<i>Hector Campbell Elementary (11326 SE 47th Ave) - CLOSED</i>	<i>Clac_sch87</i>		X	X	
Linwood Elementary (11909 SE Linwood Ave)	Clac_sch19	X			X
Milwaukie Elementary School (11250 SE 27 th Ave)	Clac_sch20			X	X
Milwaukie High School (2301 SE Willard St)	Clac_sch28	Rebuild in progress per a 2016 bond.			
Portland Waldorf School (2300 SE Harrison St)	-	2007 RVS report did not include structural appendix for this facility.			
Seth Lewelling Elementary (5325 SE Logus Rd)	Clac_sch88	X			
St. John Catholic School (10956 SE 25th Ave)	-	2007 RVS report did not include structural appendix for this facility.			
Public Safety					
CFD Fire Station 1 (ca. 1983) (11300 SE Fuller Rd)	Clac_fir09	X			
CFD Fire Station 2 (ca. 1993) (Public Safety Building) (3200 SE Harrison)	Clac_fir26	X			
CFD Fire Station 3 (ca. 1997) (2930 SE Oak Grove Blvd)	Clac_fir27	X			
CFD Fire Station 4 (ca. 1999) (6600 SE Lake Rd)	Clac_fir08	X			
Hospital					
Providence Milwaukie (10150 SE 32 nd Ave)	Clac_hos02	X			

Source: [DOGAMI 2007. Open File Report O-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#) "*" – Site ID is referenced on the [RVS Clackamas County Map](#)

Note 1: Bold indicates facilities that have been seismically retrofitted or rebuilt.

Note 2: Private schools were not assessed by DOGAMI as part of O-07-02.

Mitigation Activities

Milwaukie has taken mitigation steps to reduce the city’s vulnerability in earthquake events. Additional mitigation activities completed by the City of Milwaukie include:

- Compliance with SB 13, enacted in 2001, requiring local governments to develop seismic preparation procedures, inform their employees about the procedures, and conduct earthquake drills.

- Conformance with seismic-related construction requirements in the Oregon Structural Specialty Code and Oregon One- and Two-Family Dwelling Specialty Code.
- Adoption of a policy to require undergrounding of power lines in new subdivisions.
- Development Code restrictions regarding construction on steep slopes.
- The following buildings have been constructed to be earthquake safe: Water tower at 40th Avenue and Harvey Street, Milwaukie High School Fine Arts Center, Linwood Elementary Main Office and Gym, and the Milwaukie Library.
- Ardenwald Elementary retrofitted per 2008 bond passed by voters (former building demolished in 2009).
- Milwaukie High School scheduled for reconstruction/rebuild of main building by August 2021 through a 2016 bond passed by voters.⁸

Earthquake Regional Impact Analysis

In 2018, DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)). Their study focused on damage to buildings, and the people that occupy them, and to two key infrastructure sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and night time (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damaged varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood structures that fare worse in an earthquake. The Portland Hills fault scenario created greater damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills Fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios, it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios, however, the impact is considerably less than it is to the transportation routes. Additional capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts.

Table MA-6 shows the permanent resident population that are vulnerable to injury or death (casualty) and the buildings in the city that are susceptible to liquefaction and landslides. It does not predict that damage will occur in specific areas due to either liquefaction or landslide. More population and property are exposed to higher degrees of expected damage or casualty under the Portland Hills Fault “wet” scenario than in any other scenario.

⁸ [Milwaukie High School Bond Project](#). Capital Construction Bond, North Clackamas Schools. Last visited March 28, 2019.

Table MA-6 Expected damages and casualties for the CSZ fault and Portland Hills fault: earthquake, soil moisture, and event time scenarios

	Cascadia Subduction Zone (M9.0)		Portland Hills Fault (M6.8)	
	"Dry" Soil	"Wet" Saturated Soil	"Dry" Soil	"Wet" Saturated Soil
Number of Buildings	7,891	7,891	7,891	7,891
Building Value (\$ Million)	2,890	2,890	2,890	2,890
Building Repair Cost (\$ Million)	295	394	1,341	1,598
Building Loss Ratio	10%	14%	46%	55%
Debris (Thousands of Tons)	162	193	542	615
Long-Term Displaced Population	93	83	2,459	5,456
Total Casualties (Daytime)	294	380	1,427	1,595
Level 4 (Killed)	14	19	82	89
Total Casualties (Nighttime)	34	92	326	546
Level 4 (Killed)	1	3	10	16

Source: DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8, 12-9, 12-10, and 12-11.

Cascadia Subduction Zone Scenario

The City of Milwaukie is expected to have a 10% building loss ratio with a repair cost of \$295 million under the CSZ “dry” scenario, and a 14% building loss ratio with a repair cost of \$394 million under the CSZ “wet” scenario.⁹ The city is expected to have around 294 daytime or 34 nighttime casualties during the CSZ “dry” scenario and 380 daytime or 92 nighttime casualties during the CSZ “wet” scenario. It is expected that there will be a long-term displaced population of around 93 for the CSZ “dry” scenario and 83 for the CSZ “wet” scenario.¹⁰

Portland Hills Fault Scenario

The City of Milwaukie is expected to have a 46% building loss ratio with a repair cost of \$1.341 billion under the CSZ “dry” scenario, and a 55% building loss ratio with a repair cost of \$1.598 billion under the CSZ “wet” scenario.¹¹ The long-term displaced population and casualties are greatly increased for all the Portland Hills Fault scenarios. The city is expected to have around 1,427 daytime or 326 nighttime casualties during the Portland Hills Fault “dry” scenario and 1,595 daytime or 546 nighttime casualties during the Portland Hills Fault “wet” scenario. It is expected that there will be a long-term displaced population of around 2,459 for the Portland Hills Fault “dry” scenario and 5,456 for the Portland Hills Fault “wet” scenario.¹²

Recommendations from the report included topics within Planning, Recovery, Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMPs mitigation strategies (Table MA-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and the recommendations see:

⁹ DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8 and 12-9.

¹⁰ Ibid, Tables 12-8 and 12-9.

¹¹ Ibid, Tables 12-10 and 12-11

¹² Ibid, Tables 12-10 and 12-11.

Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, [O-18-02](#)).

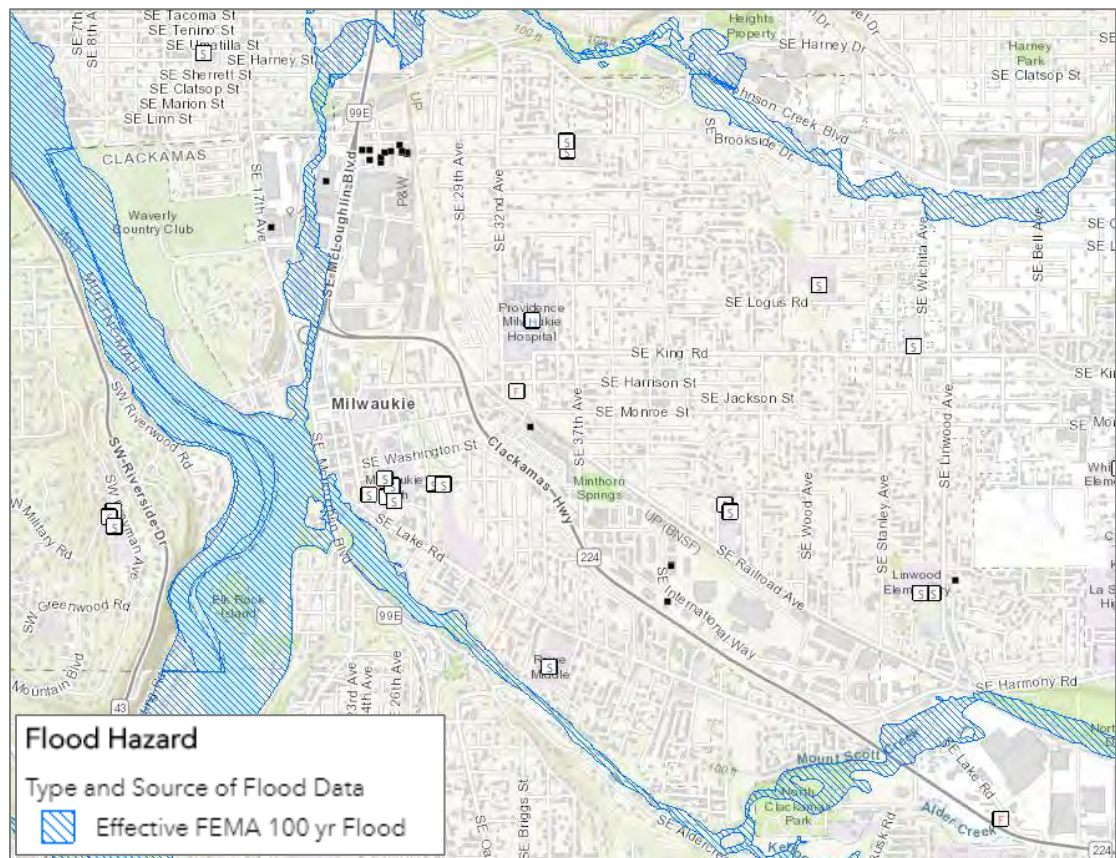
Please review Volume I, Section 2 for additional information on this hazard.

Flood

The HMAC determined that the city's probability for flood is **high** and that their vulnerability to flood is **high**. *The probability rating did not change, while the vulnerability rating increased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent, and probability of a potential event. Figure MA-4 illustrates the flood hazard area for Milwaukie.

Figure MA-4 Special Flood Hazard Area



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

Note: To view detail click the link above to access Oregon HazVu

For additional maps including the 1996 flood inundation area see the City's [Flood Hazard Map Viewer](#)

Portions of Milwaukie have areas of floodplain (special flood hazard areas, SFHA). These include Johnson Creek, Kellogg Creek, Mount Scott Creek, Minthorn Creek, Spring Creek, and Willamette River. The Federal Emergency Management Agency (FEMA) regulatory floodplains for each of these rivers are depicted as relatively narrow areas on each side of the channels. On the Willamette River, the floodway is generally confined within high

stream banks. The FEMA 100-year map shows that 1.3 miles of the transportation network could be affected in a flood.

Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage, and economic loss from business interruption. It is important for the city to be aware of flooding impacts and assess its level of risk.

The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners, and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of Milwaukie outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage. City staff has identified sites where local drainage facilities are taxed during high flows, especially where open ditches enter culverts or go underground into storm sewers and works to mitigate the stormwater flood risks in these areas (see the Milwaukie's [Stormwater Master Plan](#) for more information).

The speed of onset, lack of warning and depth of flooding make dam failures a potentially deadly, albeit unlikely, occurrence. There are four major dams upstream of Milwaukie on the Clackamas River: North Fork, Faraday, River Mill and Timothy. These are operated by Portland General Electric and subject to the dam safety and warning requirements of the Federal Energy Regulatory Commission. According to the Clackamas County Emergency Operations Plan, areas of Milwaukie bordering on the Willamette River in the vicinity of its confluence with the Clackamas River would be inundated by a wall of water 60-80 feet high in approximately an hour and a half should the North Fork dam fail under a "probable maximum flood" (a worst-case scenario where all four dams fail). In December 2015, Milwaukie had to evacuate approximately 50 people from their homes as Mount Scott and Johnson Creek overflowed.

The largest flooding event to affect Milwaukie was the February 1996 flood. The high-water level meant tributaries could not drain into the Tualatin and Willamette rivers, which led to localized flooding on several backed-up creeks.

The extent of flooding hazards in Milwaukie primarily depends on climate and precipitation levels. Additionally, withdrawals for irrigation and drinking water, as well as stream and wetland modifications or vegetation removal can influence water flow.

Vulnerability Assessment

Due to insufficient data and resources, Milwaukie is currently unable to perform a quantitative risk assessment for this hazard. However, the city completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

The areas around Johnson Creek (impacts industrial area), Kellogg Creek, Mount Scott Creek (impact North Clackamas Park, senior center and multiple residences north of Highway 224 and south of Lake Road), and Willamette River are particularly vulnerable to flooding. Additionally, proposed lots on 19th Avenue may be vulnerable to Willamette River flooding. Johnson Creek runs through the downtown mixed-use and North Milwaukie Industrial/Innovation Area. Kellogg Creek mostly affects residential areas in the chance of flooding. The downtown area is located near the Willamette River due to the historic use of the river for economic reasons.

Additionally, a great deal of infrastructure (bridges, water lines, sewage pump stations, etc.) is in the floodplain. Infrastructure exposed to flooding includes, but is not limited to, Highway 224, Lake Road, McLoughlin Boulevard, and the North Milwaukie Innovative Area. Disruption to this infrastructure could result in transportation issues, power outages, sewage back-up, and affect overall community and environmental health.

National Flood Insurance Program (NFIP)

FEMA’s Flood Insurance Study (FIS), and Flood Insurance Rate Maps (FIRMs) are effective as of January 18, 2019 and June 17, 2008. Table MA-7 shows that as of July 2018, Milwaukie has 60 National Flood Insurance Program (NFIP) policies in force. Of those, 50 are for properties that were constructed before the initial FIRMs. The last Community Assistance Visit (CAV) for Milwaukie was on June 26, 2019 (including an audit of Title 18: Flood Hazard Areas). Milwaukie does not participate in the Community Rating System (CRS).

Table MA-7 Flood Insurance Detail

	Clackamas County	Milwaukie
Effective FIRM and FIS	6/17/2008	1/18/2019
Initial FIRM Date	-	6/18/1980
Total Policies	1,957	60
Pre-FIRM Policies	1,086	50
Policies by Building Type		
Single Family	1,761	31
2 to 4 Family	30	4
Other Residential	58	16
Non-Residential	9	1
Minus Rated A Zone	123	2
Insurance in Force	\$541,833,400	\$18,107,600
Total Paid Claims	590	48
Pre-FIRM Claims Paid	450	41
Substantial Damage Claims	83	5
Total Paid Amount	\$20,830,662	\$2,228,684
Repetitive Loss Structures	51	6
Severe Repetitive Loss Properties	4	0
CRS Class Rating	-	NP
Last Community Assistance Visit	-	6/26/2019

Source: Information compiled by Department of Land Conservation, and Development, July 2018.
 Note: The portion of the cities of Portland and Tualatin that are within Clackamas County are not included in this table. NP = Not Participating

The table shows that most flood insurance policies are for residential structures, primarily single-family homes. There has been a total of 48 paid claims for \$18,107,600. The city complies with the NFIP through enforcement of their flood damage prevention ordinance (Title 18) and their floodplain management program.

Risk Analysis - Repetitive Loss Properties:

Milwaukie works to mitigate problems regarding flood issues as they arise. Some areas in the city are more susceptible to flooding issues and have incurred repetitive losses. The Community Repetitive Loss record for Milwaukie identifies six (6) Repetitive Loss (RL) Properties¹³, none are considered Severe Repetitive Loss (SRL) Properties¹⁴. RL and SRL properties are troublesome because they continue to expose lives and valuable property to the flooding hazard. Local governments as well as federal agencies such as FEMA attempt to address losses through floodplain insurance and attempts to remove the risk from repetitive loss of properties through projects, such as acquiring land and improvements, relocating homes or elevating structures. Continued repetitive loss claims from flood events lead to an increased amount of damage caused by floods, higher insurance rates, and contribute to the rising cost of taxpayer funded disaster relief for flood victims.

Table MA-8 provides information on the identified RL and SRL properties. There have been 17 paid RL claims totaling \$612,550. Of these properties, none (0) are considered SRL. Three (3) of the RL properties are not insured as of July 2018. For additional detail and a map of their general location see Volume I, Section 2 and Figure 2-13.

Table MA-8 Repetitive Loss and Severe Repetitive Loss Properties Detail

RL or SRL Property	Location	Currently Insured?	Flood Zone	Occupancy	Historic Building	Total Paid Claims	Total Paid Amount
RL	Property 1	NO	A19	Non-residential	No	2	\$396,804
RL	Property 3	YES	X	Single Family	No	2	\$65,060
RL	Property 5	NO	X	Single Family	No	2	\$5,058
RL	Property 14	NO	B	Single Family	No	6	\$100,814
RL	Property 15	YES	C	2-4 Family	No	3	\$27,463
RL	Property 16	YES	C	2-4 Family	No	2	\$17,351
Total						17	\$612,550

Source: Department of Land Conservation and Development, July 2018.

Notes: RL – Repetitive Loss Property, SRL – Severe Repetitive Loss Property

For location details see Table 2-15 in the Clackamas NHMP Volume I, Section 2.

Mitigation Activities

Milwaukie employs several mitigation strategies to reduce the city’s risk to flood events, including mapping flood-prone areas by address. The city’s priority is to mitigate residences

¹³ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

¹⁴ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP, and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000, and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

located within the floodway (see FL #1). The city development code includes policies and regulations for flood prone areas including, Natural Resources Overlay Zone (Chapter 19.402, [Natural Resources Administrative Map](#)), Flood Hazard Regulations (Title 18 – Flood Hazard Areas (includes the SFHA and the 1996 flood inundation area; [Flood Hazard Map Viewer](#)), and Willamette Greenway Zone (Chapter 19.401). Milwaukie regularly inspects and maintains the stormwater facilities. Catch basins are routinely cleaned and inspected and a regular street sweeping program reduces the amount of debris and contaminants entering the stormwater system. The city maintains a [Stormwater Master Plan](#) and has been planning various projects to restore Kellogg Creek. These projects would include building a bridge over the creek and downtown revitalization.

To improve stormwater management, Milwaukie lined the interiors of all pipes along the 18th Avenue infiltration line. This mitigation project minimizes the amount of groundwater that infiltrates into sewer lines and helps reduce the overall amount of water going into the wastewater treatment plant, thus reducing the chance of overflow of the sewer system. Additionally, a severe repetitive loss property on Rusk Road was purchased and demolished using FEMA Flood Mitigation Assistance funding in 2018 (grant covered approximately \$315,000 for the purchase of the property, additional funds were allocated for staff hours, title report, due diligence reports, and demolition contract).

In 2006 Clackamas County Water Environment Services partnered with eight community groups to restore the Three Creeks area – including Mount Scott, a tributary to Kellogg Creek and the Willamette. The group reshaped the stream channel to make it more natural; removed invasive species; planted thousands of native plants to stabilize; and put in lard wood and boulders to stabilize the channel and provide habitat for fish. The groups also removed trash and transient camps that polluted the streams during floods.

Projects completed by the Johnson Creek Watershed Council:

- Tree Plantings along Johnson Creek.
- Storm water detention near Milport Road.

In 2018, the city completed its [Urban Forest Plan](#) that includes information on tree planting strategies.

Please review Volume I, Section 2 for additional information on this hazard.

Landslide

The HMAC determined that the city's probability for landslide is **low** and that their vulnerability to landslide is **low**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Although catastrophic landslides have not occurred in Milwaukie, steep slopes do exist along the banks of the Willamette River and Kellogg Creek.

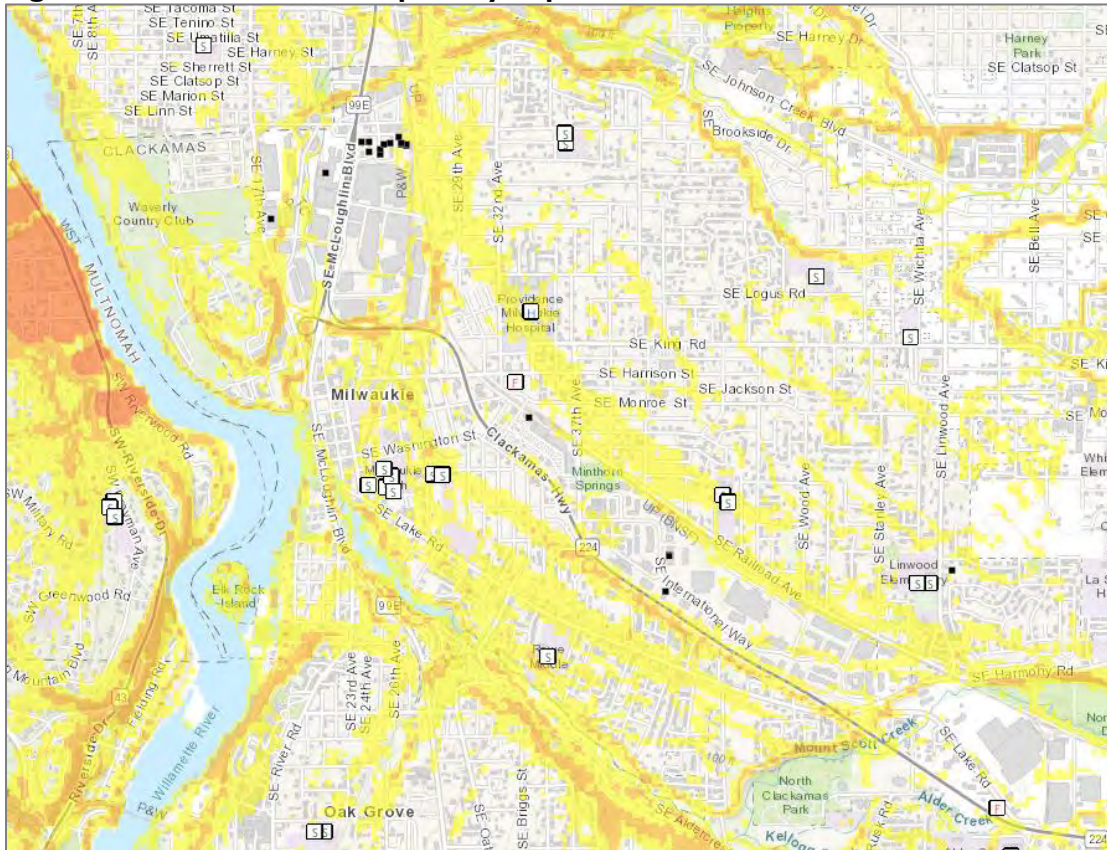
Landslide susceptibility exposure for Milwaukie is shown in Figure MA-5.

Most of Milwaukie demonstrates a low to moderate landslide susceptibility exposure. Approximately 4% of Milwaukie has very high or high, and approximately 31% moderate,

landslide susceptibility exposure.¹⁵ However, most of the areas that are identified to exhibit dangerous potential rapidly moving landslides are vacant and often preserved in wooded and dedicated open space.

Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard, and assets.

Figure MA-5 Landslide Susceptibility Exposure



Low	Landsliding unlikely. Areas classified as Landslide Density = Low (less than 7%) and areas classified as Slopes Prone to Landsliding = Low.
Moderate	Landsliding possible. Areas classified as Landslide Density = Low to Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = Moderate OR areas classified as Landslide Density = Moderate (7%-17%) and areas classified as Slopes Prone to Landsliding = Low.
High	Landsliding likely. Areas classified as Landslide Density = High (greater than 17%) and areas classified as Slopes Prone to Landsliding = Low and Moderate OR areas classified as Landslide Density = Low and Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = High.
Very High	Existing landslides Landslide Density and Slopes Prone to Landsliding data were not considered in this category. Note: the quality of landslide inventory (existing landslides) mapping varies across the state.

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

Note: To view detail click the link above to access Oregon HazVu

¹⁵ DOGAMI. [Open-File Report, O-16-02](#), *Landslide Susceptibility Overview Map of Oregon* (2016)

Vulnerability Assessment

Due to insufficient data and resources, Milwaukie is currently unable to perform a quantitative risk assessment for this hazard. However, DOGAMI completed a statewide landslide susceptibility assessment in 2016 ([O-16-02](#)), general findings from that report are provided above and within Figure MA-5. Additionally, the city completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

Across the Willamette River, in the Riverdale area, there is a large area of land at a very high risk of landslide. This could result in potential flooding along Milwaukie's banks in the event of a landslide that disrupts the flow of the Willamette River. Within the city, parts of Highway 224, SE Lake Rd and SE Johnson Creek Blvd are located within the areas of high landslide susceptibility. These important arterials that help connect Milwaukie. The Milwaukie Heights area, which includes mostly low density residential and open space areas, is also vulnerable. This exposure means that large scale and simultaneous landslides triggered by an earthquake could substantially disrupt city operations buildings, fire stations and key pieces of infrastructure (bridges, sewage pump stations, water reservoirs) that would hinder the ability of the city to respond to emergency situations created by such an event.

As a result, it will be important for the city to pursue opportunities for retrofitting and mitigating important structures and infrastructure, such that said facilities can withstand and survive landslides, particularly simultaneous landslides generated by an earthquake. Business continuity planning shall also be an important factor, given the number of economic centers and employment facilities that are threatened by the landslide hazard.

Potential landslide-related impacts are adequately described within Volume I, Section 2, and include infrastructure damages, economic impacts (due to isolation, and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides, and debris flows can potentially occur during any winter, and thoroughfares beyond city limits are susceptible to obstruction as well.

The most common type of landslides are slides caused by erosion. Slides move in contact with the underlying surface, are generally slow moving, and can be deep. Rainfall-initiated landslides tend to be smaller; while earthquake induced landslides may be quite large. All soil types can be affected by natural landslide triggering conditions.

Mitigation Activities

Milwaukie works to mitigate future landslide hazards. The city development code includes several policies and regulations to protect slopes including Erosion Control (Chapter 16.28), Willamette Greenway Zone Overlay (Chapter 19.401), and limitations of permitted development within slopes greater than 25%.

Please review Volume I, Section 2 for additional information on this hazard.

Severe Weather

Severe weather can account for a variety of intense, and potentially damaging hazard events. These events include extreme heat, windstorms, and winter storms. The following section describes the unique probability, and vulnerability of each identified weather hazard.

Extreme Heat

The HMAC determined that Milwaukie's probability for extreme heat events is **moderate** and that their vulnerability is **high**. *The probability and vulnerability ratings increased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the county is likely to affect the city as well.

A severe heat episode or "heat wave" occurs about every two to three years, and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days with temperatures greater than or equal to 90-degrees, or 100-degrees, Fahrenheit. On average, the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit, and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

Milwaukie has not experienced any life-threatening consequences from the few historical extreme heat events, although changes in climate indicate that the area should expect to see more extreme heat events.

Please review Volume I, Section 2 for additional information on this hazard.

Windstorm

The HMAC determined that Milwaukie's probability for windstorm is **moderate** and that their vulnerability to windstorm is **low**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent, and probability of a potential event within the region. Because windstorms typically occur during winter months, they are sometimes accompanied by flooding and winter storms (ice, freezing rain, and very rarely, snow). Other severe weather events that may accompany windstorms, including thunderstorms, hail, lightning strikes, and tornadoes are generally negligible for Milwaukie.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation, and economic disruptions result as well.

Damage from high winds generally has resulted in downed utility lines, and trees usually limited to several localized areas. Electrical power can be out anywhere from a few hours to several days. Outdoor signs have also suffered damage. If the high winds are accompanied

by rain (which they often are), blowing leaves, and debris clog drainage-ways, which, in turn, may cause localized urban flooding.

Please review Volume I, Section 2 for additional information on this hazard.

Winter Storm (Snow/Ice)

The HMAC determined that the city's probability for winter storm is **high** and that their vulnerability to winter storm is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent, and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting Milwaukie typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

Most winter storms typically do not cause significant damage, they are frequent, and have the potential to impact economic activity. Road closures due to winter weather are an uncommon occurrence but can interrupt commuter and commercial traffic.

Vulnerability Assessment

Due to insufficient data and resources, Milwaukie is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. However, the city completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

The areas of Milwaukie that are often most at risk to severe storms are residential areas on steeper slopes, where roads may be icy and, thus, difficult to climb and descend. Road corridors leading to residential areas with fuller tree canopies are susceptible to downed tree limbs, and those areas that are above 500 feet in elevation are particularly vulnerable. However, some weather systems are characterized by a temperature inversion, where the valley floor is colder than the nearby hills. Consequently, severe storms affect the entire city. In 2016 and 2017 the state of Oregon declared a state of emergency for severe storms. The city's plowing, sanding and de-icing removal plan is maintained by the public works department and includes provisions to place equipment on designated principal routes throughout Milwaukie ([Plowing and Sanding Routes Map](#)). Private property owners are also required to clear the sidewalks abutting their property of snow or ice within 24 hours after the snow has stopped falling. For more information see the city's Winter Weather Response Plan information [webpage](#) and their [Winter Weather Response Plan](#).

The major risk to property results from exposed utilities, especially power lines and water pipes that are damaged by wind, broken tree limbs and cold temperatures. Businesses also suffer economic losses when they must close as the result of the inclement weather and/or the loss of power, which, in turn, disrupts the local supply chain of goods and services.

Periods of extended ice coverage hinder emergency response services and limit the mobility of residents, which could result in serious life safety issues.

Residents and businesses that are in areas that exhibit the severe storm hazard face some risk of damage from severe storms. Severe weather events are expected to impact nearly all Milwaukie residents. In addition, critical infrastructure, economic centers, cultural or historic assets, environmental assets, and hazardous material sites are exposed to the severe weather hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Assets section.

The exposure of these facilities and infrastructure means that severe weather events could substantially disrupt the operations of city government buildings and fire stations, impairing key city functions, while hindering the ability of emergency response personnel to respond to emergency situations that are created by a severe storm event.

All these facilities depend upon utility lines, roads and bridges to operate and perform their respective important functions within the city. Exposed utility and power lines are particularly vulnerable to damage from severe winter storms by wind, ice and snow. More hardened infrastructure, like bridges and roads, can sustain a severe winter storm, but during the event, they are often hazardous to traverse because of icy, windy and snowy conditions.

Consequently, severe weather (wind or winter storm) could substantially disrupt numerous key resources and facilities within Milwaukie through impediments to the transportation system and damage to the power grid. Among other things, these transportation problems and power failures disrupt business operations and educational facilities, resulting in economic losses and halting educational opportunities.

Power to hazardous material sites could also be disrupted. The sites themselves could be damaged or rendered inaccessible. In turn, these conditions could pose threats to the natural environment of Milwaukie and the health of its population, while disrupting the availability of gasoline for vehicle transport and furthering economic losses.

As a result, it will be important for the city to pursue opportunities for undergrounding utilities and retrofitting utility lines so that they may withstand cold weather conditions without freezing and bursting. Adhering to current building codes for weatherization of structures, as well as current engineering and fire codes that pertain to the steepness of new roads, are also key factors for the city to consider. Business continuity planning shall also be an important factor, given the number of economic centers and employment facilities that are threatened by the severe storm hazard.

Mitigation Activities

Mitigating severe weather can be difficult because storms affect all areas of the city, but Milwaukie has made progress to reduce the effects of storms. Milwaukie has a tree board to maintain a plan for the care of the trees as well as codes about where trees can be planted (Chapter 16.32). Most utilities are underground, and all new utilities are required to be undergrounded, but, in case of power outages, the city's critical facilities have back up power generation. Milwaukie also has a designated snow plow and sanding routes to help expedite snow removal ([Plowing and Sanding Routes Map](#)).

Please review Volume 1, Section 2 for additional information on this hazard.

Volcanic Event

The HMAC determined that Milwaukie's probability for a volcanic event is **low** and that their vulnerability to a volcanic event is **low**. *The probability did not change and the vulnerability rating decreased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of volcanic hazards, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the western portion of the County is likely to affect Milwaukie as well. Several volcanoes are located near Milwaukie, the closest of which are Mount Hood, Mount Adams, Mount Saint Helens, Mount Rainier and Three Sisters.

Vulnerability Assessment

Due to insufficient data and resources, Milwaukie is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard.

Due to Milwaukie's relative distance from volcanoes, the city is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Depending on wind patterns and which volcano erupts, however, the city may experience ashfall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city could experience a heavier coating of ash.

Mitigation Activities

The existing volcano hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Wildfire

The HMAC determined that Milwaukie's probability for wildfire is **low**, and that their vulnerability to wildfire is **low**. *These ratings did not change since the previous version of this NHMP addendum.*

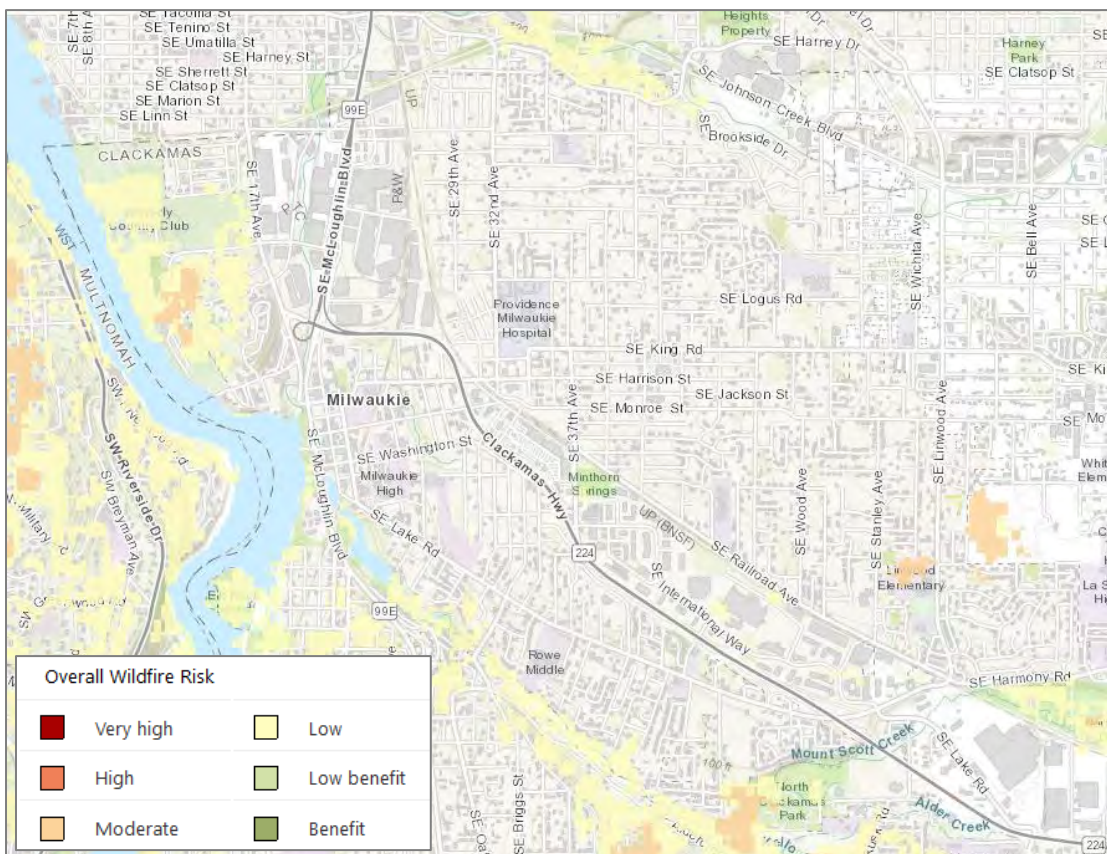
The [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) was completed in May 2018. The CWPP is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard: <https://www.clackamas.us/dm/CWPP.html>. Information specific to Milwaukie is found in the following chapter: [Chapter 10.3: Clackamas Fire District #1](#).

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions. Weather and urbanization conditions are primarily at cause for the hazard level. Milwaukie has not experienced a catastrophic wildfire within city limits. Clackamas Fire District #1 also provides services to other cities besides Milwaukie, including Oregon City, Happy Valley, Johnson City and many unincorporated areas within Clackamas County.

Clackamas County has two major physiographic regions—the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern Clackamas County. The Willamette River Valley, which includes Milwaukie, is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range has a relatively small population and is characterized by heavily forested slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to its dense forest land. Human caused fires are responsible for most fires in Clackamas County.

Milwaukie is highly urbanized and as such does not have much danger of wildfire within its boundaries. The city does have parks and neighborhoods surrounded by mature trees. Located on the edge of its southeastern boundary is the Three Creeks Park, which has heavy fuels adjacent to homes and infrastructure. Three Creeks Park is a designated Medium Priority Community at Risk (CARs).¹⁶ Figure MA-6 shows overall wildfire risk in Milwaukie.

Figure MA-6 Overall Wildfire Risk



Source: [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

¹⁶ Clackamas County Community Wildfire Protection Plan, *Clackamas Fire District #1* (2018), Table 10.13-1.

Most of the city has less severe (moderate or less) wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions.¹⁷ However, conditions vary widely and with local topography, fuels, and local weather (including wind) conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts.

Vulnerability Assessment

Due to insufficient data and resources, Milwaukie is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. However, the city completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

Milwaukie does not have much vulnerability to wildfire, though there is always the risk of fire destroying residential and commercial areas. Vegetation along roadways can be highly dangerous, as negligent motorists provide ignition sources by tossing cigarette butts out car windows. Because schools are generally located near parks and scenic areas, they can be threatened by wildfires.

The potential community impacts, and vulnerabilities described in Volume I, Section 2 are generally accurate for the city as well. Milwaukie's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. The city will update Milwaukie's wildfire risk assessment, if the fire plan presents better data during future updates (an action item is included to participate in future updates to the CWPP).

Property can be damaged or destroyed with one fire as structures, vegetation and other flammables easily merge to become unpredictable and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

Mitigation Activities

Milwaukie and Clackamas Fire District #1 (CFD#1) use several mitigation tools to reduce the city's risk to wildfires. CFD #1 provides emergency fire suppression, medical response and rescue services to the community. Mutual aid agreements with neighboring jurisdictions are also in place. Water supply and storage capacity in Milwaukie conforms with recommended fire flow requirements.

The city does not allow backyard burning due to requirements of DEQ. The CFD #1 provides outreach and education to the community on wildfire mitigation via news releases, posters,

¹⁷ [Oregon Wildfire Risk Explorer](#), date accessed March 29, 2019.

signage, website messages, safety exhibits at community events, and visits to schools, civic organizations and neighborhood associations.

CFD #1 serves the cities of Happy Valley, Johnson City, Milwaukie and Oregon City, as well as the unincorporated areas of Barton, Beaver Creek, Boring, Carus, Carver, Central Point, Clackamas, Clarkes, Damascus, Eagle Creek, Highland, Hillsview, Holcomb, Kelso, Jennings Lodge, Oak Grove, Redland, South End, Sunnyside, and Westwood. For more information on the fire district see their addendum.

Please review the [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#), Volume I, Section 2, and the Clackamas Fire District #1 Addendum in Volume II for additional information on this hazard.

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ATTACHMENT A: ACTION ITEM FORMS

ACTION ITEM FORMS

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* - Priority Action Item

Note: The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity.

Summary of Action Changes

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

Previous NHMP Actions: Completed

Multi-Hazard Action #1 (2012/13): “Improve vegetation management throughout the city” is considered complete since the city has an established program for vegetation management.

Landslide Action #1 (2012/13): “Reduce the vulnerability of property owners in landslide-prone areas” is considered complete since the city has an established program for steep slope development.

Wildfire Action #1 (2012/13): “Promote fire-resistant strategies for new and existing developments” is considered complete since the city has an established program for promoting fire resistant strategies through the development and building codes.

See 2019 status identified in each action for activities that have been completed since the previous plan.

Previous NHMP Actions: Removed

Multi-Hazard Action #8 (2012/13): “Improve the hazard assessment in the Milwaukie Natural Hazards Mitigation Plan” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Note: 2012/13 Actions MH #2, MH #3, MH#4, MH #5, MH #6, MH #7, and MH #9 were renumbered to 2019 Actions MH #1, MH #2, MH #3, MH #4, MH#5, MH #6, and MH #7 respectively.

New NHMP Actions (2019):

- Multi-Hazard #8
- Wildfire Action #1

See action item forms below for detail.

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 NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the County, participating cities, and special districts. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. The City addresses statewide planning goals and legislative requirements through its comprehensive plan, capital improvements plan, mandated standards and building codes. To the extent possible, the City 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 several 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 HMAAC but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and/or resources toward completion of the action items.

Internal partner organizations are departments within the City 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.

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:	
Ensure that there are adequate shelter facilities in hazard-free zones to serve Milwaukie residents.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018/19 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires that communities create partnerships with emergency response organizations and plan for the shelter and safety of their residents [201.6(c)(4)(ii)]. The city works with the Red Cross to get potential facilities inspected. Since 2009, a CERT Volunteer has worked to identify facilities that are adequate shelter sites for Milwaukie residents. There are currently seven facilities in Milwaukie that are Red Cross certified and trained shelter facilities: The Milwaukie Center (5440 SE Kellogg Creek Dr), Eagles Wings Ministries (10902 SE Garrett Dr), and Milwaukie Presbyterian Church (2416 SE Lake Rd). Outside the city are the Clackamas Park Friends Church (8120 SE Thiessen Rd, Oak Grove) and King of Kings Lutheran Church (5501 SE Thiessen Rd, Oak Grove) 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Identify and contact potential shelter sites to see if there is an interest in becoming a designated Red Cross shelter site; Maintain relationship with Red Cross to renew and maintain shelters in the city and develop sites as needed 			
Coordinating Organization:		Emergency Management	
Internal Partners:		External Partners:	
CFD #1, CERT Volunteer		American Red Cross	
Potential Funding Sources:		Estimated cost:	Timeline:
General Funds		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #2*

Proposed Action Item:		Alignment with Plan Goals:	
Improve network of communications during a disaster.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018/19 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The city successfully recruited and trained Amateur Radio Operators and identified their 800 MHz communication deficiencies, but funding is still needed to fix those deficiencies. The school district now posts emergency notices on their website. The city now has reverse 9-1-1 capabilities and two variable message sign trailers for use communications in a disaster. The Beacon box program provides communication from neighborhoods to the EOC during a disaster. There are 4 boxes throughout the city that have radios that CERT members can communicate with the EOC during an emergency. Milwaukie CERT has 3-4 ham operators that can help if needed. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Address 800 MHz communication deficiencies, if any arise; Work with the Oregon office of emergency management (OEM) and the Regional Disaster Preparedness Organization (RDPO) to resolve 800 MHz communication inoperability; Improve communication between school officials and parents by updating school emergency contact information for parents/children every 3 months; Supply schools with communication equipment necessary for emergency situations; Post bulletins on the internet for school emergency info, community bulletin board on cable, etc.; Partner with REM tech and REG on the Emergency Alert System (EAS); and Educate citizens and other agencies within the Milwaukie on use of the #ClackCo Public Alerts. Inform residents about the County's Emergency Notification System (CCENS) Work to tie-in or interface with both #ClackCo Public Alerts and CCENS to help with redundancy 			
Coordinating Organization:		Information Systems Technology	
Internal Partners:		External Partners:	
Public Works, CERT		School District, OEM, RDPO	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund		Low to Medium	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High		

* - High Priority Action Item

Multi-Hazard #3*

Proposed Action Item:		Alignment with Plan Goals:	
Increase outreach and education for hazard awareness and natural disaster preparedness, especially for low-income, elderly, non-English speaking, and other vulnerable populations.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan; Policy 7.2.5			
2018/19 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires that communities communicate with the public after the hazard plan is updated. [201.6(c)(4)(ii)]. Hazard maps were made available to the public via the city's website. Clackamas Fire District #1 held disaster preparedness training in schools, senior centers and to city employees. The city has engaged in a broad effort to educate the public about Emergency Preparedness. A city webpage was dedicated to the topic, as well as efforts to coordinate a monthly speaker's series on emergency preparation with topics ranging from preparing for earthquakes to community resiliency. Citizens and neighborhood association members are encouraged to become trained through CERT. Two shelters have become Red Cross certified, The American Legion and Eagles Wings Ministries. Emergency Preparedness tips are sent through the city's newsletter, The Pilot, which goes to every address in the city of Milwaukie. Emergency Preparedness tips are provided at each of the seven neighborhood associate meetings. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Disseminate hazard related information to the public; Translate outreach materials into Spanish and provide translation services at public meetings. Identify property owners in the hazard zones, and conduct a target mailing to disseminate hazard information; Conduct public education as hazard seasons approach; Target neighborhood associations for public education and outreach; Add emergency preparedness and response curriculum to school programs; and Develop public education flyers as billing inserts. 			
Coordinating Organization:		Emergency Management	
Internal Partners:		External Partners:	
Public Works, Community Services, CFD#1, CERT		OEM, FEMA	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High		

* - High Priority Action Item

Multi-Hazard #4

Proposed Action Item:		Alignment with Plan Goals:	
Maintain and promote CERT program activity in the area and recruit new members for training.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018/19 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The City maintains regular CERT trainings for residents and city employees. As of 2019, there are currently 34 residents who are trained as CERT responders. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Provide information about the CERT program to Milwaukie residents through local publications, neighborhood organizations, churches, etc.; Identify needs of local CERT programs and obtain funding to purchase CERT supplies; Encourage neighborhood associations to sponsor CERT teams; Create CERT teams of city employees. 			
Coordinating Organization:		CFD#1	
Internal Partners:		External Partners:	
Emergency Management, CERT		County EOC	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #5

Proposed Action Item:		Alignment with Plan Goals:	
Maintain and enhance strategies for debris management for all hazards.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Development Code, Zoning Ordinance, Stormwater Master Plan, Disaster Debris Management Plan			
2018/19 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)] • A partnership for a debris removal plan was developed with Metro. • Disaster Debris Management Plan last updated in August 2018/19. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Create an inventory of equipment needed for each hazard; • Develop agreements with other jurisdictions, businesses, and tree service outfits to share equipment and manage debris during disasters. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Emergency Management		Metro, Oregon Department of Transportation, Department of Environmental Quality, USACE, Clackamas County Disaster Management	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #6

Proposed Action Item:		Alignment with Plan Goals:	
Improve and obtain resources and equipment essential for responding to and recovering from disasters.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Stormwater Mater Plan			
2018/19 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii) Three drinking water bladders were obtained from UASI for the Metro area to use. Boring Water District obtained a generator which Milwaukie can request to use through mutual aid agreements. The city now owns a portable 250kw generator for the Lava Drive pump station. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Harden infrastructure Contact local facilities that have large trucks that could serve as water tenders in emergency situations, or purchase water tenders for the city; Partner with national guard, local businesses, contractors and developers; Obtain funding to purchase one fixed generator for the Lava Drive pump station; and Obtain funding to purchase one storage trailer for emergency supplies. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Emergency Management			
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #7*

Proposed Action Item:		Alignment with Plan Goals:	
Integrate the goals and action items from the Milwaukie Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Development Code, Zoning Ordinance			
2018/19 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating natural hazards plans into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community. A Spring Park Master Plan was adopted which called for better vegetation management in the park. New codes were adopted to reflect EOC changes and improvements. City is in the process of updating their Goal 7: Natural Hazards element of their comprehensive plan (<i>expected December 2019</i>), which proposes stronger floodplain protections. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Use the mitigation plan to help the City's Comprehensive Land Use Plan meet 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; Use zoning codes to regulate development in hazard-prone areas; Integrate the city's mitigation actions into the current emergency operations plan and capital improvement plans (where appropriate); Partner with other organizations and agencies with similar goals to promote building codes that are more disaster resistant at the state level; Use citizen input for the creation of appropriate ordinances; and Use the natural hazard mitigation planning to learn how to better integrate the NHMP into existing documents and programs. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Engineering		Department of Land Conservation and Development, Department of Geology and Mineral Industries, Oregon Department of Transportation, Department of Environmental Quality	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, DLCDC Technical Assistance Grant		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High		

* - High Priority Action Item

Multi-Hazard #8*

Proposed Action Item:		Alignment with Plan Goals:	
Coordinate natural hazard related climate change action items through the Milwaukie Community Climate Action Plan .		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Milwaukie Community Climate Change Action Plan			
2018/19 Status/Rationale for Proposed Action Item:			
The Climate Change action items provide direction on specific activities that the City and residents in Milwaukie can take to reduce the impacts of climate change.			
Ideas for Implementation:			
Implement relevant mitigation strategies identified in the Climate Action Plan related to the following topic areas: <ul style="list-style-type: none"> • Building Energy and Efficiency • Vehicles and Fuels • Land Use and Transportation Planning • Materials use, purchasing, and recovery • Natural resources • Public health and emergency preparedness 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Emergency Management, Planning, Community Services, CFD#1		Portland General Electric, NW Natural, Energy Trust of Oregon, Clackamas Water Environment Services	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New action item		
Priority:	High		

* - High Priority Action Item

Drought #1

Proposed Action Item:		Alignment with Plan Goals:	
Develop public brochures to raise awareness about drought hazards and mitigation actions residents can take to reduce the impact of drought.		Protect Life and Property; Encourage Partnerships and Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan			
2018/19 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. The continued education of the public to different hazards is important for communities to do and helps create more resilient communities. Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Meet monthly with neighborhood associations to raise awareness and explain the threat of drought; Write articles in the city newsletter, The Pilot, explaining drought hazards and mitigation activities; Utilize the website to post information regarding drought; and Have a booth at the Farmer's Market from May-November, providing information to the public about the dangers of drought and mitigation activities that residents can take. 			
Coordinating Organization:		Neighborhood Services	
Internal Partners:		External Partners:	
Emergency Management			
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Earthquake #1*

Proposed Action Item:		Alignment with Plan Goals:	
Conduct seismic evaluations on identified critical and essential facilities and infrastructure and implement appropriate structural and non-structural mitigation strategies.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Capital Improvement Project Plan, Stormwater Master Plan, Comprehensive Plan			
2018/19 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for earthquakes to cause damage can assist a community in mitigating its overall risk to earthquakes. Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. Refer to risk assessment, and DOGAMI's rapid visual assessment scores Seismic assessment of Public Safety building completed in 2018/19. The Police Department is in the planning stages of retrofitting and is waiting on funding. One school has been retrofitted, with the Milwaukie High School's retrofit expected to be completed in 2021. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Obtain funding to perform seismic evaluations; Conduct seismic evaluations on identified community assets (including shelters) for implementing appropriate structural and non-structural mitigation strategies; Prioritize seismic upgrades based on criticality of need and population served; Seismically retrofit critical government facilities to guarantee continuous operation during and after a natural disaster; Partner with appropriate organizations to implement seismic upgrades; and Create damage assessment procedures. 			
Coordinating Organization:		Facilities	
Internal Partners:		External Partners:	
Building		DOGAMI, School District, Clackamas Fire District #1	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund, Seismic Rehabilitation Grant Program, Hazard Mitigation Assistance Grants, Utility Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High		

* - High Priority Action Item

Flood #1*

Proposed Action Item:		Alignment with Plan Goals:	
Evaluate alternatives for reducing the flooding hazard for properties along Kellogg Creek, Johnson Creek, Mount Scott Creek area, and the Willamette River.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Flood Ordinance; Stormwater Master Plan; Comprehensive Plan			
2018/19 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. • Kellogg Creek is in the planning stage for different restoration projects. • A severe repetitive loss property on Rusk Road was purchased and demolished using FEMA Flood Mitigation Assistance funding in 2018/19; (grant covered approximately \$315,000 for the purchase of the property, additional funds were allocated for staff hours, title report, due diligence reports, and demolition contract). 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Prioritize mitigation of residences located within the floodway. • Identify repetitive flood loss properties (see NFIP section in this addendum) and discuss mitigation strategies with property owners. • Regulate development to a higher standard • Limit cut and fill 			
Coordinating Organization:		Engineering	
Internal Partners:		External Partners:	
Planning, Public Works		Department of Land Conservation and Development; Association of State Floodplain Managers	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, HMGP, FMA, PDM		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	High		

* - High Priority Action Item

Flood #2

Proposed Action Item:		Alignment with Plan Goals:	
Ensure continued compliance with the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Flood Ordinance; Zoning Code, FEMA FIRMs, Comprehensive Plan			
2018/19 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The National Flood Insurance Program provides communities with federally backed flood insurance to homeowners, renters, and business owners, if communities develop and enforce adequate floodplain management ordinances. The benefits of adopting NFIP standards for communities are a reduced level of flood damage in the community and stronger buildings that can withstand floods. The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will help reduce the level of flood damage to new and existing buildings in communities while providing homeowners, renters and business owners additional flood insurance protection. All new development must comply with Title 18 of the City's Municipal Code prior issuance of permits. When projects begin prior to obtaining permits, a stop work order is placed on the property and remains until the project can be reviewed for compliance. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Assess the floodplain ordinances to ensure they reflect current flood hazards and situations and meet or exceed NFIP requirements. Partner with FEMA/DOGAMI to develop and obtain better flood maps. Mitigate areas that are prone to flooding and/or have the potential to flood. Recommend revisions to requirements for development within the floodplain where appropriate. Consider participation in the National Flood Insurance Program's Community Rating System; Community Assistance Visits (CAV) are scheduled visits to communities participating in the NFIP for: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. Actively participate with DLCD and FEMA during Community Assistance Visits. 			
Coordinating Organization:		Engineering	
Internal Partners:		External Partners:	
Planning, Building		Department of Land Conservation and Development; Association of State Floodplain Managers; FEMA	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to Medium	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Severe Weather #1

Proposed Action Item:		Alignment with Plan Goals:	
Bury vulnerable critical infrastructure, such as power lines, to lessen potential failures during severe weather.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Stormwater Master Plan; Development Code			
2018/19 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to disrupt utility services can assist a community in mitigating its overall risk to wind and winter storms. A FEMA grant was used to evaluate the trees along designated routes. Current development standards for downtown areas and new subdivisions require undergrounding. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Partner with PGE to obtain funding to bury power lines for critical facilities within the city; Partner with PGE to continue hazardous tree inventory and mitigation programs; and Partner with major businesses and employers to encourage undergrounding of power lines. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Engineering		Clackamas County Water Environment Services, METRO, Department of Environmental Quality, Department of Land Conservation and Development, Department of State Lands	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

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; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships and Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Clackamas County Community Wildfire Protection Plan (2018/19)			
2018/19 Status/Rationale for Proposed Action Item:			
The wildfire mitigation action items provide direction on specific activities that organizations and residents in Milwaukie can take to reduce wildfire hazards. CCWPP updated in 2018/19.			
Ideas for Implementation: CCWPP Identified Focus Areas and Priority Actions			
<u>Wildfire Risk Assessment (Ch. 4):</u>			
<ol style="list-style-type: none"> Maintain and update the Fuels Reduction (FR) and Communities at Risk (CAR) maps and databases. Continue to track structure vulnerability data throughout the County through structural triage assessments. Update the Overall Wildfire Risk Assessment as new data becomes available. 			
<u>Hazardous Fuels Reduction and Biomass Utilization (Ch. 5):</u>			
<ol style="list-style-type: none"> Develop and maintain an inventory of potential and successful FR projects by meeting with parks and natural lands managers quarterly. Continue securing funding to implement projects/hire seasonal ODF staff. 			
<u>Emergency Operations (Ch. 6):</u>			
<ol style="list-style-type: none"> Develop and FDB Communications Works Group. Conduct a Conflagration Exercise. 			
<u>Education and Community Outreach (Ch. 7):</u>			
<ol style="list-style-type: none"> Develop Firewise toolkit for CAR's. Create incentives for fuels reduction. Update and distribute the Burn Permitting and Fire Restrictions Brochure. Continue to improve address signage throughout the County. 			
<u>Structural Ignitability Policies and Programs (Ch. 8):</u>			
<ul style="list-style-type: none"> Identify a DTD representative for the WFEPCC. Improve coordination with Rural Fire Agencies. Integrate WU into Plan Map and include a public outreach strategy. 			
Coordinating Organization:		Clackamas Fire District #1	
Internal Partners:		External Partners:	
Public Works, Building, Planning		Clackamas Fire Defense Board, ODF, U.S. Forest Service, public land management agencies	
Potential Funding Sources:		Estimated cost:	Timeline:
ODF, operating budgets		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	High		

* - High Priority Action Item

ATTACHMENT B: PUBLIC INVOLVEMENT SUMMARY

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

To provide the public information regarding the draft NHMP addendum, and provide an opportunity for comment, an announcement (see text below) was announced on the city's website and an email contact was provided for public comment. The opportunity to review the draft plan and to comment was left open from August 5 through September 3, 2019.

During the public review period there were no comments provided by the public.



Press Release

HOME » Feedback Sought For Natural Hazard Mitigation Plan

Feedback Sought for Natural Hazard Mitigation Plan



The city is in the process of updating its Natural Hazard Mitigation Plan and seeking feedback from the community before it is finalized.

This update is being done in cooperation with the Institute for Policy Research and Engagement's Oregon Partnership for Disaster Resilience program at the University of Oregon and the Oregon Military Department's Office of Emergency Management using funds from the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation Grant Program.

By readopting the plan, Milwaukie will maintain its eligibility to apply for federal funding for natural hazard mitigation projects. The local planning process includes a range of representatives from city and county governments and emergency management personnel, along with outreach to the community.


A natural hazard mitigation plan provides communities with a set of goals, action items and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides a number of benefits, including reduced loss of life, property, essential services, critical facilities, and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

A PDF of the draft Milwaukie Natural Hazard Mitigation Plan is available below. Input will be collected until Tuesday, Aug. 20. To provide feedback and submit comments, email Steve Hoffeditz, emergency operations manager, at hoffeditzs@milwaukieoregon.gov.

A PDF of the draft Milwaukie Natural Hazard Mitigation Plan is available below. Input will be collected until Tuesday, Aug. 20. To provide feedback and submit comments, email Steve Hoffeditz, emergency operations manager, at hoffeditzs@milwaukieoregon.gov.

For questions about the Natural Hazard Mitigation Plan or the update process in general, contact Michael Howard, assistant program director for the Oregon Partnership for Disaster Resilience, at 541.346.8413, mrhoward@uoregon.edu or Steve Hoffeditz at 503.786.7456, hoffeditzs@milwaukieoregon.gov.

SUPPORTING DOCUMENTS

 [Draft Natural Hazard Mitigation Plan](#) (3 MB)

SHARE     

ATTACHMENT C: MAPS




The following pages include City of Milwaukie Critical and Essential Assets and Flood Hazard Maps.

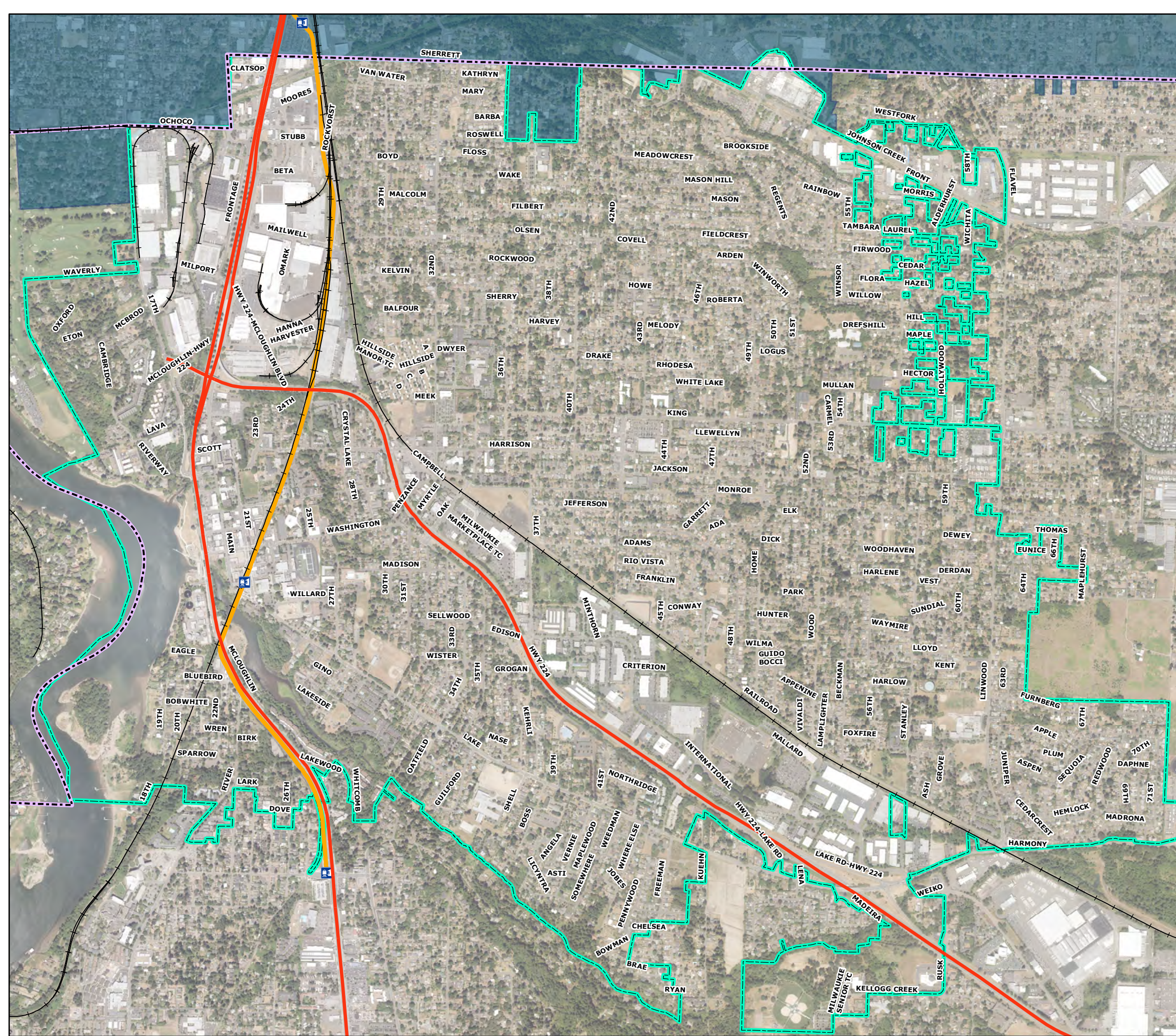
Natural Hazards Mitigation Plan - Assets & FEMA Flood Hazard Zones

Transportation Infrastructure

-  Highway
-  RR Track
-  MAX Light Rail (Orange Line)
-  Light Rail Stop

Jurisdictional Boundaries

-  Clackamas County
-  City of Milwaukie
-  City of Portland

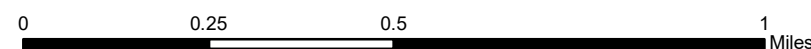


Data Sources: City of Milwaukie GIS, Clackamas County GIS, Metro Data Resource Center

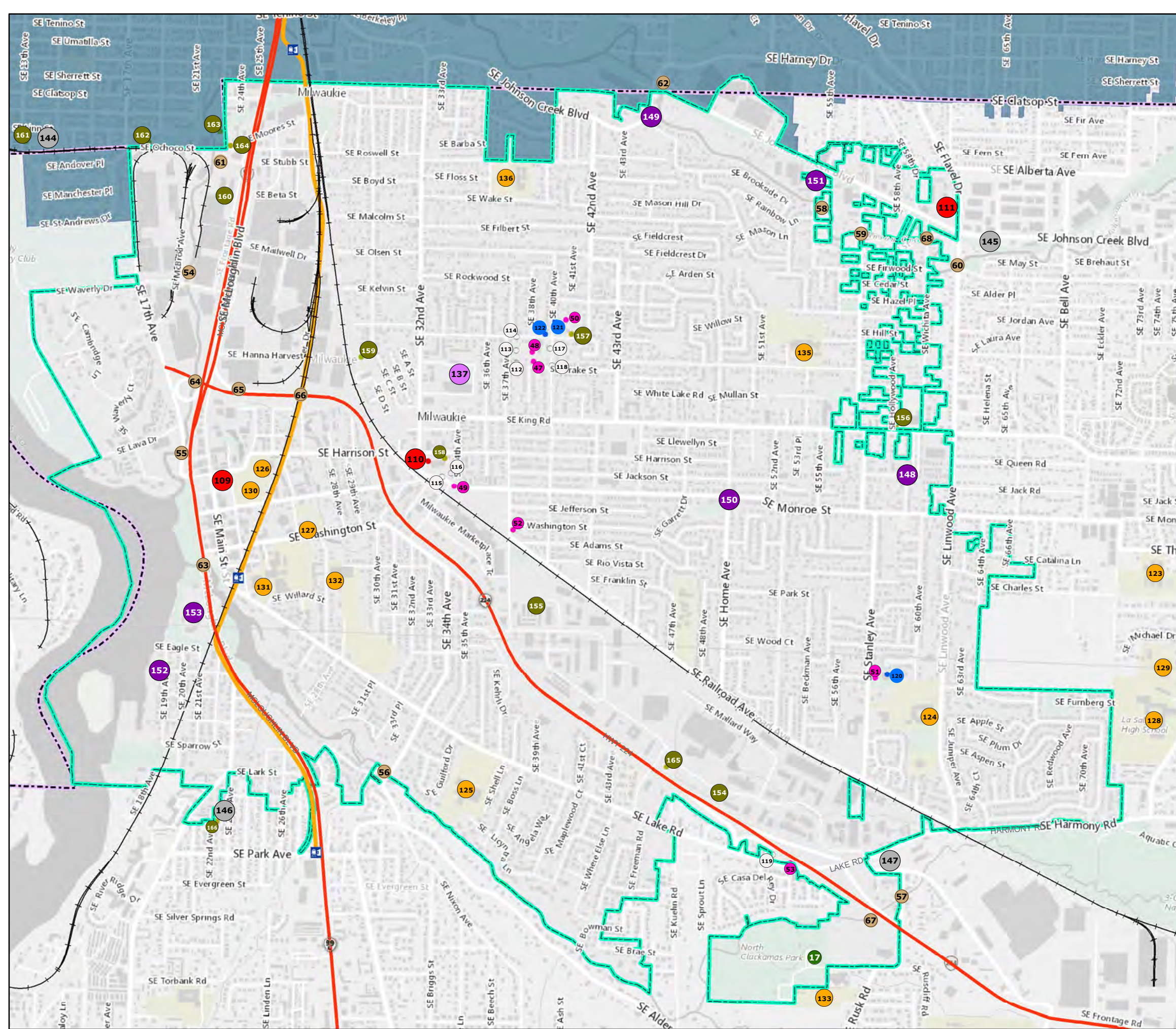
Date: Tuesday, July 23, 2019

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GIS Coordinator - City of Milwaukie
6101 SE Johnson Creek Blvd. Milwaukie, OR 97206 (503) 786-7687



Natural Hazards Mitigation Plan - Critical & Essential Assets



Transportation Infrastructure

- Highway
- RR Track
- MAX Light Rail (Orange Line)
- Light Rail Stop

Jurisdictional Boundaries

- Clackamas County
- City of Milwaukie
- City of Portland

Parks

- 17. The Milwaukie Center

Groundwater

- 47. City of Milwaukie Well No. 2
- 48. City of Milwaukie Well No. 3
- 49. City of Milwaukie Well No. 4
- 50. City of Milwaukie Well No. 5
- 51. City of Milwaukie Well No. 6
- 52. City of Milwaukie Well No. 7
- 53. City of Milwaukie Well No. 8

Bridges

- 54. Bridge over Johnson Creek (Milport Rd.)
- 55. Bridge over Johnson Creek (17th Ave.)
- 56. Bridge over Kellogg Creek (Oatfield Rd.)
- 57. Bridge over Mt. Scott Creek (Rusk Rd.)
- 58. Bridge over Johnson Creek (55th Ave.)
- 59. Bridge over Johnson Creek (Stanley Ave.)
- 60. Bridge over Johnson Creek (Linwood Ave.)
- 61. Bridge over Johnson Creek (Ochoco St.)
- 62. Bridge over Johnson Creek (J.C. Blvd.)
- 63. Bridge over Kellogg Creek (McLoughlin Blvd.)
- 64. Bridge over Kellogg Creek (McLoughlin Blvd./SR 224)
- 65. Bridge over McLoughlin Blvd. (SR 224)
- 66. Bridge over Orange Line & 26th Ave (SR 224)
- 67. Bridge over Mt. Scott Creek (SR 224)
- 68. Bridge over Johnson Creek (Wichita Ave.)

Municipal

- 109. Milwaukie City Hall
- 110. Clackamas Fire District Station #2
- 111. Public Works Campus

Water Treatment

- 112. Water Treatment Tower
- 113. Water Treatment Tower
- 114. Water Treatment Tower
- 115. Water Treatment Tower
- 116. Water Treatment Tower
- 117. Water Treatment Backwash Station

Water Storage

- 118. Water Treatment Clearwell
- 119. City Well No. 8 Containment Chamber
- 120. Stanley Ave. Storage Reservoir
- 121. Water Tower
- 122. City Water Reservoir No. 2

Schools

- 123. Whitcomb Elementary
- 124. Linwood Elementary
- 125. Rowe Middle
- 126. Milwaukie Junior High School
- 127. St. John The Baptist
- 128. La Salle High
- 129. Christ The King
- 130. Portland Waldorf School
- 131. Milwaukie High
- 132. Milwaukie Elementary
- 133. Cascade Heights Public Charter
- 135. Lewelling Elementary
- 136. Ardenwald Elementary

Vulnerable Populations

- 137. Providence Milwaukie Hospital

Electrical

- 144. Sellwood Substation
- 145. Bell Substation
- 146. Island Substation
- 147. Harmony Substation

Wastewater

- 148. Wastewater Pump Station
- 149. Wastewater Pump Station
- 150. Wastewater Pump Station
- 151. Wastewater Pump Station
- 152. Wastewater Pump Station
- 153. Kellogg Creek Treatment Plant

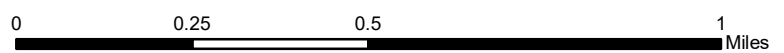
Cellular

- 154. Cell Tower/Antenna
- 155. Cell Tower/Antenna
- 156. Cell Tower/Antenna
- 157. Cell Tower/Antenna
- 158. Cell Tower/Antenna
- 159. Cell Tower/Antenna
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- 162. Cell Tower/Antenna
- 163. Cell Tower/Antenna
- 164. Cell Tower/Antenna



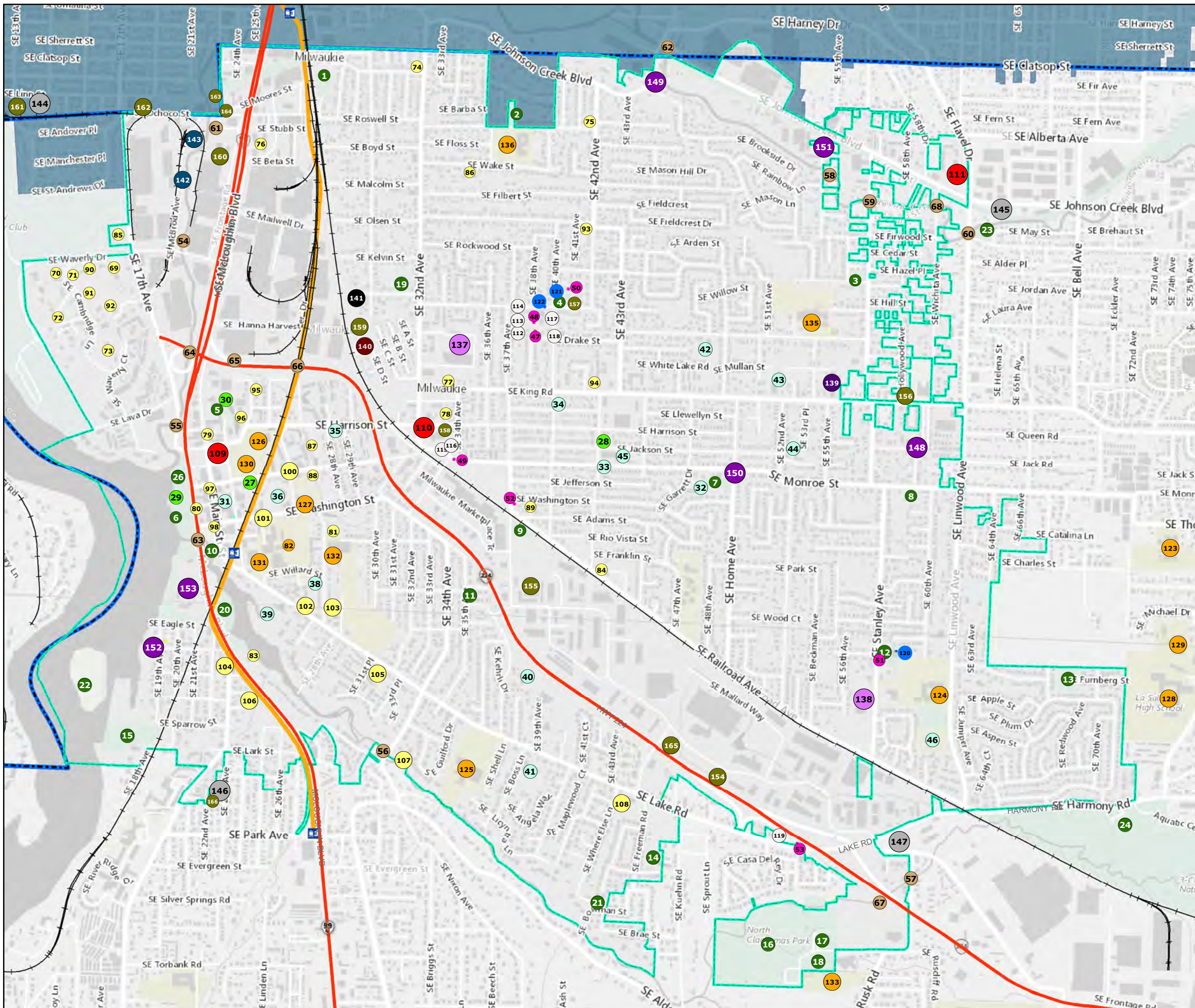
Data Sources: City of Milwaukie GIS, Clackamas County GIS, Metro Data Resource Center
 Date: Thursday, July 18, 2019

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Milwaukie NHMP - All Asset Locations

- Highway
- +— RR Track
- MAX Light Rail (Orange Line)
- Light Rail Stop
- Clackamas County
- City of Milwaukie
- City of Portland
- Parks
- Community Centers
- Places of Worship
- Groundwater
- Bridges
- Historic Structures
- Municipal
- Water Treatment
- Water Storage
- Schools
- Correctional
- Electrical
- Wastewater
- Cellular



Note: See reverse side for full list of asset locations

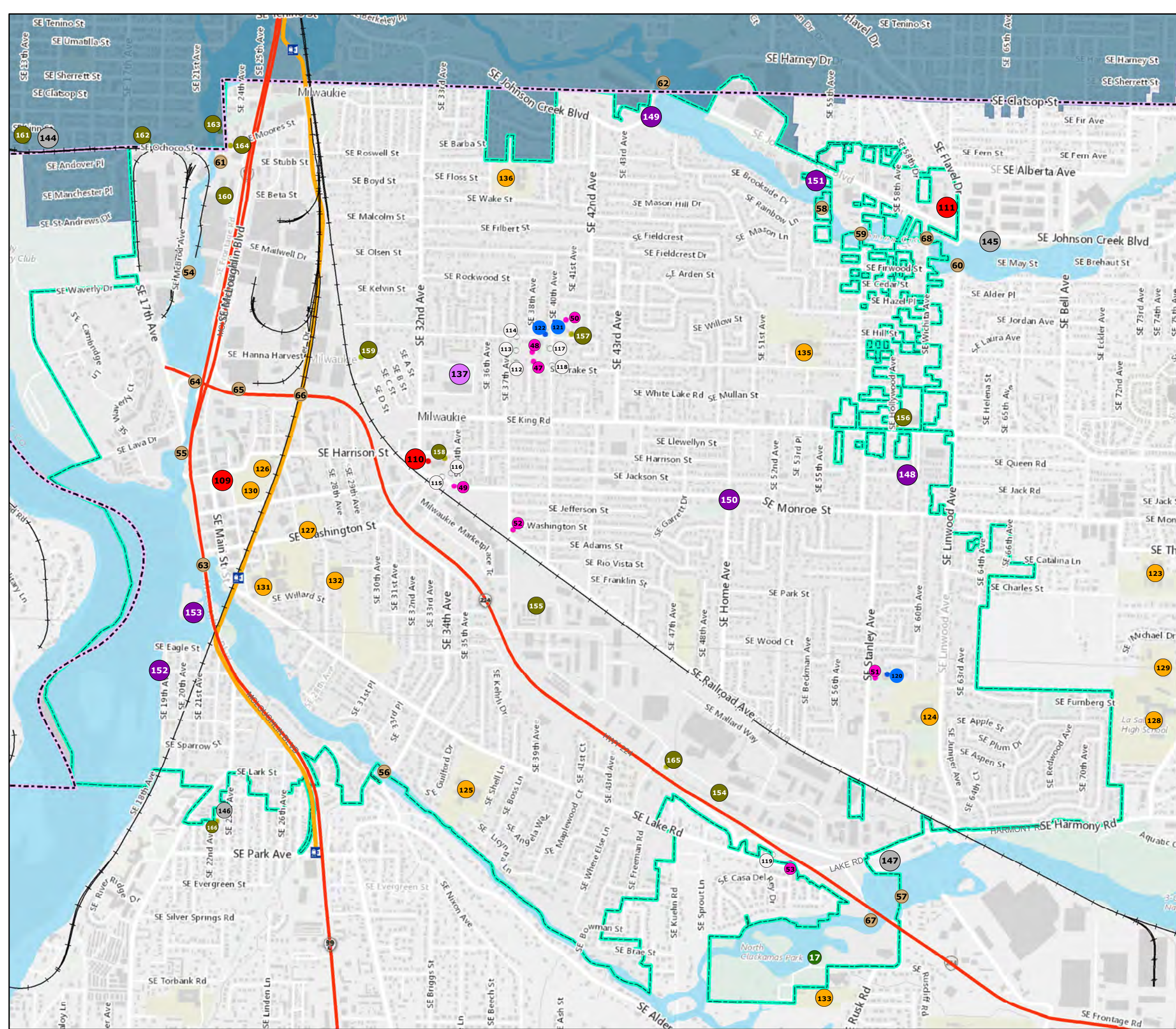


Data Sources: City of Milwaukie GIS, Clackamas County GIS, Metro Data Resource Center

Date: Tuesday, July 23, 2019

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Natural Hazards Mitigation Plan - Assets & FEMA Flood Hazard Zones

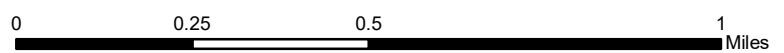


- FEMA Flood Hazard Zone**
 - 1% Annual Chance Flood Hazard ("100-Year Floodplain")
- Transportation Infrastructure**
 - Highway
 - Light Rail Stop
 - RR Track
 - MAX Light Rail (Orange Line)
- Jurisdictional Boundaries**
 - Clackamas County
 - City of Milwaukie
 - City of Portland
- Parks**
 - 17. The Milwaukie Center
- Groundwater**
 - 47. City of Milwaukie Well No. 2
 - 48. City of Milwaukie Well No. 3
 - 49. City of Milwaukie Well No. 4
 - 50. City of Milwaukie Well No. 5
 - 51. City of Milwaukie Well No. 6
 - 52. City of Milwaukie Well No. 7
 - 53. City of Milwaukie Well No. 8
- Bridges**
 - 54. Bridge over Johnson Creek (Milport Rd.)
 - 55. Bridge over Johnson Creek (17th Ave.)
 - 56. Bridge over Kellogg Creek (Oatfield Rd.)
 - 57. Bridge over Mt. Scott Creek (Rusk Rd.)
 - 58. Bridge over Johnson Creek (55th Ave)
 - 59. Bridge over Johnson Creek (Stanley Ave.)
 - 60. Bridge over Johnson Creek (Linwood Ave.)
 - 61. Bridge over Johnson Creek (Ochoco St.)
 - 62. Bridge over Johnson Creek (J.C. Blvd.)
 - 63. Bridge over Kellogg Creek (McLoughlin Blvd.)
 - 64. Bridge over Kellogg Creek (McLoughlin Blvd./SR 224)
 - 65. Bridge over McLoughlin Blvd. (SR 224)
 - 66. Bridge over Orange Line & 26th Ave (SR 224)
 - 67. Bridge over Mt. Scott Creek (SR 224)
 - 68. Bridge over Johnson Creek (Wichita Ave.)
- Water Treatment**
 - 112. Water Treatment Tower
 - 113. Water Treatment Tower
 - 114. Water Treatment Tower
 - 115. Water Treatment Tower
 - 116. Water Treatment Tower
- Water Treatment**
 - 117. Water Treatment Backwash Station
 - 118. Water Treatment Clearwell
 - 119. City Well No. 8 Containment Chamber
- Water Storage**
 - 120. Stanley Ave. Storage Reservoir
 - 121. Water Tower
 - 122. City Water Reservoir No. 2
- Schools**
 - 123. Whitcomb Elementary
 - 124. Linwood Elementary
 - 125. Rowe Middle
 - 126. Milwaukie Junior High School
 - 127. St. John The Baptist
 - 128. La Salle High
 - 129. Christ The King
 - 130. Portland Waldorf School
 - 131. Milwaukie High
 - 132. Milwaukie Elementary
 - 133. Cascade Heights Public Charter
 - 135. Lewelling Elementary
 - 136. Ardenwald Elementary
- Vulnerable Populations**
 - 137. Providence Milwaukie Hospital
- Electrical**
 - 144. Sellwood Substation
 - 145. Bell Substation
 - 146. Island Substation
 - 147. Harmony Substation
- Wastewater**
 - 148. Wastewater Pump Station
 - 149. Wastewater Pump Station
 - 150. Wastewater Pump Station
 - 151. Wastewater Pump Station
 - 152. Wastewater Pump Station
 - 153. Kellogg Creek Treatment Plant
- Cellular**
 - 154. Cell Tower/Antenna
 - 155. Cell Tower/Antenna
 - 156. Cell Tower/Antenna
 - 157. Cell Tower/Antenna
 - 158. Cell Tower/Antenna
 - 159. Cell Tower/Antenna
 - 160. Cell Tower/Antenna
 - 161. Cell Tower/Antenna
 - 162. Cell Tower/Antenna
 - 163. Cell Tower/Antenna
 - 164. Cell Tower/Antenna
- Municipal**
 - 109. Milwaukie City Hall
 - 110. Clackamas Fire District Station #2
 - 111. Public Works Campus

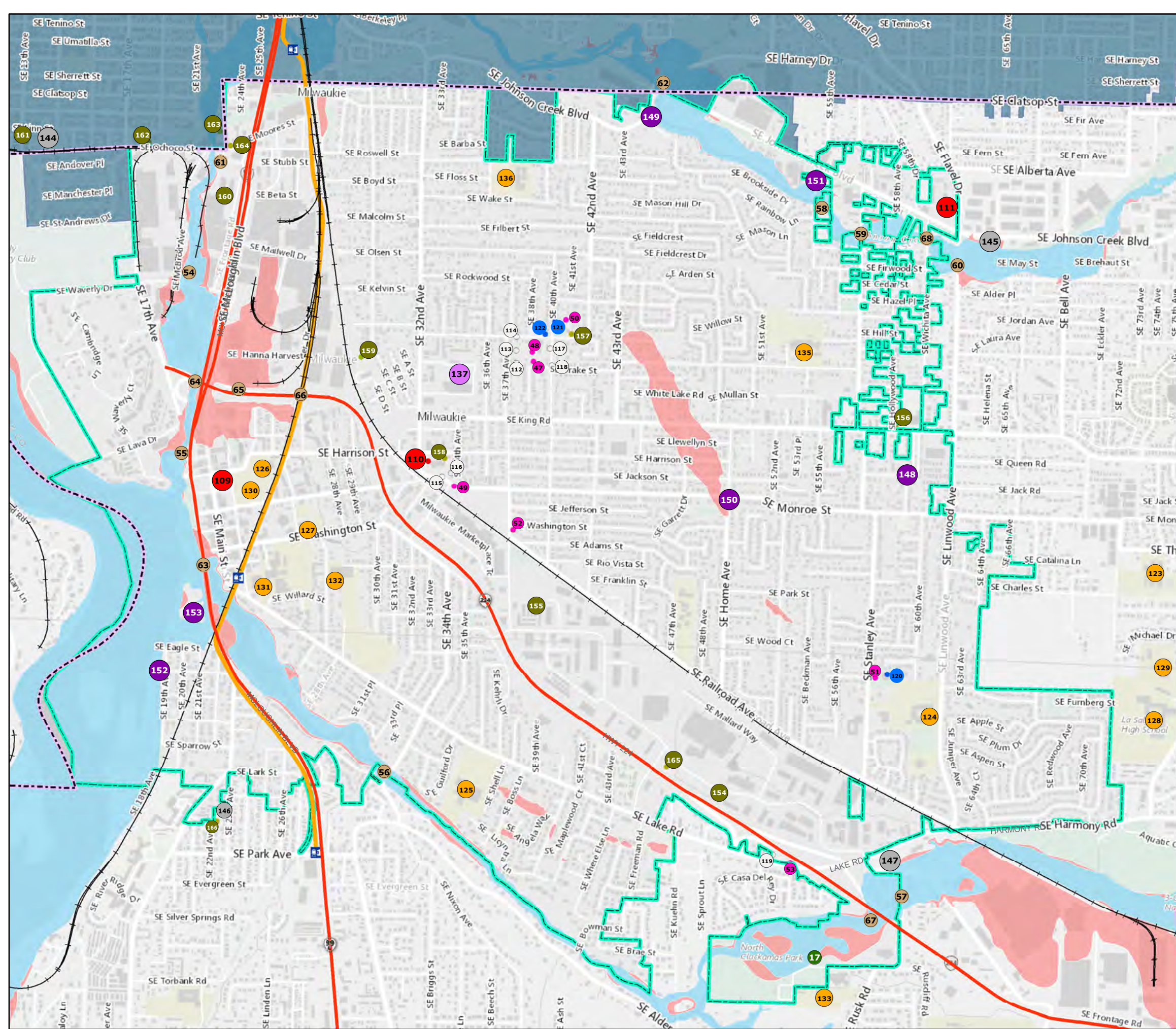


Data Sources: City of Milwaukie GIS, Clackamas County GIS, Metro Data Resource Center
 Date: Monday, July 22, 2019

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Natural Hazards Mitigation Plan - Assets & FEMA Flood Hazard Zones

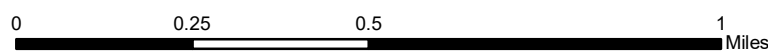


- FEMA Flood Hazard Zone**
- 1% Annual Chance Flood Hazard ("100-Year Floodplain")
 - 0.2% Annual Chance Flood Hazard ("500-Year Floodplain")
- Transportation Infrastructure**
- Highway
 - Light Rail Stop
 - RR Track
 - MAX Light Rail (Orange Line)
- Jurisdictional Boundaries**
- Clackamas County
 - City of Milwaukie
 - City of Portland
- Parks**
- 17. The Milwaukie Center
- Groundwater**
- 47. City of Milwaukie Well No. 2
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City of Molalla Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan



March 2019

Volume II: Molalla Addendum



Prepared for:

City of Molalla

Prepared by:

**University of Oregon
Institute for Policy Research and Engagement
Oregon Partnership for Disaster Resilience**

Planning grant funding provided by:



FEMA

Federal Emergency Management Agency (FEMA)
Pre-Disaster Mitigation Program
Grant: EMS-2017-PC-0005
Sub-grant Application Reference: PDMC-PL-10-OR-2016-001, and

Additional Support Provided by:



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FEMA

January 27, 2020

The Honorable Jim Bernard
Chair, Clackamas County Commissioners
2020 Kaen Road Suite A
Oregon City, Oregon 97045

Dear Chairman Bernard:

On April 12, 2019, the United States Department of Homeland Security’s Federal Emergency Management Agency (FEMA) Region 10, approved the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act’s, Hazard Mitigation Assistance grants through April 11, 2024, through your state.

Clackamas County	City of Estacada	City of Lake Oswego
City of West Linn	City of Wilsonville	City of Johnson City
City of Oregon City	City of Happy Valley	City of Canby
Clackamas Fire District	City of Gladstone	City of Sandy
City of Milwaukie	City of Molalla	

The updated list of approved jurisdictions includes the cities of Milwaukie and Molalla which recently adopted the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan’s approval, please contact Joseph Murray, State Hazard Mitigation Planner with the Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities. If you have questions regarding FEMA’s mitigation grant programs, please contact Amie Bashant, State Hazard Mitigation Officer with the Oregon Military Department, Office of Emergency Management, at 503-378-4660.

Sincerely,

Mark Carey, Director
Mitigation Division

Enclosure

JG



RESOLUTION NUMBER 2020-02

**A RESOLUTION OF THE CITY OF MOLALLA, OREGON,
ADOPTING THE CITY OF MOLALLA REPRESENTATION IN THE UPDATES
TO THE CLACKAMAS COUNTY MULTI-JURISDICTIONAL NATURAL
HAZARDS MITIGATION PLAN.**

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

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

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

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

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

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

WHEREAS, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the City of Molalla addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan and pre-approved it (dated October 3, 2019) contingent upon this official adoption of the participating governments and entities;

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

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

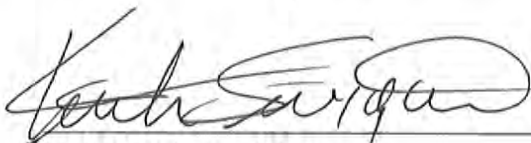
WHEREAS, City of Molalla adopts the NHMP and directs the City Manager to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.

Now, Therefore, the City of Molalla Resolves as follows:

Section 1. The City of Molalla adopts the Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan; and

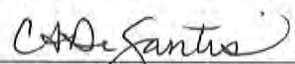
Section 2. The City of Molalla will submit this Adoption Resolution to the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan.

Adopted this 22nd day of January, 2020



Keith Swigart, Mayor

ATTEST:



Christie DeSantis, City Recorder

Purpose

This is an update of the Molalla addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation and Volume III (Appendices) which provide additional information. This addendum meets the following requirements:

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

Updates to Molalla's addendum are further discussed throughout the NHMP and within Volume III, Appendix B, which provides an overview of alterations to the document that took place during the update process.

Molalla adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on **January 22, 2020**. FEMA Region X approved the Clackamas County NHMP on April 12, 2019 and the City's addendum on **January 27, 2020**. With approval of this NHMP the City is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **April 11, 2024**.

Mitigation Plan Mission

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

The City concurs with the mission statement developed during the Clackamas County planning process (Volume I, Section 3):

Promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

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

The City concurs with the goals developed during the Clackamas County planning process (Volume I, Section 3). All NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Below is a list of the NHMP goals:

GOAL #1: PROTECT LIFE AND PROPERTY

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

GOAL #2: ENHANCE NATURAL SYSTEMS

- Balance watershed planning, natural resource management, and land use planning with natural hazards mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

GOAL #3: AUGMENT EMERGENCY SERVICES

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, and business, and industry.
- Coordinate and integrate natural hazards mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL #4: ENCOURAGE PARTNERSHIPS FOR IMPLEMENTATION

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

GOAL #5: PROMOTE PUBLIC AWARENESS

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

NHMP Process, Participation and Adoption

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

Molalla first developed an addendum to Clackamas County's Natural Hazards Mitigation Plan in 2009. This plan was updated in 2012/2013 and in 2018/2019. The most recent previous update of the Molalla addendum to the Clackamas County NHMP was approved by FEMA on April 8, 2013.

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

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research, and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM), Clackamas County, and Molalla to update their NHMP. This project is funded through the Federal Emergency Management Agency's (FEMA) Fiscal-Year 2016 (FY16) Pre-Disaster Mitigation (PDM) Competitive Grant Program EMS-2017-PC-0005 (PDMC-PL-10-OR-2016-001). Members of the Molalla NHMP Hazard Mitigation Advisory Committee (HMAC) also participated in the County NHMP update process (Volume III, Appendix B).

The Clackamas County NHMP, and Molalla addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. The Molalla HMAC guided the process of developing the NHMP.

Convener

The Molalla City Manager serves as the NHMP addendum convener. The convener of the NHMP will take the lead in implementing, maintaining and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the City of Molalla HMAC met formally and informally, to discuss updates to their addendum (Volume III, Appendix B). The HMAC reviewed and revised the City's addendum, with focus on the NHMP's risk assessment and mitigation strategy (action items).

This addendum reflects decisions made at the designated meetings and during subsequent work and communication with Clackamas County Resilience Coordinator, and the OPDR. The changes are highlighted with more detail throughout this document and within Volume III, Appendix B. Other documented changes include a revision of the City's risk assessment and hazard identification sections, NHMP mission and goals, action items, and community profile.

The Molalla HMAC was comprised of the following representatives:

- Convener, Dan Huff, City Manager
- Dan Zinder, GIS Analyst

Public participation was achieved with the establishment of the HMAc, which was comprised of City officials representing different departments and sectors and members of the public. The HMAc served as the local review body for the NHMP's development. Community members were provided an opportunity for comment via the NHMP review process, and through a survey administered by Clackamas County (Volume III, Appendix G).

NHMP Implementation and Maintenance

The City Council will be responsible for adopting the Molalla addendum to the Clackamas County NHMP. This addendum designates a HMAc and a convener to oversee the development and implementation of action items. Because the City addendum is part of the County's multi-jurisdictional NHMP, the City will look for opportunities to partner with the County. The City's HMAc will convene after re-adoption of the Molalla NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The City Manager will serve as the convener and will be responsible for assembling the HMAc. The HMAc will be responsible for:

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating and training new HMAc members on the NHMP and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement; and
- Documenting successes and lessons learned during the year.

The convener will also remain active in the County's implementation and maintenance process (Volume I, Section 4).

The City will utilize the same action item prioritization process as the County (Volume I, Section 4).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, and Building Codes, as well as the [Clackamas County NHMP](#), and the [State of Oregon NHMP](#).

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the city. Plans and policies already in existence have support from residents, businesses and policy makers. Where possible, Molalla will implement the NHMP's recommended actions through existing plans and policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items

through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Future development without proper planning may result in worsening problems associated with natural hazards. Molalla's acknowledged comprehensive plan is the City of Molalla Comprehensive Plan (1980, updated September 2014). The Oregon Land Conservation and Development Commission first acknowledged the plan in 1980. The City implements the plan through the Development Code.

Molalla currently has the following plans, regulations, and projects that relate to natural hazard mitigation. For a complete list visit the City's [website](#):

- [Comprehensive Plan](#)
- [Wastewater Flow Mapping](#)
- [Municipal Code](#)
 - [Section 13.04.276 Approved devices and installation thereof – Methods of backflow prevention required](#)
 - [Section 13.08.470 Protection of excavations – Restoration of public property](#)
 - [Section 17.4.2.040 Application Submission Requirements](#)
 - [Section 21.50.010 Dangerous building defined](#)
 - [Section 21.90.020 Tree Retention](#)
- [Transportation Systems Plan](#)
- [Stormwater Treatment](#)
- [Wastewater Facility and Collection System Master Plan](#)
- [Water System Master Plan](#)
- [Stormwater Master Plan](#)
- [Parks and Recreation Master Plan](#)
- [Smoke Testing Report](#)
- Natural Features Report
- Capital Improvement Program

Other plans:

- [Clackamas County Community Wildfire Protection Plan](#)
 - [Molalla Rural Fire Protection District #73](#)

Government Structure

The City of Molalla has a council-manager form of government. The City Council consists of six members; a mayor and five councilors. The mayor presides over Council meetings. The mayor and City Council members are elected to four-year terms of office through a general election. The City Council is responsible for identifying problems and needs within the community and then addressing those problems through community goals and objectives.

Community Development is responsible for residential building and planning and monitoring future development. They make recommendations to City Council for changes to the Planning and Land Development Ordinance, Historic District Zones, the Comprehensive Plan and the Zoning Map.

The City of Molalla provides a variety of services to promote the safety and welfare of its residents. Public services that support the demands of a growing community include Community Development, Community Services, GIS, Public Safety, and Public Works. The City contracts with Clackamas County for building including electrical, mechanical, and plumbing.

Economic Development: Helps to develop economic opportunities for the community.

Finance: Manages the city's financial operations, including the general ledger, accounts receivable, accounts payable, payroll, utility billing, banking, and investments.

Parks & Recreation: Provides neighborhood and community parks to serve all residents of Molalla. Develop and maintain a city-wide system of trails to provide recreational opportunities.

Planning Department: The Department manages development projects within the city and produces the strategic vision of the city.

Police: Consists of the Molalla Police, who provide services to enhance the health and safety of Molalla residents.

Public Works: Responsible for maintaining streets, streetlights, water, sewer, and stormwater systems and manages the Water Treatment and Wastewater Treatment Plants. It consists of three divisions: Administration and Engineering, Water Quality, and Maintenance. Public works is also responsible for emergency management and response.

Continued Public Participation

An open public involvement process is essential to the development of an effective NHMP. To develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunity for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the NHMP during review.¹ Keeping the public informed of the City's efforts to reduce its risk to future natural hazard events is important for successful NHMP implementation and maintenance. The City is committed to involving the public in the NHMP review and updated process (Volume I, Section 4). The City posted the plan update for public comment before FEMA approval, and after approval will maintain the plan on the City's website:

<https://www.cityofmolalla.com/>

NHMP Maintenance

The Clackamas County NHMP and City addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the County NHMP update process, the City will also review and update its addendum (Volume I, Section 4). The convener will be responsible for convening the HMAC to address the questions outlined below.

- Are there new partners that should be brought to the table?

¹ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

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

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

Mitigation Strategy

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

The City's mitigation strategy (action items) were first developed during the 2009 NHMP planning process and revised during subsequent NHMP updates. During these processes, the HMAC assessed the City's risk, identified potential issues, and developed a mitigation strategy (action items).

During the 2018/2019 update process the City re-evaluated their mitigation strategy (action items). During this process action items were updated, noting what accomplishments had been made and whether the actions were still relevant; any new action items were identified at this time (see Volume III, Appendix B for more information on changes to action items).

Priority Action Items

Table MO-1 presents a list of mitigation actions. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity. High priority actions are shown in **bold** text with grey highlight. The City will focus their attention, and resource availability, upon these achievable, high leverage, activities over the next five-years. Although this methodology provides a guide for the HMAC in terms of implementation, the HMAC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for detailed information for each action. Full text of the plan goals referenced in Table MO-1 is located on page MO-2.

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Table MO-I Molalla Action Items

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
MH #1	Develop public education programs to inform the public about methods for mitigating the impacts of natural hazards.	Planning Commission	Planning, City Recorder	Ongoing	✓		✓	✓	✓
MH #2	Continue to integrate mitigation strategies into existing regulatory documents and programs, where appropriate.	Planning Commission	Planning	Ongoing	✓	✓	✓	✓	✓
MH #3	Improve vegetation management throughout the city.	Planning	Code Enforcement	Long Term		✓		✓	
MH #4	Identify and map out evacuation routes for all hazards.	Public Works	Planning, Administration	Short Term	✓		✓		✓
EQ #1	Conduct seismic evaluations on City Hall/Police Building and implement appropriate structural and non-structural mitigation strategies.	Public Works	Administration	Long Term	✓		✓		
FL #1	Obtain funding for implementing recommendations outlined in the Stormwater Master Plan.	Public Works	Planning, Administration	Ongoing	✓	✓	✓	✓	
FL #2	Minimize overall impervious cover and disconnect impervious areas.	Planning	Public Works	Long Term	✓	✓			
LS #1	Identify and locate a secondary location for the water intake system and move it away from the hillside.	Public Works	Planning, Administration	Long Term	✓	✓	✓		

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
SW #1	Reduce negative effects from severe windstorm and severe winter storm events.	Public Works	Planning, Administration	Ongoing	✓	✓	✓	✓	✓
WF #1	Promote fire-resistant strategies for new and existing developments.	HMAC	Molalla RFD, Administration	Ongoing	✓	✓	✓	✓	✓
WF #2	Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan.	HMAC	Public Works, Planning, Administration	Ongoing	✓	✓	✓	✓	✓

Source: City of Molalla HMAC, 2018

Note: Full text of the plan goals referenced in this table is located on page MO-2.

Risk Assessment

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

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

The local level rationale for the identified mitigation strategies (action items) is presented herein and within Volume I, Section 2 and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure MO-1. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure MO-1 Understanding Risk



Hazard Analysis

The Molalla HMA developed their hazard vulnerability assessment (HVA), using their previous HVA and the County’s HVA as a reference. Changes from their previous HVA and the County’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Molalla, which are discussed throughout this addendum.

Table MO-2 shows the HVA matrix for Molalla listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for

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

Two catastrophic hazards (Cascadia Subduction Zone earthquake and Crustal earthquake) and two chronic hazards (winter storm and windstorm) rank as the top hazard threats to the City (Top Tier). Drought, wildfire, and extreme heat comprise the next highest ranked hazards (Middle Tier), while flood, volcanic event, and landslide comprise the lowest ranked hazards (Bottom Tier).

Table MO-2 Hazard Analysis Matrix – Molalla

Hazard	Maximum				Total Threat Score	Hazard Rank	Hazard Tiers
	History	Vulnerability	Threat	Probability			
Earthquake - Cascadia	4	45	100	49	198	#1	Top Tier
Earthquake - Crustal	6	50	100	21	177	#2	
Winter Storm	10	35	70	56	171	#3	
Windstorm	20	35	50	56	161	#4	
Drought	10	20	50	42	122	#5	Middle Tier
Wildfire	6	40	40	49	114	#6	
Extreme Heat Event	2	20	40	49	111	#7	
Flood	6	25	30	35	96	#8	Bottom Tier
Volcanic Event	2	15	50	14	81	#9	
Landslide	4	10	20	14	48	#10	

Source: Molalla HMAC, 2018.

Table MO-3 categorizes the probability and vulnerability scores from the hazard analysis for the City and compares the results to the assessment completed by the Clackamas County HMAC. Variations between the City and County are noted in **bold** text within the city ratings.

Table MO-3 Probability and Vulnerability Comparison

Hazard	Molalla		Clackamas County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Moderate	High	Low
Earthquake - Cascadia	Moderate	High	Moderate	High
Earthquake - Crustal	Low	High	Low	High
Extreme Heat	Moderate	Moderate	Low	High
Flood	Moderate	Moderate	High	Moderate
Landslide	Low	Low	High	Low
Volcanic Event	Low	Low	Low	Moderate
Wildfire	Moderate	High	High	Moderate
Windstorm	High	Moderate	Moderate	Low
Winter Storm	High	Moderate	Moderate	Moderate

Source: Molalla and Clackamas County HMAC, 2018.

Community Characteristics

Table MO-4 and the following section provides information on City specific demographics and assets. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation.

Considering the City specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation. Between 2010 and 2016 the City grew by 975 people (12%; as of 2018 the population was 9,625) and median household income increased by about 1%.² Between 2018 and 2040 the population is forecast to grow by 67% to 16,118.³ In August 2014, the City annexed 107 acres into the City. New development has complied with the standards of the [Oregon Building Code](#) and the city's development code.

Transportation/Infrastructure

Molalla is roughly 29 miles from Portland and is connected to surrounding communities by two state highways that run through the downtown area. Highway 211 runs east-west and connects Molalla to Interstate 5 and 99E. Highway 213 runs north-south through the City and connects it to both Silverton and Oregon City. Molalla's proximity to Portland and Salem has enabled residents to live in town and work elsewhere.

Motor vehicles represent the dominant mode of travel through and within Molalla. The South Clackamas Transportation District (SCTD) is the bus service that provides public transit to the City. There are no port services available on Molalla River, a tributary of the Willamette River, but there are recreational areas along the river.

Economy

Molalla's proximity to major transportation routes and access to rail has made it a desirable place for commercial and industrial development. Historically Molalla's economy focused on forestry and farming, which is still has a major presence in the workforce. The city's residents work in a variety of industries, with "construction, extraction, and maintenance occupations" (16% of workforce) and "sales and related occupations" (13%) accounting for the top two occupations.⁴

Molalla has an economic advantage due to its location at the north end of the Willamette Valley and its proximity to Portland. A significant portion of the land available for industrial development in Clackamas County is in the Molalla area. There are currently new expansions in existing industries currently underway with available industrial land in its Four Corners Industrial Park or at Avison's Certified Industrial Site.⁵

² Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018 and Social Explorer, Table T57, U.S. Census Bureau, 2012-2016 and 2006-2010 American Community Survey Estimates.

³ Portland State University, Population Research Center, "Population Forecast Tables", 2017.

⁴ Social Explorer, Table 50, U.S. Census Bureau, 2012-2016 American Community Survey Estimates

⁵ Economic Development (2019). City of Molalla. <https://www.cityofmolalla.com/ed>

Table MO-4 Community Characteristics

Population Characteristics		
2010 Population	8,110	
2016 Population [2018 Population]	9,085	[9,625]
2040 Forecasted Population	16,118	
Race (non-Hispanic) and Ethnicity (Hispanic)		
White	82%	
Black/ African American	< 1%	
American Indian and Alaska Native	1%	
Asian	1%	
Native Hawaiian and Other Pacific Islander	0%	
Some Other Race	0%	
Two or More Races	1%	
Hispanic or Latino	15%	
Limited or No English Spoken	6%	
Vulnerable Age Groups		
Less than 15 Years	2,340	26%
65 Years and Over	921	10%
Disability Status		
Total Population	1,299	15%
Children	70	3%
Seniors	520	58%

Income Characteristics		
Households by Income Category		
Less than \$15,000	253	8%
\$15,000-\$29,999	406	13%
\$30,000-\$44,999	574	18%
\$45,000-\$59,999	537	17%
\$60,000-\$74,999	382	12%
\$75,000-\$99,999	426	14%
\$100,000-\$199,999	540	17%
\$200,000 or more	45	1%
Median Household Income	\$55,082	
Poverty Rates		
Total Population	1,478	17%
Children	444	17%
Seniors	77	9%
Housing Cost Burden		
Owners with Mortgage	849	42%
Renters	540	48%

Source: U.S. Census Bureau, 2012-2016 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018; Portland State University, Population Research Center, "Population Forecast Tables", 2017.

Housing Characteristics		
Housing Units		
Single-Family	2,398	73%
Multi-Family	668	20%
Mobile Homes	218	7%
Year Structure Built		
Pre-1970	719	22%
1970-1989	467	14%
1990 or later	2,098	64%
Housing Tenure and Vacancy		
Owner-occupied	2,032	62%
Renter-occupied	1,131	34%
Seasonal	0	0%
Vacant	121	4%

Molalla has grown substantially since its incorporation in 1913 and has an area today of 2.26 square miles. It is in the south-central region of Clackamas County, located approximately 29 miles southeast of the City of Portland. The City is within the Molalla River watershed, with the Molalla River about a mile east of the UGB.⁶

The city has three drainage basins: Molalla River basin, Creamery Creek basin, and Bear Creek basin. Located at 371 feet above sea level, Molalla's climate is consistent with a Mediterranean climate zone, with warm summers and cool, wet winters. Molalla receives most of its rainfall between October and May, and averages 42 inches of rain, and around 6 inches of snow, per year.⁷

According to the [Comprehensive Plan](#), land has been designated for single-family residential, medium-density residential, multi-family residential, central commercial, general commercial, light industrial, heavy industrial, and public/semi-public. The plan incorporates natural hazard considerations, resulting in slopes of 25% or greater being considered unbuildable for future housing needs.

⁶ [Annual Water Quality Report](#) (2017). City of Molalla. Retrieved March 10, 2019.

⁷ ["Monthly Average for Molalla, OR"](#) The Weather Channel Interactive, Inc. Retrieved March 10, 2018.

Community Assets

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of Molalla. It is important to note that the facilities identified as “critical” and “essential” are characterized differently than the structural code that identifies buildings as “essential” and “non-essential.” The structural code uses different language and criteria and therefore have completely different meanings than the buildings identified in this addendum.

Note: The tables below indicate if infrastructure or facilities are known to have vulnerabilities to the listed natural hazards based on the best available data.

Critical Facilities

Facilities that are critical to government response, and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include: 911 Centers, Emergency Operations Centers, Police, and Fire Stations, Public Works facilities, sewer, and water facilities, hospitals, bridges, roads, shelters, and more.

Table MO-5 Critical Facilities in Molalla

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Facilities									
City Hall and Police Department									
Fleet Services									
Public Works									
Sewage Treatment Plant									
Fire Stations									
Molalla RFPD #73 - Main Station 82									
Hospitals									
Molalla Medical – Urgent Care									
Providence Medical									
Potential Shelter Sites									
Molalla Adult Community									

Hazardous Materials:

Facilities that, if damaged, could cause serious secondary impacts may also be considered “critical.” A hazardous material facility is one example of this type of critical facility. Those sites that store, manufacture, or use potentially hazardous materials include: Gas Stations, IXL Propane, IDMS, Molalla Aquatic Center, Molalla Wastewater Treatment Plant, Molalla Water Treatment Plant, and Pacer Propane.

Essential Facilities

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public’s ability to recover from the emergency. These facilities may include: City buildings such as the Public Services Building, the City Hall, and other public facilities such as schools.

Table MO-6 Essential Facilities in Molalla

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Essential Facilities									
Schools									
Molalla Elementary School		X							
Molalla High School									
Molalla River Middle School		X							
Granges									
Foothills									
Molalla Grange									
South Molalla									
Churches									
Church of Christ of Latter-Day Saints									
Church of the Nazarene									
Country Church									
Evangelical Church of North America									
Grace Lutheran Church									
Molalla Assembly of God									
Molalla Christian Church									
Molalla Four Square Church									
Saint James Catholic Church									
Seventh-Day Adventist									
South Clackamas Community Church									
United Methodist Church									
Food Providers									
Safeway									
Other Essential Facilities									
High School Football Field									
Masonic Lodge									
Molalla Aquatic Center									
Molalla Communications Company									
Molalla Public Library									
Moose Lodge									
Safeway									
Skydive Oregon Airport									

Critical Infrastructure:

Infrastructure that provides necessary services for emergency response include:

Table MO-7 Critical Infrastructure in Molalla

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Infrastructure									
Arterials									
*designates road maintained by others									
Highways 213*									
Highways 211*									
Bridges									
Bridge over the Molalla River									
Feyer Park Bridge									
Milk Creek Bridge									
Mulino Bridge*									
Pudding River Bridge									
Wagon Wheel Park Bridge									
Other Critical Infrastructure									
Communication Towers									
NW Natural Pipelines									
Power Substations									
Sewage Infrastructure									
Water Distribution/Drainage Infrastructure									

Environmental Assets:

Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic, and functional ecosystem services for the community include: Bear Creek Byway, Billy Sheets Field, Bohlander Field, Clark Park, High School Sports Complex, Ivor Davies Trail Park, Leonard Long Park, Rosse Posse Acres (Elk Farm), Sally Fox Park, and the Molalla BMX Track.

Economic Assets/Population Centers:

Economic assets include businesses that employ large numbers of people and provide an economic resource to the city of Molalla. If damaged, the loss of these economic assets could significantly affect economic stability, and prosperity. Population Centers usually are aligned with economic centers, and are a concern during evacuation/notification during a hazard event include:

Table MO-8 Economic Assets/Population Centers in Molalla

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Economic Assets / Population Centers									
Economic Centers									
Brentwood Corporation									
Bus Company – First Student									
Cash Ice									
Coors Tech									
Fountain Valley Dental									
International Forest Products Limited									
IXL Propane									
Molalla Buckaroo									
Molalla Dental Clinic									
Molalla Market Center									
Molalla Redi-Mix									
Molalla Square (Bi-Mart)									
Northwest Polymers									
Pacer Propane									
Safeway Shopping Center									
Population Centers									
Bear Creek Subdivision									
Big Meadows Subdivision									
Fir Crest Apartments									
Lexington Estates									
Molalla School District									
Rondel Court									
Schools									
Shel Mar Estates									
Stone Place Apartments									
Sunrise Acres									
Toliver Terrace									
Twin Meadows Subdivision									

Vulnerable Populations:

Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, often experience the impacts of natural hazards and disasters more acutely. Populations that have special needs or require special consideration include:

Table MO-9 Vulnerable Populations in Molalla

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Vulnerable Populations									
Assisted Living Facilities									
Evergreen Court									
Molalla Manor									
Pheasant Pointe									
Twin Firs Mobile Home Park									
Child Care Centers									
24 Hours Child Care/Preschool									
Early Horizons Preschool Childcare, Inc.									
Schools									
Molalla Elementary School									
Molalla High School									
Molalla River Middle School									
Rural Dell Elementary									
Other Vulnerable Populations									
Cole Apartments (Spanish speaking)									
Molalla Adult Community Center									
Molalla Mobile Manor									
Plaza Los Robles (Spanish speaking)									

Hazard Characteristics

Drought

The HMAC determined that the City's probability for drought is **moderate** and that their vulnerability to drought is **moderate**. *The probability rating and the vulnerability ratings did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent and probability of a potential event. Due to the climate of Clackamas County, past and present weather conditions have shown an increasing potential for drought.

The City of Molalla Public Works Department manages Molalla's water supply. Molalla houses one large water intake facility and water treatment plant, which provides water to both the City of Molalla and the City of Sherwood. The City draws its water supply from the Molalla River and serves approximately 3,100 residents. There is potential contamination sources within Molalla's drinking water protection area from agriculture, managed forest land, and other sources.⁸ There is an action item to find a second accessible water source for the City in case of contamination or drought. The results of the current search will be updated this year and next steps will be considered.

Vulnerability Assessment

Due to insufficient data and resources, Molalla is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables MO-5 through MO-10.

Mitigation Activities

The existing drought hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Earthquake (Cascadia Subduction Zone)

The HMAC determined that the City's probability for a Cascadia Subduction Zone (CSZ) earthquake is **moderate** and that their vulnerability to a CSZ earthquake is **high**. *The probability rating decreased, and the vulnerability rating did not change, since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake and Crustal earthquake.*

Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent and probability of a potential event. Generally, an event that affects the County is likely to affect Molalla as well. The causes and characteristics of an earthquake event are appropriately described within the Volume I, Section 2 as well as the location and extent of potential hazards. Previous occurrences are well documented within Volume I, Section 2 and the community impacts described by the County would generally be the same for Molalla as well.

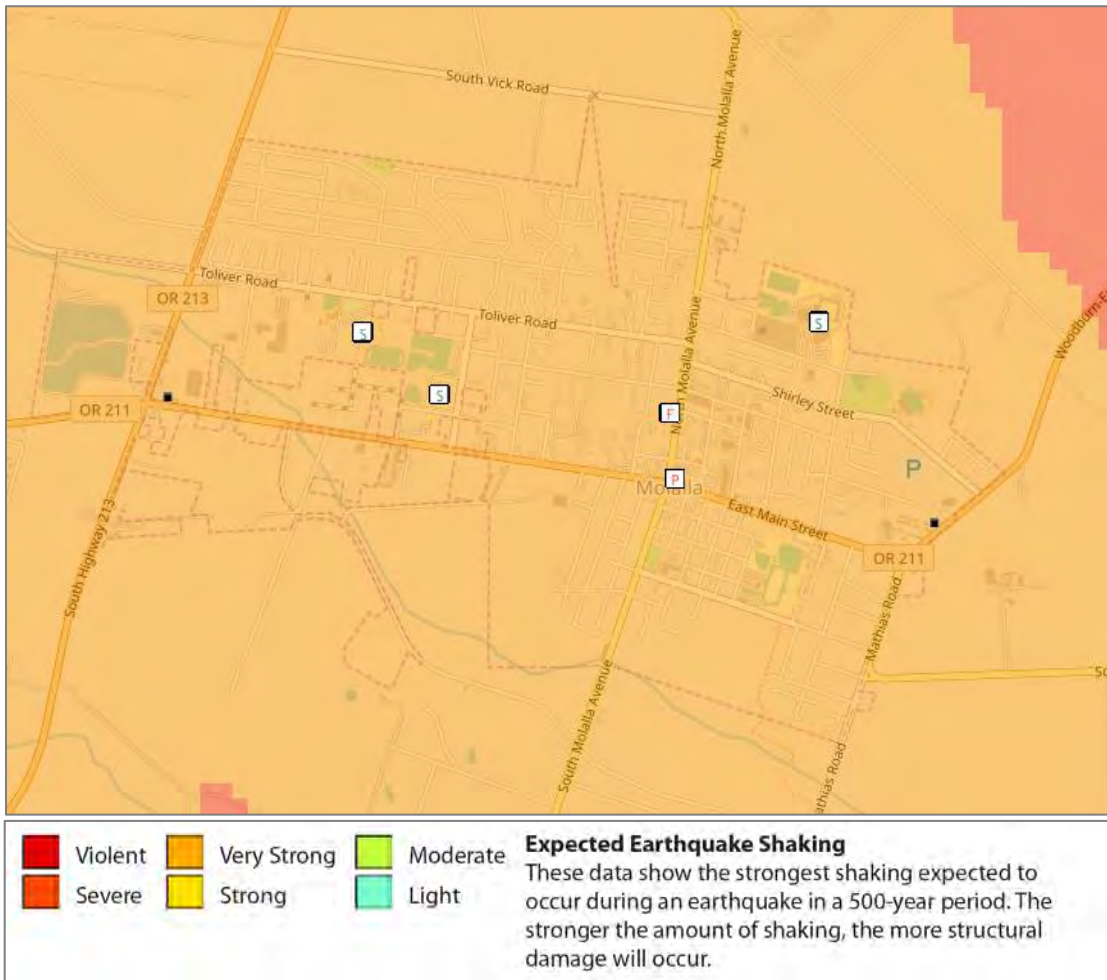
Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Gales Creek-Newberg-Mt Angel Structural Zone, Portland Hills Fault Zone, and the Canby-Molalla Fault Zone (discussed in the crustal earthquake section).

Figure MO-2 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the city is expected to experience very strong shaking

⁸ [Source Water Assessment Summary Brochure: City of Molalla](#) (2003). Oregon Health Division and Department of Environmental Quality.

(orange), while areas around the city will experience severe shaking (light red) (shown by the red northeast corner) in a CSZ event.

Figure MO-2 Cascadia Subduction Zone Expected Shaking



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

Note: To view detail click the link above to access Oregon HazVu.

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year. Scientists have found evidence that 11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D.⁹

The city's proximity to the Cascadia Subduction Zone, potential slope instability and the prevalence of certain soils subject to liquefaction and amplification combine to give the city

⁹ The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. <http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf>

a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places the city predominately within the “Valley Zone” (Valley Zone, from the summit of the Coast Range to the summit of the Cascades). Within the Northwest Oregon region, damage and shaking is expected to be strong and widespread - an event will be disruptive to daily life and commerce and the main priority is expected to be restoring services to business and residents.

The City is not within the severe shaking area, though there is significant area around the City that have severe and very severe shaking if a large earthquake were to occur. These areas include Highway 211 and Highway 213, which could result in Molalla having access issues from emergency vehicles and other response efforts.

Earthquake (Crustal)

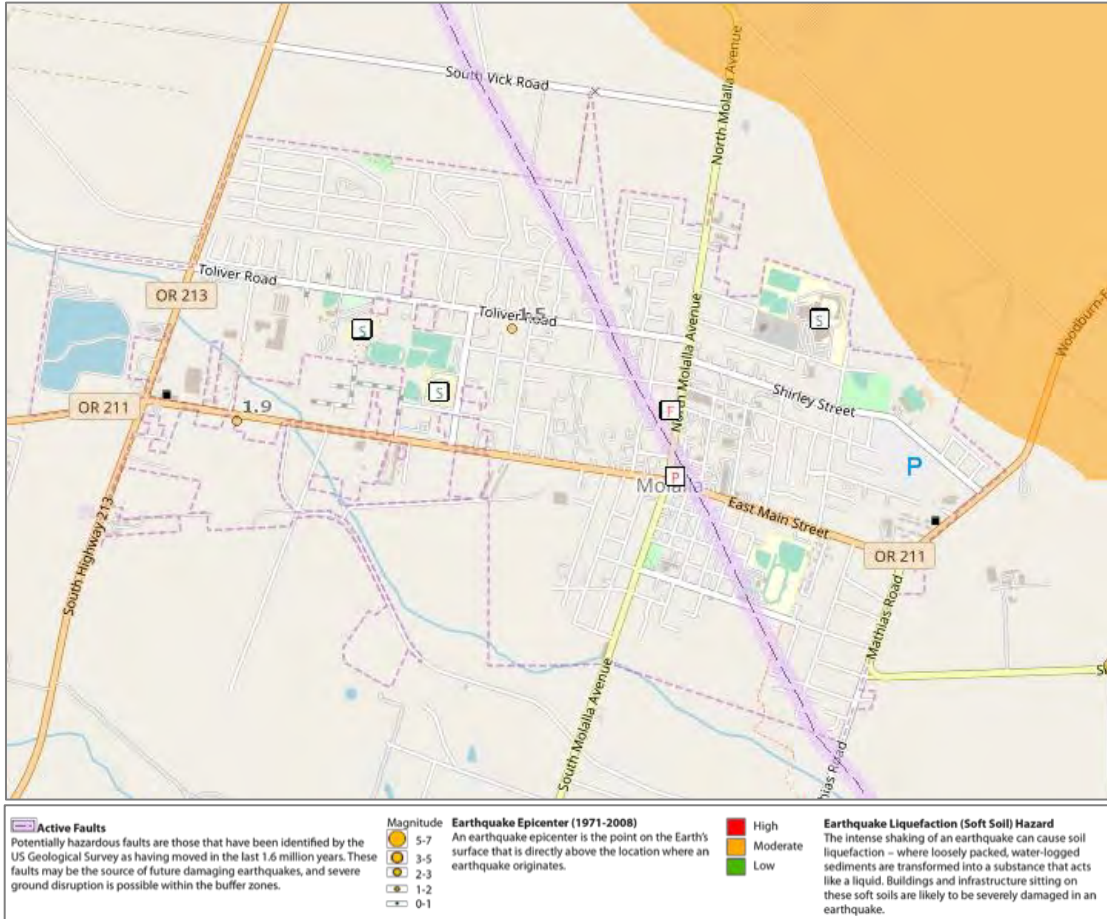
The HMAC determined that the City’s probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**. *The probability rating decreased, and the vulnerability rating did not change, since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake and Crustal earthquake.*

Volume I, Section 2 describes the causes and characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Molalla as well. Figure MO-3 shows a generalized geologic map of the Molalla area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows the areas of greatest concern within the City limits as red and orange.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

The Canby-Molalla Fault runs through the center of the City and can generate high-magnitude earthquakes. The City is also 15 miles away from the Portland Hills Fault Zone (discussed in greater detail below). Historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8. In December 2017 a 4.0 tremor was felt in Molalla along the same epicenter as the 5.6 quake, this time no damage occurred.

Figure MO-3 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



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

Note: To view detail click the link above to access Oregon HazVu

Canby-Molalla Fault Zone

The Canby-Molalla Fault Zone is a series of NE-trending fault that vertically displace the Columbia River Basalt with discontinuous aeromagnetic anomalies that represent significant offset of Eocene basement and volcanic rocks. The fault zone extends for 31 miles from the vicinity of Tigard south through the towns of Canby and Molalla in northern Oregon.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and lies about 15 miles northeast of Molalla.

Vulnerability Assessment

Due to insufficient data and resources, Molalla is currently unable to perform a quantitative risk assessment for this hazard. However, in 2018 the Department of Geology and Mineral Industries (DOGAMI) completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)), findings from that report are provided at the end of the crustal earthquakes hazard section.

Seismic building codes were implemented in Oregon in the 1970s, however, stricter standards did not take effect until 1991 and early 2000s. As noted in the community profile, approximately 36% of residential buildings were built prior to 1990, which increases the City’s vulnerability to the earthquake hazard. Information on specific public buildings’ (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table MO-10; each “X” represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), zero (0) have a very high (100% chance) collapse potential and zero (0) have a high (greater than 10% chance) collapse potential.

For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables MO-5 through MO-10.

Table MO-10 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Molalla Elementary (910 Toliver Rd)	Clac_sch32	X			
Molalla River Middle (318 Leroy Ave)	Clac_sch33	X			
Molalla High (357 Francis St)	Clac_sch68	X			
Molalla RFPD #73					
Station 82 (EOC) (320 N Molalla Ave)	Clac_fir18	Retrofit per SRGP 2015-2017 Phase II			
Police					
City Hall/Police Department (117 N Molalla Ave)	Clac_pol10	X			

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#) “*” – Site ID is referenced on the [RVS Clackamas County Map](#)
Note: Bold indicates facilities that have been seismically retrofitted or rebuilt.

In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

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

Mitigation Activities

Molalla has taken mitigation steps to reduce the city's vulnerability in earthquake events. City Hall and the water treatment plant are up to the newest building codes, meaning these buildings can be occupied even after large earthquake events. Seismic retrofit grant awards per the [Seismic Rehabilitation Grant Program](#)¹⁰ have been funded to retrofit Molalla Fire District Station 82 (Phase Two of 2015-2017 grant award, \$1,189,967).

Earthquake Regional Impact Analysis

In 2018 DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)). Their study focused on damage to buildings, and the people that occupy them, and to two key infrastructure sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and night time (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damage varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood structures that fare worse in an earthquake. The Portland Hills fault scenario created greater damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios, however, the impact is considerably less than it is to the transportation routes. Additional, capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts.

Table MO-11 shows the permanent resident population that are vulnerable to injury or death (casualty) and the buildings in the City that are susceptible to liquefaction and landslides, it does not predict that damage will occur in specific areas due to either liquefaction or landslide. More population and property are exposed to higher degrees of expected damage or casualty under the Portland Hills Fault "wet" scenario than in any other scenario.

¹⁰ The Seismic Rehabilitation Grant Program (SRGP) is a state of Oregon competitive grant program that provides funding for the seismic rehabilitation of critical public buildings, particularly public schools and emergency services facilities.

Table MO-11 Expected damages and casualties for the CSZ fault and Portland Hills fault: earthquake, soil moisture, and event time scenarios

	Cascadia Subduction Zone (M9.0)		Portland Hills Fault (M6.8)	
	"Dry" Soil	"Wet" Saturated Soil	"Dry" Soil	"Wet" Saturated Soil
Number of Buildings	3,176	3,176	3,176	3,176
Building Value (\$ Million)	854	854	854	854
Building Repair Cost (\$ Million)	21	21	37	37
Building Loss Ratio	2%	2%	4%	4%
Debris (Thousands of Tons)	11	11	14	16
Long-Term Displaced Population	8	8	17	17
Total Casualties (Daytime)	12	12	17	17
Level 4 (Killed)	0	0	1	1
Total Casualties (Nighttime)	3	3	7	7
Level 4 (Killed)	0	0	0	0

Source: DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8, 12-9, 12-10, and 12-11.

Cascadia Subduction Zone Scenario

The City of Molalla is expected to have a 2% building loss ratio with a repair cost of \$21 million under the CSZ “dry” scenario, and under the CSZ “wet” scenario.¹¹ The city is expected to have around 12 daytime or 3 nighttime casualties during the CSZ “dry” scenario and 12 daytime or 3 nighttime casualties during the CSZ “wet” scenario. It is expected that there will be a long-term displaced population of around 8 for the CSZ “dry” scenario and 8 for the CSZ “wet” scenario.¹²

Portland Hills Fault Scenario

The City of Molalla is expected to have a 4% building loss ratio with a repair cost of \$37 million under the CSZ “dry” scenario, and under the CSZ “wet” scenario.¹³ The long-term displaced population and casualties are greatly increased for all the Portland Hills Fault scenarios. The city is expected to have around 17 daytime or 7 nighttime casualties during the Portland Hills Fault “dry” scenario and 17 daytime or 7 nighttime casualties during the Portland Hills Fault “wet” scenario. It is expected that there will be a long-term displaced population of around 17 for the Portland Hills Fault “dry” scenario and 17 for the Portland Hills Fault “wet” scenario.¹⁴

Recommendations from the report included topics within Planning, Recovery, Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMPs mitigation strategies (Table MO-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and the recommendations see: *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, [O-18-02](#)).

Please review Volume I, Section 2 for additional information on this hazard.

¹¹ DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8 and 12-9.

¹² Ibid, Tables 12-8 and 12-9.

¹³ Ibid, Tables 12-10 and 12-11

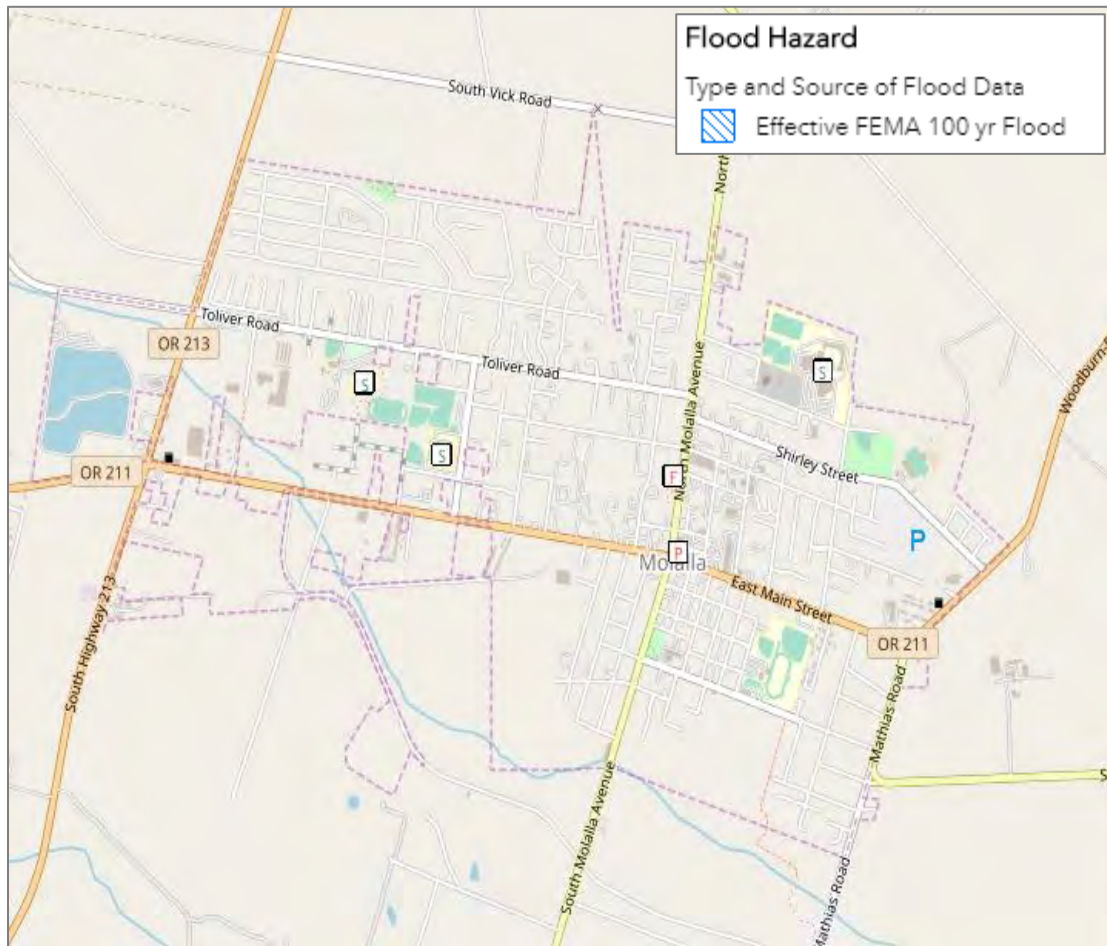
¹⁴ Ibid, Tables 12-10 and 12-11.

Flood

The HMAC determined that the City's probability for flood is **moderate** and that their vulnerability to flood is **moderate**. *The probability rating decreased and the vulnerability rating did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent, and probability of a potential event. Figure MO-4 illustrates the flood hazard area for Molalla.

Figure MO-4 Special Flood Hazard Area



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

Note: To view detail click the link above to access Oregon HazVu

The latest flooding incident was in February 2014 when Main Street was flooded. While Molalla does not show any areas within the FEMA mapped special flood hazard areas (100-year flood vulnerability), the city regularly experiences urban flooding. This is primarily due to inadequate storm drain pipes, and culverts that are too small. Molalla also has clay soils, which means that the percolation rate is very slow, and the water table is very high. Additionally, the extent of flooding will vary depending on climatic conditions and precipitation levels. Areas within Molalla that are frequently impacted by urban flooding events include: the intersection of South Cole and Main Street; East 3rd Street; Mathias Road south of 8th Street; areas south of 7th Street; and Highway 213 south of Toliver Road.

Typically, roads are covered with water in urban flooding events, and water will occasionally overflow manholes in some parts of the city. Newer homes are built on higher ground to avoid flooding issues, and many older homes have pumps within their crawlspaces to avoid flood events.

Vulnerability Assessment

Due to insufficient data and resources, Molalla is currently unable to perform a quantitative risk assessment for this hazard. Molalla is a “Non-special Flood Hazard Area” (NSFHA), which means the entire city is in a low-to-moderate risk flood zone. A NSFHA is not in any immediate danger from flooding caused by overflowing rivers or hard rains.

Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage, and economic loss from business interruption. It is important for the City to be aware of flooding impacts and assess its level of risk.

The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners, and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of Molalla outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage.

The extent of flooding hazards in Molalla primarily depends on climate and precipitation levels. Additionally, withdrawals for irrigation and drinking water, as well as stream and wetland modifications or vegetation removal can influence water flow. In the past flooding has occurred along Main Street and other roadways due to urban flooding. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables MO-5 through MO-10.

Mitigation Activities

Molalla employs several mitigation strategies to reduce the city’s risk to flood events. The city development code includes policies and regulations for flood prone areas including the Water Resources Overlay District, and mapping and protecting ‘significant vegetation’ within the City’s community design standards. Development review practices and conditions of development require developers to account for all stormwater management onsite to reduce the risks of urban flooding in the future. Molalla regularly inspects and maintains the stormwater facilities. Enclosed pipe sections and catch basins are routinely cleaned and inspected using the combination truck, and a regular street sweeping program reduces the amount of debris and contaminants entering the stormwater system. The Stormwater Master Plan and Water System Mater Plan both address the potential for urban flooding and actions to avoid it in the future.

National Flood Insurance Program (NFIP)

FEMA’s Flood Insurance Study (FIS), and Flood Insurance Rate Maps (FIRMs) are effective as of June 17, 2008. Table MO-12 shows that as of July 2018, Molalla has six (6) National Flood Insurance Program (NFIP) policies in force. Of those, one (1) is for a property that was

constructed before the initial FIRMs. Molalla has not had a Community Assistance Visit (CAV) and does not participate in the Community Rating System (CRS). The table shows that all flood insurance policies are for residential structures, primarily single-family homes. There has been a total of four (4) paid claims for \$110,943. The City complies with the NFIP through enforcement of their water resources overlay district and the mapping of their local wetland inventory.

The Community Repetitive Loss record for Molalla identifies no Repetitive Loss Properties¹⁵ or Severe Repetitive Loss Properties¹⁶.

Table MO-I2 Flood Insurance Detail

	Clackamas County	Molalla
Effective FIRM and FIS	6/17/2008	6/17/2008
Initial FIRM Date	-	6/17/2008
Total Policies	1,957	6
Pre-FIRM Policies	1,086	1
Policies by Building Type		
Single Family	1,761	5
2 to 4 Family	30	1
Other Residential	58	0
Non-Residential	9	0
Minus Rated A Zone	123	0
Insurance in Force	\$541,833,400	\$1,927,900
Total Paid Claims	590	4
Pre-FIRM Claims Paid	450	2
Substantial Damage Claims	83	0
Total Paid Amount	\$20,830,662	\$110,943
Repetitive Loss Structures	51	0
Severe Repetitive Loss Properties	4	0
CRS Class Rating	-	NP
Last Community Assistance Visit	-	-

Source: Information compiled by Department of Land Conservation, and Development, July 2018.

Note: The portion of the cities of Portland and Tualatin that are within Clackamas County are not included in this table.

NP = Not Participating

Please review Volume I, Section 2 for additional information on this hazard.

¹⁵ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

¹⁶ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP, and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000, and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

Landslide

The HMAC determined that the City's probability for landslide is **low** and that their vulnerability to landslide is **low**. *The probability rating did not change, while the vulnerability rating decreased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Molalla does not have a history of landslides. This is due to the relatively flat topography within the UGB as well as the City's requirements of geological analysis on slopes of 25% or greater, usually located along stream embankments, before extensive tree removal, excavation, or construction occurs.

Although landslides have not occurred in Molalla, in 1996 a landslide upstream of Molalla dammed the Molalla River for about 6 or 7 hours and destroyed the City's intake valves. A dammed river is the City's biggest vulnerability to landslide hazards, which could also damage Highway 211 and 213 bridges.

Landslide susceptibility exposure for Molalla is shown in Figure MO-5. Most of Molalla demonstrates a low landslide susceptibility exposure. There are no areas within Molalla that have very high or high landslide susceptibility exposure, while approximately 4% show moderate landslide susceptibility exposure.¹⁷

Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard, and assets.

Vulnerability Assessment

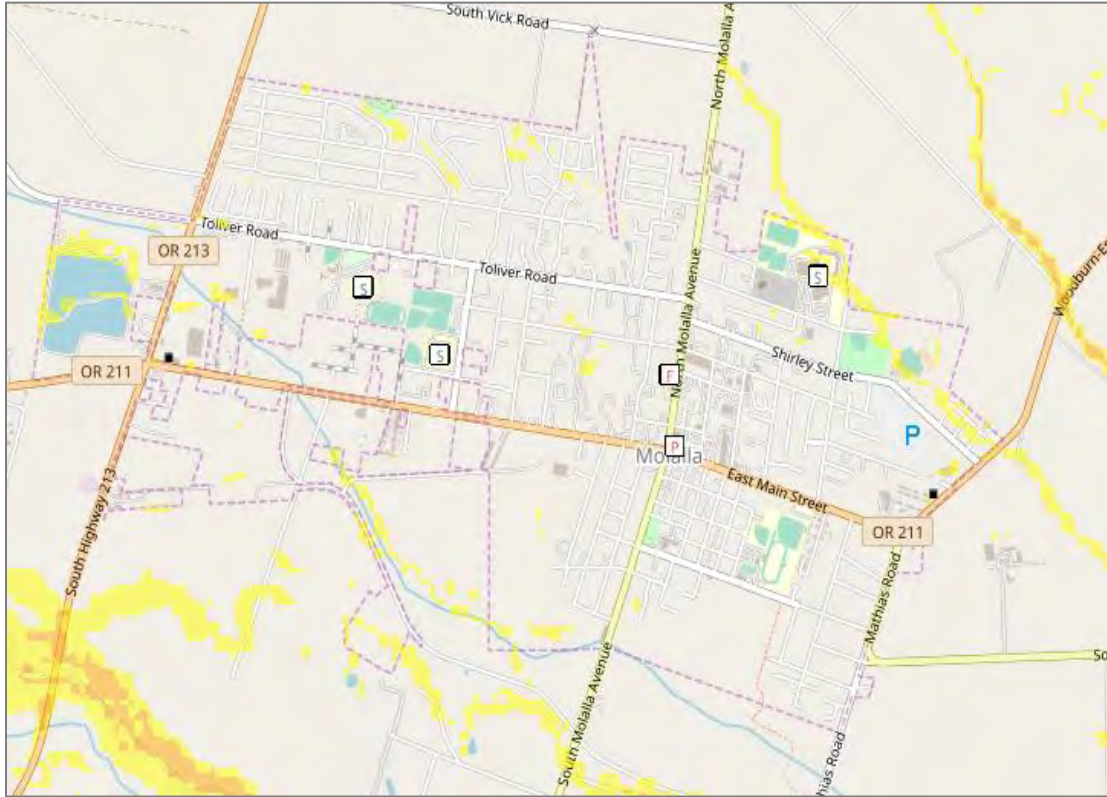
Due to insufficient data and resources, Molalla is currently unable to perform a quantitative risk assessment for this hazard. However, DOGAMI completed a statewide landslide susceptibility assessment in 2016 ([O-16-02](#)), general findings from that report are provided above and within Figure MO-5.

Potential landslide-related impacts are adequately described within Volume I, Section 2, and include infrastructure damages, economic impacts (due to isolation, and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides, and debris flows can potentially occur during any winter, and thoroughfares beyond City limits are susceptible to obstruction as well. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables MO-5 through MO-10.

The most common type of landslides are slides caused by erosion. Slides move in contact with the underlying surface, are generally slow moving, and can be deep. Rainfall-initiated landslides tend to be smaller; while earthquake induced landslides may be quite large. All soil types can be affected by natural landslide triggering conditions.

¹⁷ DOGAMI. [Open-File Report, O-16-02](#), *Landslide Susceptibility Overview Map of Oregon* (2016)

Figure MO-5 Landslide Susceptibility Exposure



Low	Landsliding unlikely. Areas classified as Landslide Density = Low (less than 7%) and areas classified as Slopes Prone to Landsliding = Low.
Moderate	Landsliding possible. Areas classified as Landslide Density = Low to Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = Moderate OR areas classified as Landslide Density = Moderate (7%-17%) and areas classified as Slopes Prone to Landsliding = Low.
High	Landsliding likely. Areas classified as Landslide Density = High (greater than 17%) and areas classified as Slopes Prone to Landsliding = Low and Moderate OR areas classified as Landslide Density = Low and Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = High.
Very High	Existing landslides Landslide Density and Slopes Prone to Landsliding data were not considered in this category. Note: the quality of landslide inventory (existing landslides) mapping varies across the state.

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

Note: To view detail click the link above to access Oregon HazVu

Mitigation Activities

Molalla works to mitigate future landslide hazards. The city development code includes several policies and regulations to protect slopes as mentioned above. Within the Comprehensive Plan there is language that make slopes of 25% or greater as unbuildable. The Municipal Code has surface and subsurface drainage requirements (21.70.100) to limit the potential of changes to surface drainage on slopes.

Please review Volume I, Section 2 for additional information on this hazard.

Severe Weather

Severe weather can account for a variety of intense, and potentially damaging hazard events. These events include extreme heat, windstorms, and winter storms. The following section describes the unique probability, and vulnerability of each identified weather hazard.

Extreme Heat

The HMAC determined that the City's probability for extreme heat events is **moderate** and that their vulnerability is **moderate**. *The probability rating decreased, and the vulnerability rating did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the City as well.

A severe heat episode or "heat wave" occurs about every two to three years, and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days with temperatures greater than or equal to 90-degrees, or 100-degrees, Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit, and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The City of Molalla has not experienced any life-threatening consequences from the few historical extreme heat events, although changes in climate indicate that the area should expect to see more extreme heat events.

Please review Volume I, Section 2 for additional information on this hazard.

Windstorm

The HMAC determined that the City's probability for windstorm is **high** and that their vulnerability to windstorm is **moderate**. *The probability and vulnerability ratings did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent, and probability of a potential event within the region. Because windstorms typically occur during winter months, they are sometimes accompanied by flooding and winter storms (ice, freezing rain, and very rarely, snow). Other severe weather events that may accompany windstorms, including thunderstorms, hail, lightning strikes, and tornadoes are generally negligible for Molalla.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation, and economic disruptions result as well.

Damage from high winds generally has resulted in downed utility lines, and trees usually limited to several localized areas. Electrical power can be out anywhere from a few hours to several days. Outdoor signs have also suffered damage. If the high winds are accompanied

by rain (which they often are), blowing leaves, and debris clog drainage-ways, which in turn may cause localized urban flooding.

Please review Volume I, Section 2 for additional information on this hazard.

Winter Storm (Snow/Ice)

The HMAC determined that the City's probability for winter storm is **high** and that their vulnerability to winter storm is **moderate**. *The probability and vulnerability ratings did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent, and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the City typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

The biggest impact of winter storms is congestion on roadways. In January 2007 the City experienced freezing temperatures and high winds caused a tree to fall on the main fire station and blocked some of the roads.

Most winter storms typically do not cause significant damage, they are frequent, and have the potential to impact economic activity. Road, and rail closures due to winter weather are an uncommon occurrence but can interrupt commuter, and commercial traffic as noted above.

Vulnerability Assessment

Due to insufficient data and resources, Molalla is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Assets section and Tables MO-5 through MO-10.

Mitigation Activities

Mitigating severe weather can be difficult because storms affect all areas of the city, but Molalla has made progress to reduce the effects of storms. Most utilities are above ground, though all new utilities are required to be underground. All water, phone and sewer lines have been placed underground. Molalla also has snowplows and clears arterials first to help expedite snow removal.

Please review Volume I, Section 2 for additional information on this hazard.

Volcanic Event

The HMAC determined that the City's probability for a volcanic event is **low** and that their vulnerability to a volcanic event is **low**. *The probability rating did not change, while the vulnerability decreased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of volcanic hazards, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the western portion of the County is likely to affect Molalla as well. Several

volcanoes are located near Molalla, the closest of which are Mount Hood, Mount Adams, Mount Saint Helens, Mount Rainier, and the Three Sisters.

Vulnerability Assessment

Due to insufficient data and resources, Molalla is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables MO-5 through MO-10.

Due to Molalla's relative distance from volcanoes, the city is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Depending on wind patterns and which volcano erupts, however, the city may experience ashfall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city could experience a heavier coating of ash.

Mitigation Activities

The existing volcano hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Wildfire

The HMAC determined that the City's probability for wildfire is **moderate**, and that their vulnerability to wildfire is **high**. *These ratings did not change since the previous version of this NHMP addendum.*

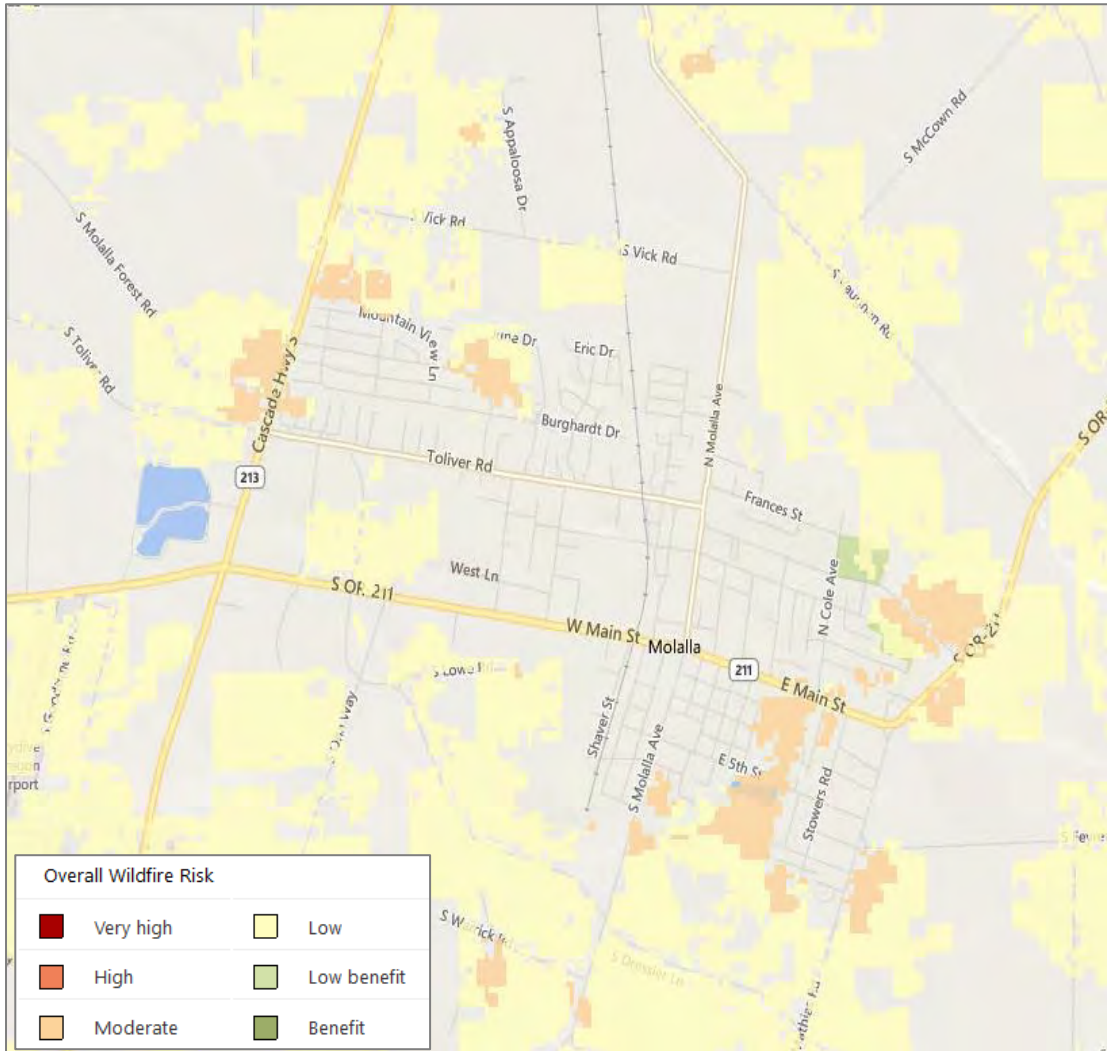
The [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) was completed in May 2018. The CWPP is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard: <https://www.clackamas.us/dm/CWPP.html>. Information specific to Molalla is found in the following chapter: [Chapter 10.9: Molalla Rural Fire Protection District #73](#).

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions. Weather, and urbanization conditions are primarily at cause for the hazard level. Molalla has not experienced a wildfire within City limits, but the city has abundant wooded areas that are a concern in the case of a wildfire event. Figure MO-6 shows overall wildfire risk in Molalla.

Clackamas County has two major physiographic regions: the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern Clackamas County. The Willamette River Valley, which includes Molalla, is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range has a relatively small population and is characterized by heavily forested slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to its dense forest land. Human caused fires are responsible for most fires in

Clackamas County. In Molalla most instances the fires have been small enough to contain quickly and easily.

Figure MO-6 Overall Wildfire Risk



Source: [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

Molalla is surrounded mostly by farmlands which creates a buffer from the forested areas. There are some areas of heavy tree coverage in the northeast and southern portions of the City. Identified High and Medium Priority Communities at Risk (CARs) are all located outside of the City limits.¹⁸ Wildfires are not a frequent occurrence within the city, but regional wildfires occasionally introduce pollutants within the city. Molalla sits in the bottom of a valley, and pollution from regional fires settles in the area, causing health concerns for residents.

Most of the city has less severe (moderate or less) wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions.¹⁹ However,

¹⁸ Clackamas County Community Wildfire Protection Plan, *Molalla Fire Department* (2018), Table 10.13-1.

¹⁹ [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

conditions vary widely and with local topography, fuels, and local weather (including wind) conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts.

Vulnerability Assessment

Due to insufficient data and resources, Molalla is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables MO-5 through MO-10.

The potential community impacts, and vulnerabilities described in Volume I, Section 2 are generally accurate for the City as well. Molalla's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. The City will update the City's wildfire risk assessment if the fire plan presents better data during future updates (an action item is included to participate in future updates to the CWPP).

Property can be damaged or destroyed with one fire as structures, vegetation, and other flammables easily merge to become unpredictable, and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

Mitigation Activities

Molalla uses several mitigation tools to reduce the city's risk to wildfires. Molalla Rural Fire Protection District #73 adopted a district-wide wildland map that governs new construction, and an active public education program for high risk-wildfire areas (including information on fire prevention and defensible space).

Please review the [2017 Clackamas Community Wildfire Protection Plan \(CWPP\)](#) and Volume I, Section 2 for additional information on this hazard.

ATTACHMENT A: ACTION ITEM FORMS

ACTION ITEM FORMS

Multi-Hazard #1	41
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Flood #2*	47
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Severe Weather #1	49
Wildfire #1	50
Wildfire #2	51

* - Priority Action Item

Note: The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity.

Summary of Action Changes

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

Previous NHMP Actions Completed:

Flood Action #1 (2012): “Evaluate flooding risk in areas being considered for future growth, as it relates to the comprehensive plan” was removed. During the recent comprehensive plan update process, it was determined that areas of potential growth are outside of flood hazard areas. Existing flood ordinance have been deemed adequate for current and potential growth.

Flood Action #4 (2012): “Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances” is considered complete. It was determined by the steering committee that this action is a function of NFIP participation, as such the action is not needed in the NHMP since participation in the NFIP requires compliance. Additionally, the City does not have areas of mapped special flood hazard areas.

See 2018 status identified in each action for activities that have been completed since the previous plan.

New NHMP Actions added to this version (2018/2019):

No new actions were added during this update.

Previous NHMP Actions Removed from this version:

Multi-Hazard Action #3 (2012): “Identify and pursue funding opportunities to develop and implement hazard mitigation activities” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Multi-Hazard Action #4 (2012): “Continue to update and improve hazard assessments in the Natural Hazards Mitigation Plan as new information becomes available” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and considered during the five-year plan updates and did not need to be included as an action.

Multi-Hazard Action #6 (2012): “Identify and encourage churches and other facilities to become certified Red Cross shelter sites and maintain a list of disaster shelters located throughout Molalla” was removed from the list since this is a function of the Red Cross and not the City’s job to complete.

Note: 2012 Actions MH#5 and MH#7 were renumbered to 2018/2019 Actions MH#3 and MH#4. 2012 Actions FL#2, FL #3, and FL#5 were renumbered to 2018/2019 Actions FL #1, FL #2, and FL #3

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 HMAAC 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 Severe Weather Action Item #1: *“Reduce negative effects from severe windstorm and severe winter storm events”* has been addressed by requiring new developments to put utilities underground and there are snowplow routes determined, the HMAC will continue this effort of mitigating severe weather 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:	
Develop public education programs to inform the public about methods for mitigating the impacts of natural hazards.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Conducting public outreach campaigns raises awareness about natural hazards and helps illustrate what residents and businesses can do to reduce the impact of a natural disaster on their properties, thereby significantly reducing the impact of natural hazards on the City of Molalla. • The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the county's actions to mitigate hazards. • The City currently does hazard planning activities and is continuing to work on public outreach. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Conduct public education as hazard seasons approach. These include: earthquake awareness month in April, wildfire prevention in summer, flood, severe storm and landslide outreach in fall/winter; • Identify property owners in flood and wildfire hazard zones and conduct a target mailing to disseminate hazard information; • Partner with Clackamas County and other jurisdictions to develop public education flyers for all hazards; • Include hazard information on the city website; • Encourage individual homeowners to implement mitigation practices; • Educate the public about the resources available for hazard mitigation, response, and preparedness; • Include insurance information in public outreach and education materials. 			
Coordinating Organization:		Planning Commission	
Internal Partners:		External Partners:	
Planning, City Recorder		Neighborhood Associations, Molalla Chamber of Commerce, Clackamas County Emergency Management, Oregon Office of Emergency Management, FEMA	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

Multi-Hazard #2

Proposed Action Item:		Alignment with Plan Goals:	
Continue to integrate mitigation strategies into existing regulatory documents and programs, where appropriate.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Zoning Ordinance			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating natural hazards plans into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community. The City updated their Design Standards within their development code. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Use the mitigation plan to help the City's Comprehensive Land Use Plan meet 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 mitigation strategies within current capital improvement plans. When applicable, utilize mitigation funding to assist with capital improvement projects. Incorporate the Natural Hazards Mitigation Plan into deed restrictions and conditions of approval where appropriate. 			
Coordinating Organization:		Planning Commission	
Internal Partners:		External Partners:	
Planning		Department of Land Conservation and Development, Department of Geology and Mineral Industries, Oregon Department of Transportation, Department of Environmental Quality	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, DLCD Technical Assistance Grant		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

Multi-Hazard #3

Proposed Action Item:		Alignment with Plan Goals:	
Continue vegetation management throughout the city.		Enhance Natural Systems; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Landscaping and vegetation make a difference in mitigating the impacts of natural hazards. Trees break the force of the wind and stabilize the soil. Wetlands absorb much of the overflow from stream channels. Fire-resistant vegetation can retard the spread of wildfires toward vulnerable buildings. Limiting or regulating the amount of vegetation cleared off a hillside lot reduces the risk of increasing the number of landslide-prone areas in a community. Planting vegetation or maintaining slope terraces can also reduce slope-runoff. Planners can use landscaping requirements to preserve or enhance the protection such natural features afford. These requirements may be part of site plan reviews or a separate set of zoning regulations and environmental performance standards. The City has updated their code enforcement and stormwater management practices around vegetation. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Partner with Clackamas County, Oregon Department of Transportation (ODOT), railroad companies, Oregon Department of Forestry (ODF), US Forestry Service (USFS), and citizens to control vegetation along transportation corridors; Identify appropriate practices for eliminating invasive species such as blackberry and English Ivy; Maintain a healthy tree population to develop a canopy within the urban area; Maintain vegetation coverage for slope stability; Provide education to the public about justifications for, and benefits of vegetation mitigation practices. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Code Enforcement		Clackamas County, railroad companies, ODOT, ODF, PGE, USFS	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

Multi-Hazard #4

Proposed Action Item:		Alignment with Plan Goals:	
Identify and map out evacuation routes for all hazards.		Protect Life and Property; Augment Emergency Services; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Mapping out evacuation routes for all hazards before those hazards occur help first responders and residents know the routes to take when a situation arises. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Partner with nearby cities to ensure they are on board with the proposed evacuation routes. Ensure that MOU's with local Law Enforcement are up-to-date as copies of them will be needed in the event of a disaster; Hold a table-top exercise for City Staff and Special Districts to ensure they are aware of the proposed routes; Work with neighborhood associations and schools to distribute information regarding evacuation route. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Planning, Administration		Red Cross	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:		Added during the 2012 plan update process	
Priority:		Medium	

Earthquake #1*

Proposed Action Item:		Alignment with Plan Goals:	
Conduct seismic evaluations on City Hall/Police Building and implement appropriate structural and non-structural mitigation strategies.		Protect Life and Property; Augment Emergency Services	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. • The main fire station has been partially seismically retrofitted. The City Hall/Police building is next on the list of vulnerable public buildings. A new police department building is proposed to be built. Seismic upgrades are not scheduled at this time for City Hall. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Research non-structural seismic mitigation strategies; • Obtain funding to perform evaluations; • Prioritize seismic upgrades based on criticality of need and population served; • Partner with appropriate organizations to implement seismic upgrades; • Seismically retrofit facilities to guarantee continuous operation during and after a natural disaster. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Administration		Clackamas County Emergency Management, Oregon Office of Emergency Management, Infrastructure Finance Authority, DOGAMI, FEMA	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Seismic Rehabilitation Grant Program, Hazard Mitigation Assistance Grants		Moderate to High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	High		

* - High Priority Action Item

Flood #1*

Proposed Action Item:		Alignment with Plan Goals:	
Obtain funding for implementing recommendations outlined in the Stormwater Master Plan.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Stormwater Master Plan; Wetland Inventory Overlay			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. The Stormwater Master Plan addresses the issues around urban flooding that Molalla is currently vulnerable to. The Stormwater Master Plan is scheduled to be updated 2021/2022 and obtaining funding is ongoing. Priority is to update SDC's and rates. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Review all recommendations and determine priority for implementation; Identify funding sources to implement recommendations; Increase capacity of storm drain pipes and culverts throughout the city. Identify undersized culverts and pipes; prioritize construction projects; include culvert and pipe enhancement in the Capital Improvements Plan; and coordinate with the Oregon Department of Transportation for access to culverts along roadways (if applicable). 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Planning, Administration		ODOT; Department of Land Conservation and Development; Clackamas County Water Environmental Services	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	High		

* - High Priority Action Item

Flood #2*

Proposed Action Item:		Alignment with Plan Goals:	
Minimize overall impervious cover and disconnect impervious areas.		Protect Life and Property; Enhance Natural Systems	
Alignment with Existing Plans/Policies:			
Stormwater Master Plan; Natural Features Report			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Minimizing overall impervious cover is a management recommendation within the city's Natural Features Report. Paved roadways, sidewalks, driveways and parking areas are the primary sources of impervious surface area. Impervious areas alter runoff and recharge values and site hydrology. On the other hand, maintain pervious surfaces encourages surface water infiltration and groundwater recharge. Molalla deals mostly with urban flooding, which can be caused or exacerbate this type of flooding. The 2017 edition of Molalla's Public Works Standards addresses the issues around impervious cover and discusses the different types of projects to be accomplished in the near future. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Substitute pervious surfaces for impervious wherever possible; Utilize the minimum required width for streets and roads; Where appropriate, avoid the use of curb and gutter. Utilize vegetated open swales, preferably "engineered swales" with a permeable soil base; Minimize excess parking space construction; utilize pervious pavers in low-use areas; Minimize cul-de-sac diameters, use doughnut cul-de-sacs, or use alternative turnarounds; Minimize compaction of the landscape. In areas where soils will become compacted due to construction equipment, specify that the soils will be "disked" prior to seeding, and amended with loam or sand to increase absorption capacity; Require developers to design and construct drainage systems that cannot release more water from the new development than was released before the construction; Preserve natural vegetative cover; Disconnect streets and parking areas from closed culverts; Increase the time travel of water off of the site; Revegetate all cleared and graded areas; Provide sheet flow into natural open space; Protect wetlands and stream corridors. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Planning		Clackamas County Water Environmental Services	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Medium to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	High		

* - High Priority Action Item

Landslide #1

Proposed Action Item:		Alignment with Plan Goals:	
Identify and locate a secondary location for the water intake system and move it away from the hillside.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Development Code			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing a secondary location for the water intake system provides redundancy in the system and reduces the overall threat due to landslide to the water system. As of 2019, this remains a concern, however, it is also considered not feasible due to regulatory burden to relocate intake. 			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
<ul style="list-style-type: none"> Locate a safer location for the water system, away from the hillside. Research the feasibility of having a secondary water intake system, instead of moving the current one. Work with county's Planning and GIS departments to determine the feasibility of moving the water intake system. Identify possible funding opportunities to support the project. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Planning, Administration		Clackamas County Water Environment Services, Clackamas County Department of Transportation and Development – Planning, Clackamas County GIS	
Potential Funding Sources:		Estimated cost:	Timeline:
General fund		Medium to High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2012 plan development process		
Priority:	Low		

Severe Weather #1

Proposed Action Item:		Alignment with Plan Goals:	
Reduce negative effects from severe windstorm and severe winter storm events.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Stormwater Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to cause power outages can assist a community in mitigating its overall risk to wind and winter storms. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Reduce power outages by partnering with PGE to obtain funding to bury power lines subject to frequent failures; Encourage auxiliary power sources for hospitals, grocery stores, etc.; Develop partnerships to implement programs to keep trees from threatening lives, property, and public infrastructure; Continue to require new developments to underground power lines; Partner with PGE to continue hazardous tree inventory and mitigation programs. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Administration, Planning		PGE; ODOT; private landowners	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

Wildfire #1

Proposed Action Item:		Alignment with Plan Goals:	
Promote fire-resistant strategies for new and existing developments.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; 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:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wildfires to cause physical damage to homes can assist a community in mitigating its overall risk to wildfires. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Describe the procedures for ongoing maintenance of fuel breaks, and place information on the city website for public view; Require street design that facilitates the movement of firefighting equipment; Review roofing standards and develop recommendations for promoting noncombustible roofing; Maintain awareness of potential city growth into the wild land urban interface. 			
Coordinating Organization:		HMAC	
Internal Partners:		External Partners:	
Molalla RFD, Administration		Clackamas Fire Defense Board, Oregon Department of Forestry, U.S. Forest Service, U.S. Bureau of Land Management, public land management agencies	
Potential Funding Sources:		Estimated cost:	Timeline:
General fund, operating budgets		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Added during the 2009 plan development process		
Priority:	Medium		

Wildfire #2

Proposed Action Item:		Alignment with Plan Goals:	
Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan .		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; 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:			
The wildfire mitigation action items provide direction on specific activities that organizations and residents in Molalla can take to reduce wildfire hazards.			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
Wildfire Risk Assessment (Ch. 4):			
<ol style="list-style-type: none"> 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):			
<ol style="list-style-type: none"> 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):			
<ol style="list-style-type: none"> 1. Develop and FDB Communications Works Group. 2. Conduct a Conflagration Exercise. 			
Education and Community Outreach (Ch. 7):			
<ol style="list-style-type: none"> 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):			
<ol style="list-style-type: none"> 1. Identify a DTD representative for the WFEP. 2. Improve coordination with Rural Fire Agencies. 3. Integrate WU into Plan Map and include a public outreach strategy. 			
Coordinating Organization:		Molalla Rural Fire Protection District #73	
Internal Partners:		External Partners:	
Public Works, Parks and Recreation, Natural Resources		Clackamas Fire Defense Board, Oregon Department of Forestry, U.S. Forest Service, U.S. Bureau of Land Management, public land management agencies	
Potential Funding Sources:		Estimated cost:	Timeline:
ODF, operating budgets		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	High (CWPP identified priority actions listed above)		

ATTACHMENT B: PUBLIC INVOLVEMENT SUMMARY

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

To provide the public information regarding the draft NHMP addendum, and provide an opportunity for comment, an announcement (see text below) was provided on the city's website, social media pages, and the local newspaper including a method for the public to provide comment from August 16 through September 9.

During the public review period there were no comments provided.

Press Release

Molalla Natural Hazard Mitigation Plan Addendum

CLACKAMAS COUNTY PRE-DISASTER MITIGATION PLANNING

Note - the comment period is now closed. Thank you.

DATE: August 16, 2019

Notice and Opportunity for Public Comment - Molalla addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan Update -

Molalla seeks additional public input on update to Natural Hazard Mitigation Plan

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

A natural hazard mitigation plan provides communities with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities, and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

An electronic version of the updated draft Molalla NHMP addendum will be available for formal public comment beginning August 16, 2019 and ending September 4th, 2019.

Public Comment may be submitted in person, via email, or via snail mail as follows.

Physical Address: 117 N Molalla Ave, Molalla OR 97038

Email: dzinder@cityofmolalla.com

Mailing Address:

P.O. Box 248

Molalla, OR 97038

If you have any questions regarding the Molalla NHMP addendum or the update process in general, please contact:

Dan Zinder

Associate Planner

(503) 759-0226

dzinder@cityofmolalla.com

or

Michael Howard

Assistant Program Director for the Oregon Partnership for Disaster Resilience

(541) 346-8413

mrhoward@uoregon.edu

Supporting Documents

 Molalla Natural Hazard Mitigation Plan Addendum (2 MB)



City of Oregon City Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan



Photo Credit: Jason Faucera

March 2019

Volume II: Oregon City Addendum



Prepared for:

City of Oregon City

Prepared by:

University of Oregon
Institute for Policy Research and Engagement
Oregon Partnership for Disaster Resilience

Planning grant funding provided by:



FEMA

Federal Emergency Management Agency (FEMA)
Pre-Disaster Mitigation Program
Grant: EMS-2017-PC-0005
Sub-grant Application Reference: PDMC-PL-10-OR-2016-001, and

Additional Support Provided by:



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FEMA

September 25, 2019

The Honorable Jim Bernard
Chair, Clackamas County Commissioners
2020 Kaen Road Suite A
Oregon City, Oregon 97045

Dear Chairman Bernard:

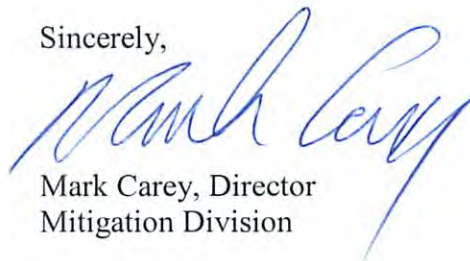
On April 12, 2019, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan* as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance grants through April 11, 2024, through your state.

Clackamas County	City of Estacada	City of Lake Oswego
City of West Linn	City of Wilsonville	City of Johnson City
City of Oregon City	City of Happy Valley	City of Canby
Clackamas Fire District		

The updated list of approved jurisdictions includes the cities of Canby, Happy Valley, Oregon City, Johnson City, and the Clackamas Fire District which recently adopted the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan*. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Joseph Murray, State Hazard Mitigation Planner with Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities.

Sincerely,



Mark Carey, Director
Mitigation Division

Enclosure

JG

RESOLUTION NO. 19-30

A RESOLUTION ADOPTING THE CITY OF OREGON CITY REPRESENTATION IN THE CLACKAMAS COUNTY MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN UPDATE

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

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

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

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

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

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

WHEREAS, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *City of Oregon City Addendum* to the *Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan* (Exhibit A) and pre-approved it (dated, July 24, 2019) contingent upon this official adoption of the participating governments and entities; and

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

WHEREAS, the NHMP is in an ongoing cycle of development and revision to improve its effectiveness.

NOW, THEREFORE, OREGON CITY RESOLVES AS FOLLOWS:

Section 1. The City of Oregon City adopts the *Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan (NHMP)* (attached as Exhibit B) as its official plan along with the *Oregon City Addendum to the NHMP* (attached as Exhibit A) and directs the City Manager to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.

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


Section 3. This resolution shall take effect immediately upon its adoption by the City Commission.

Approved and adopted at a regular meeting of the City Commission held on the 4th day of September 2019.



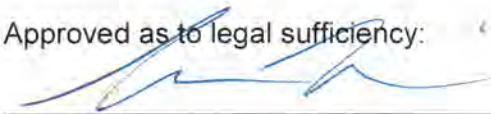
DAN HOLLADAY, Mayor

Attested to this 4th day of September 2019:



Kattie Riggs, City Recorder

Approved as to legal sufficiency:



City Attorney

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Purpose

This is an update of the Oregon City addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation and Volume III (Appendices) which provide additional information. This addendum meets the following requirements:

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

Updates to Oregon City's addendum are further discussed throughout the NHMP and within Volume III, Appendix B, which provides an overview of alterations to the document that took place during the update process.

Oregon City adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on **September 4, 2019**. FEMA Region X approved the Clackamas County NHMP on **April 12, 2019** and the City's addendum on **September 25, 2019**. With approval of this NHMP the City is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **April 11, 2024**.

Mitigation Plan Mission

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

The City concurs with the mission statement developed during the Clackamas County planning process (Volume I, Section 3):

Promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

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

The City concurs with the goals developed during the Clackamas County planning process (Volume I, Section 3). All NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Below is a list of the NHMP goals:

GOAL #1: PROTECT LIFE AND PROPERTY

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

GOAL #2: ENHANCE NATURAL SYSTEMS

- Balance watershed planning, natural resource management, and land use planning with natural hazards mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

GOAL #3: AUGMENT EMERGENCY SERVICES

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, and business, and industry.
- Coordinate and integrate natural hazards mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL #4: ENCOURAGE PARTNERSHIPS FOR IMPLEMENTATION

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

GOAL #5: PROMOTE PUBLIC AWARENESS

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

NHMP Process, Participation and Adoption

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

Oregon City first developed an addendum to Clackamas County's Natural Hazards Mitigation Plan in 1998, but the plan did not meet FEMA criteria and did not get adopted, this also happened when Oregon City tried again for the 2002 addendum. Oregon City's Plan was finally approved and adopted in 2009 with updates in 2012 and now in 2018. The last update of the Oregon City addendum to the Clackamas County NHMP was approved by FEMA on April 8, 2013.

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

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM), Clackamas County and Oregon City to update their NHMP. This project is funded through the Federal Emergency Management Agency's Pre-Disaster Mitigation (PDM) Competitive Grant Program EMS-2017-PC-0005 (PDMC-PL-10-OR-2016-001). Members of the Oregon City NHMP Hazard Mitigation Plan Committee also participated in the County NHMP update process (Volume III, Appendix B).

The Clackamas County NHMP and Oregon City addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector and regional organizations. The Oregon City Hazard Mitigation Advisory Committee (HMAC) guided the process of developing the NHMP.

Convener

Oregon City's Public Works Director served as the designated convener of the NHMP update and will take the lead in implementing, maintaining and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the Oregon City HMAC met formally and informally, to discuss updates to their addendum (Volume III, Appendix B). The HMAC reviewed and revised the City's addendum, with focus on the NHMP's risk assessment and mitigation strategy (action items).

This addendum reflects decisions made at the designated meetings and during subsequent work and communication with Clackamas County Resilience Coordinator and the OPDR. The changes are highlighted with more detail throughout this document and within Volume III, Appendix B. Other documented changes include a revision of the City's risk assessment and hazard identification sections, NHMP mission and goals, action items and community profile.

The Oregon City HMAC was comprised of the following representatives:

- Convener, John Lewis, Public Works Director
- Martin Montalvo, Public Works Operations Manager (*former*)
- Kelly Reid, Planner
- Vance Walker, Assistant Public Works Director

Public participation was achieved with the establishment of the HMAC, which was comprised of City officials representing different departments and sectors and members of the public. The HMAC served as the local review body for the NHMP's development. Community members were provided an opportunity for comment via the NHMP review process, and through a survey administered by Clackamas County (Volume III, Appendix G).

NHMP Implementation and Maintenance

The City Commission will be responsible for adopting the Oregon City addendum to the Clackamas County NHMP. This addendum designates the HMAC, and a convener to oversee the development, and implementation of action items. Because the City addendum is part of the County's multi-jurisdictional NHMP, the City will look for opportunities to partner with the County. The City's HMAC will convene after re-adoption of the Oregon City NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation, and maintenance during their meetings. The Public Works Director will serve as the convener and will be responsible for assembling the HMAC. The HMAC will be responsible for:

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing, and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating, and training new HMAC members on the NHMP, and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement; and
- Documenting successes, and lessons learned during the year.

The convener will also remain active in the County's implementation, and maintenance process (Volume I, Section 4).

The City will utilize the same action item prioritization process as the County (Volume I, Section 4).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, and Building Codes, as well as the [Clackamas County NHMP](#), and the [State of Oregon NHMP](#).

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the city. Plans and policies already in existence have support from residents, businesses and policy makers. Where possible, Oregon City will implement the NHMP's recommended actions through existing plans and policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Future development without proper planning may result in worsening problems associated with natural hazards. Metro, the regional government for Clackamas, Multnomah, and Washington counties, determines many land use laws for the tri-county region and sets the urban growth boundary. The entire Portland Metro area is subject to tremendous growth pressures due to its desirable location and the restrictions on urban sprawl placed by urban growth boundary requirements.

Oregon City's acknowledged comprehensive plan is the Oregon City Comprehensive Plan (1982, updated June 2004). The Oregon Land Conservation and Development Commission first acknowledged the plan in 1982. The City implements the plan through the development regulations (zoning, subdivision and related ordinances).

Oregon City currently has the following plans that relate to natural hazard mitigation. For a complete list visit the City's [website](#):

- [Comprehensive Plan \(1982, amended 2004\)](#)
 - [Comprehensive Plan Map](#)
- [Oregon City Municipal Code \(revised 7/2018\)](#)
 - Title 12 Streets, Sidewalks and Public Places, [Chapter 12.08 Public and Street Trees](#)
 - [Title 15 Buildings and Construction](#)
 - [Title 17 Zoning, Chapter 17.40 Historic Overlay District](#)
 - [Title 17 Zoning, Chapter 17.41 Tree Protection Standards](#)
 - [Title 17 Zoning, Chapter 17.42 Flood Management Overlay District](#)
 - [Title 17 Zoning, Chapter 17.44 US Geologic Hazards](#)
 - [Title 17 Zoning, Chapter 17.47 Erosion and Sediment Control](#)
 - [Title 17 Zoning, Chapter 17.49 Natural Resource Overlay Zone](#)
- Building Code, [2017 Oregon State Code](#) based on 2015 International Residential Code (IRC) and 2012 International Building Code
- [Downtown Community Plan](#)
- Oregon City Operations Facilities Plan
- [Transportation System Plan](#)
- [Portland Metro 2014 Regional Transportation Plan](#)
- [Sanitary Sewer Master Plan](#)
- [Stormwater Plans](#)
 - Erosion Prevention and Sediment Control Planning and Design Manual
 - Drainage Master Plan
 - South End Basin Master Plan
 - Caulfield Basin Master Plan
 - Park Place Basin Master Plan

- [Water Master Plan](#)
- [Willamette Falls Legacy Project Master Plan](#)

Government Structure

The City Commission is the policy making body for Oregon City. The commission is composed of a mayor and four commissioners, all of whom are elected from the city at large. The Mayor and Commissioners in turn appoint the city manager, who serves as the administrative head of the city's government.

The following departments within the city have a role in natural hazards mitigation:

The **Community Development Department** is responsible for guiding growth and development in the city. The department includes three divisions:

- **Building** is responsible for plan review and inspections on commercial, industrial and residential developments, as well as fire life and safety plan review.
- **Planning** is responsible for all long range and current planning for new development, as well as the city's natural resource, geologic hazard and floodplain overlay zones. It is also responsible for implementation of the Oregon City Comprehensive Plan.
- **Geographic Information Services (GIS)** supplies mapping services to the public, city planners, engineers, public works, and other departments.

The **Public Works Department** operates and maintains existing infrastructure, plans and constructs capital improvements, and enforces the municipal code. The public works department includes six divisions:

- **Engineering Services** reviews and approves development applications to ensure they are up-to-date on policies and engineering standards. It provides professional engineering services and consultation to various city departments and the public for private development.
- **Water Operations** distributes and maintains the potable water supply.
- **Wastewater Operations** provides wastewater utility by maintaining and improving the wastewater collection system. They also respond to emergency system bypasses to reduce hazards to human health and the environment.
- **Stormwater Division** provides a safe and reliable stormwater system and implements watershed protection and restoration actions that promote surface water quality and stream health.
- **Streets Division** maintains Oregon City's transportation system.

The **Finance Department** manages the city budget, information systems, and accounting. Tasks of the department include utility billing, accounts payable and receivable, payroll, budget development and management, and internal auditing.

The **Public Safety Department** is committed to providing quality public safety services to the Oregon City community. Police services are provided by the Oregon City Police Department and fire services are provided by Clackamas Fire District #1.

- **Code Enforcement** provides prompt, effective and efficient enforcement of the Oregon City Municipal Code.

The **Community Services Department** focuses on increasing, improving, and facilitating communication between the city and its residents. The department supports Oregon City Neighborhood Associations, the Citizen Involvement Committee, and numerous other citizen involvement committees. The department also manages the Library, Senior Center, and Parks and Recreation.

Continued Public Participation

An open public involvement process is essential to the development of an effective NHMP. To develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunities for the public, neighboring communities, local, and regional agencies, as well as, private, and non-profit entities to comment on the NHMP during review.¹ Keeping the public informed of efforts to reduce its risk to future natural hazard events is important for successful NHMP implementation, and maintenance. As such, the City is committed to involving the public in the NHMP review and update process (Volume I, Section 4). The City posted the plan update for public comment before FEMA approval, and after approval will maintain the plan on the City's website:

<https://www.orcity.org/publicworks/natural-hazards-mitigation-plan>

NHMP Maintenance

The Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan and City addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the County NHMP update process, the City will also review and update its addendum (Volume I, Section 4). The convener will be responsible for convening the HMAC to address the questions outlined below.

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

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

¹ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

Mitigation Strategy

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

The City's mitigation strategy (action items) were first developed during the 2009 NHMP planning process (actions from earlier versions mitigation plans that were not formally adopted were reviewed at this time). During this process, the HMAC assessed the City's risk, identified potential issues and developed a mitigation strategy (action items).

During the 2018 update process the City re-evaluated their mitigation strategy (action items). During this process action items were updated, noting what accomplishments had been made and whether the actions were still relevant; any new action items were identified at this time (see Volume III, Appendix B for more information on changes to action items).

Priority Action Items

Table OC-1 presents a list of mitigation actions. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity. High priority actions are shown in **bold** text with grey highlight. The City will focus their attention, and resource availability, upon these achievable, high leverage, activities over the next five-years. Although this methodology provides a guide for the HMAC in terms of implementation, the HMAC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for detailed information for each action. Full text of the plan goals referenced in Table OC-1 is located on page OC-2.

Table OC-I Oregon City Action Items

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
MH#1	Maintain Certification and coordinate with Clackamas County and regional partners to identify and coordinate building officials that are qualified to conduct damage assessments.	Oregon City Emergency Management	Building	Ongoing	✓		✓	✓	
MH#2	Integrate the goals and action items from the Oregon City Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	Community Development	Public Works, City Commission	Ongoing	✓	✓	✓	✓	✓
MH#3	Develop, enhance, and implement education programs aimed at mitigating natural hazards, and reducing risk.	Community Development	Public Works, CFD #1	Ongoing	✓		✓	✓	✓
MH#4	Improve vegetation management throughout Oregon City.	Community Services	Community Development, Code Enforcement, Parks and Recreation, Public Works	Ongoing			✓		✓
EQ#1	Conduct seismic evaluations on identified community assets and ‘high risk’ school and emergency service buildings and implement appropriate structural and non-structural mitigation strategies.	Oregon City Emergency Management	Community Development, Public Works	Long Term	✓		✓	✓	
FL#1	Promote and protect the use of naturally flood prone open space or wetlands as flood storage areas.	Community Development	Public Works	Ongoing	✓	✓		✓	✓

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
FL#2	Continue participating in the National Flood Insurance Program and develop strategies to reduce property damage and related financial impacts due to flooding.	Community Development	Public Works	Ongoing	✓			✓	
FL#3	Complete periodic updates of the Surface Water Management Master Plan.	Public Works	Community Development	Ongoing	✓	✓	✓	✓	
LS#1	Continue to implement municipal codes and policies mitigating future landslide damage.	Public Works	Community Development	Ongoing	✓	✓		✓	✓
LS#2	Maintain an inventory of streets and properties threatened by landslides.	Mapping/GIS	Community Development, Public Works	Ongoing	✓	✓		✓	✓
SW#1	Reduce frequency and duration of power outages from the severe wind and winter storm hazards where possible.	Public Works	Community Development	Ongoing	✓	✓	✓	✓	✓
WF#1	Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan	Clackamas Fire District #1	Community Development, Public Works	Ongoing	✓	✓	✓	✓	✓
WF#2	Complete periodic updates of the Water Master Plan.	Public Works	Community Development	Ongoing	✓	✓	✓	✓	✓
WF#3	Promote fire-resistant strategies and the use of non-combustible roofing materials by evaluating and making recommendations to current code to encourage noncombustible roofing standards in high fire-hazard areas.	Community Development	Public Works; Clackamas Fire District #1	Ongoing	✓	✓	✓	✓	✓

Source: Oregon City HMAC, 2018.

Note: Full text of the plan goals referenced in this table is located on page OC-2.

Risk Assessment

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

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

The local level rationale for the identified mitigation strategies (action items) is presented herein, and within Volume I, Section 2, and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure OC-1. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure OC-1 Understanding Risk



Hazard Analysis

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

Table OC-2 shows the HVA matrix for Oregon City listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response and recovery. The method provides the jurisdiction with sense of hazard priorities but does not predict the occurrence of a particular hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake and a Crustal earthquake event such as from the Portland Fault) and two chronic hazards (winter storm and flood) rank as the top hazard threats to the City (Top Tier). The landslide, wildfire, extreme heat, and drought hazards comprise the next highest ranked hazards (Middle Tier), while the windstorm and volcanic event hazards comprise the lowest ranked hazards (Bottom Tier).

Table OC-2 Hazard Analysis Matrix – Oregon City

Hazard	Maximum				Total Threat Score	Hazard Rank	Hazard Tiers
	History	Vulnerability	Threat	Probability			
Earthquake - Cascadia	4	45	100	49	198	#1	Top Tier
Earthquake - Crustal	6	50	100	21	177	#2	
Winter Storm	18	30	70	49	167	#3	
Flood	16	20	70	56	162	#4	
Landslide	14	35	30	63	142	#5	Middle Tier
Wildfire	12	25	70	21	128	#6	
Extreme Heat	16	15	40	56	127	#7	
Drought	10	15	50	42	117	#8	
Windstorm	14	15	30	42	101	#9	Bottom Tier
Volcanic Event	2	15	50	7	74	#10	

Source: Oregon City HMAc, 2018.

Table OC-3 categorizes the probability, and vulnerability scores from the hazard analysis for the City and compares the results to the assessment completed by the Clackamas County HMAc. Variations between the City, and County are noted in **bold** text within the city ratings.

Table OC-3 Probability and Vulnerability Comparison

Hazard	Oregon City		Clackamas County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Low	High	Low
Earthquake - Cascadia	Moderate	High	Moderate	High
Earthquake - Crustal	Low	High	Low	High
Extreme Heat	High	Low	Low	High
Flood	High	Moderate	High	Moderate
Landslide	High	Moderate	High	Low
Volcanic Event	Low	Low	Low	Moderate
Wildfire	Low	Moderate	High	Moderate
Windstorm	Moderate	Low	Moderate	Low
Winter Storm	Moderate	Moderate	Moderate	Moderate

Source: Oregon City HMAc, 2018.

Community Characteristics

Table OC-4 and the following section provides information on City specific demographics and assets. For additional information on the characteristics of Oregon City, in terms of geography, environment, population, demographics, employment and economics, as well as housing and transportation see Volume I, Section 2. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation. Considering the City specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation. Between 2010 and 2016 the City grew by 2,245 people² (7%; as of 2018 the population was 34,860) and median household income increased by 6%.³ Between 2018 and 2040 the population is forecast to grow by 20% to 41,857.⁴ In 2017, the Park Place annexation on the south side of Holcomb Blvd brought 92 acres into the City. New development has complied with the standards of the [Oregon Building Code](#) and the city's development code.

Transportation/Infrastructure

In the Oregon City, transportation has played a major role in shaping the community. Oregon City has three state highways and one interstate. State Highway 99E (or McLoughlin Blvd.), runs along the western border of the city; Highway 213 runs north to south through the eastern part of the city; Highway 43 enters at the northwest border of the city, and Interstate 205 runs along the northern border.

Today, mobility plays an important role in Oregon City and the daily experience of its residents and businesses as they move from point A to point B. Motor vehicles represent the dominant mode of travel through, and within the city. Oregon City public transportation is serviced by Tri-Met which provides daily local bus services to numerous community transit centers, including downtown Oregon City and the Clackamas County College Campus. The Canby Area Transit (CAT) additionally serves Oregon City with service to Canby, Aurora, Hubbard and Woodburn, while the South Clackamas Transportation District (SCTD) provides transportation between Clackamas Community College south to Molalla. Oregon City is also accessed by the Union Pacific Railroad main line and Amtrak, which travels northeast to southwest carrying both passengers and freight.

Economy

Oregon City is located near the greater Portland region, resulting in easy access to downtown Portland and surrounding communities. Historically, Oregon City had a strong mill and timber economic presence. Now, Oregon City residents are mostly employed in professional and related occupations.⁵ In 2016, the average per capita income for residents is \$28,232.⁶ The top economic sectors are Educational Services, and Health Care and Social Assistance; Retail Trade; and Manufacturing.⁷

² Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018.

³ Social Explorer, Table T57, U.S. Census Bureau, 2006-2010 and 2012-2016 American Community Survey Estimates.

⁴ Metro, 2040 Distributed Forecast (2016).

⁵ Social Explorer, Table T50, U.S. Census Bureau, 2012-2016 American Community Survey Estimates.

⁶ Ibid. Table T83.

⁷ Ibid. Table T49.

Table OC-4 Community Characteristics

Population Characteristics		
2010 Population	31,995	
2016 Population [2018 Population]	34,240 [34,860]	
2040 Forecasted Population*	41,857	
Race (non-Hispanic) and Ethnicity (Hispanic)		
White	86%	
Black/ African American	1%	
American Indian and Alaska Native	1%	
Asian	1%	
Native Hawaiian and Other Pacific Islander	< 1%	
Some Other Race	< 1%	
Two or More Races	3%	
Hispanic or Latino	8%	
Limited or No English Spoken	3%	
Vulnerable Age Groups		
Less than 15 Years	7,200	21%
65 Years and Over	4,455	13%
Disability Status		
Total Population	4,141	12%
Children	263	3%
Seniors	1,691	40%
Income Characteristics		
Households by Income Category		
Less than \$15,000	1,110	9%
\$15,000-\$29,999	1,193	9%
\$30,000-\$44,999	1,893	15%
\$45,000-\$59,999	1,457	11%
\$60,000-\$74,999	1,668	13%
\$75,000-\$99,999	2,097	16%
\$100,000-\$199,999	3,047	24%
\$200,000 or more	302	2%
Median Household Income	\$65,548	
Poverty Rates		
Total Population	4,835	14%
Children	1,076	13%
Seniors	299	7%
Housing Cost Burden		
Owners with Mortgage	2,802	33%
Renters	2,029	48%

Source: U.S. Census Bureau, 2012-2016 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018. [Metro, 2040 Distributed Forecast](#). Note: * = Population forecast within Metro UGB

Housing Characteristics		
Housing Units		
Single-Family	10,097	76%
Multi-Family	2,731	21%
Mobile Homes	418	3%
Year Structure Built		
Pre-1970	3,517	27%
1970-1989	3,199	24%
1990 or later	6,530	49%
Housing Tenure and Vacancy		
Owner-occupied	8,545	65%
Renter-occupied	4,222	32%
Seasonal	0	0%
Vacant	479	4%

Oregon City is near the southern limits of the Portland metro-area and is the County Seat of Clackamas County. The City has benefited from its natural setting. Its location on the Willamette and Clackamas Rivers supplied an abundant power source and bolstered an economy based on manufacturing, timber, and commerce. This prime location drew settlers from around the nation and helped Oregon City become the first incorporated city in Oregon. In the shadow of Mount Hood and surrounded by forests, Oregon City is a scenic settlement built on the "solid ground" of the valleys and hillsides.

The City has grown in land area over the years. As of 2015, Oregon City occupies 6,467 acres. Urbanization at the edge of Oregon City is constrained by the Willamette River and the City of West Linn to the west, Clackamas River and the City of Gladstone to the north, and steep topography to the south and east.

Oregon City's temperatures range from monthly average lows of 36°F in the winter months (December/January coldest) to average highs of 82°F in the summer months (July/August hottest). The average annual precipitation is 46 inches.⁸

For more information see Volume I, Section 2.

⁸ [Western Regional Climate Center, Oregon City, Oregon](#). Retrieved November 16, 2018.

Community Assets

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of Oregon City. It is important to note that the facilities identified as “critical” and “essential” are characterized differently than the structural code that identifies buildings as “essential” and “non-essential.” The structural code uses different language and criteria and therefore have completely different meanings than the buildings identified in this addendum.

Critical Facilities

Facilities that are critical to government response, and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include: 911 Centers, Emergency Operations Centers, Police, and Fire Stations, Public Works facilities, sewer, and water facilities, hospitals, bridges, roads, shelters, and more.

Table OC-5 Critical Facilities in Oregon City

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Facilities									
Fire and Police Stations: Main Fire Station is the EOC									
Station 9 – Holcomb (built in 1974)		X							
Station 15 – John Adams (remodeled 1998)									
Station 16 – Hilltop (rebuilt 2018)									
Station 17 – South End (built in 2004)									
Police Department		X							
Other Critical Facilities									
Providence Willamette Falls Hospital		X			X		X		X
Public Works Operations Center		X					X		
C-COM (9-1-1; <i>County facility</i>)									
Clackamas County EOC (<i>County facility</i>)									
PGE Substation - Canemah		X		X			X		
PGE Substation - 18 th Street		X		X			X		

Hazardous Materials:

Facilities that, if damaged, could cause serious secondary impacts may also be considered “critical.” A hazardous material facility is one example of this type of critical facility. Those sites that store, manufacture, or use potentially hazardous materials include:

- Clackamas Community College
- Benchmade
- Metro South Transfer Station
- Miles Fiberglass
- Railroad
- Rossman Landfill

Click here for a map of hazardous materials sites found on the city website: [Hazardous Materials Sites Map](#).

Critical Infrastructure:

Infrastructure that provides necessary services for emergency response include:

Table OC-6 Critical Infrastructure in Oregon City

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Infrastructure									
Natural Gas System									
Electrical Power System		X						X	X
Tri City Wastewater Treatment Plant		X		X					
Wastewater Collection System		X		X	X				
Hunter Pump Station									
Mountain View Pump Station									
Barlow Crest Reservoir									
Boynton Standpipe Reservoir and Pump Station		X							
Henrici Reservoir		X							
Mountainview Reservoir #1 (2 MG)									
Mountainview Reservoir #2 (10.5 MG)									
North Fork Water Transmission Pipe		X			X				
South Fork Water Filter Plant									
South Fork Water Intake				X					
South Fork/Division Street Pump Station		X							
Clackamas River Water/South Fork Water Intertie									
South Fork Water Transmission Line		X			X				
Metro South Transfer Station									
PGE Dam									
Water Distribution System		X		X	X				

Additionally, the following transportation infrastructure is considered vulnerable (hazards noted where applicable):

- 5th Street
- 7th Street
- Abernethy Road (flood)
- Abernethy Creek Culvert at McLoughlin Blvd.
- Anchor Way
- Anchor Way Bridge at Abernethy Creek
- Beavercreek Road (flood)
- Central Point Road
- Division Street
- George Abernethy Bridge (I-205 at Willamette)
- Glen Oak Road
- High Street
- Highway 43 Arch Bridge
- Highway 213
- Holcomb Boulevard
- Redland Road overcrossing on Hwy 213

- I-205 over Clackamas River
- Interstate 205
- Leland Road
- Linn Avenue (flood)
- Main Street (7th to McLoughlin Blvd)
- Main Street overcrossing at I-205
- Maple Lane Road
- McLoughlin Blvd Viaduct
- Main St. extension overcrossing at McLoughlin Blvd.
- McLoughlin Blvd/Highway 99E
- McLoughlin Blvd Tunnel at UPRR
- Meyers Road (flood)
- Molalla Ave
- OR City Gladstone Bridge 99
- HWY 213 overcrossing at Holcomb Blvd
- Pedestrian Bridge to Gladstone
- Redland Road
- South End Road
- Warner Milne Road
- Warner Parrott Road
- Washington Street overcrossing on Hwy 213
- Washington Street Bridge (at Abernethy Creek)

Essential Facilities and Infrastructure

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public’s ability to recover from the emergency. These facilities may include: City buildings such as the Public Services Building, the City Hall, and other public facilities such as schools.

Table OC-7 Essential Facilities in Oregon City

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Essential Facilities									
Churches^ (Potential Shelter Sites)		X		X	X		X	X	X
Schools: Potential Shelter Sites									
Gaffney Lane Elementary		X							
Holcomb Elementary		X							X
John McLoughlin Elementary		X							
King Elementary Charter		X							
Mt. Pleasant Elementary									
Park Place Elementary									
Gardiner Middle (to be rebuilt)		X							
Ogden Middle		X			X		X		
Oregon City High									
Jackson Campus - CAIS		X			X				
Clackamas Community College									
Eastham Community School		X							
Other Facilities									
City Hall		X							
Pioneer Community Center									
Community Development Building		X							
Clackamas County Jail									

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Essential Facilities									
Clackamas County Roads Services									
Veterans of Foreign Wars Post 1324									

Note: ^ Churches include: First Presbyterian, First United Methodist Church, Light on the Hill Fellowship, Logan Community Church, Maranatha Baptist Church, Mountain View Community Church, North Clackamas Christian, Oregon City Christian, Oregon City Church of the Nazarene, Oregon City Evangelical, St. John the Apostle Catholic Church, St. Paul's Episcopal Church, St. Philip Benizi Church, Trinity Lutheran Church, Victorious Faith Family Church

Essential infrastructure includes:

- Cellular Tower System
- Telephone System
- Amanda Lift Station
- Barclay Hills Lift Station
- Brendon Estates Lift Station
- Canemah Lift Station
- Cook Street Lift Station
- Hilltop Acres Lift Station
- Parrish Road Lift Station
- Pease Road Lift Station
- Hidden Creek Lift Station
- Nobel Ridge Lift Station
- Newell Crest Lift Station
- Boynton Lift Station
- Livesay Pump Station
- Fairway Downs Pump Station
- Settler's Point Pump Station
- Stormwater Management System

Economic Assets/Population Centers:

Economic assets include businesses that employ large numbers of people and provide an economic resource to the city of Oregon City. If damaged, the loss of these economic assets could significantly affect economic stability, and prosperity. Population Centers usually are aligned with economic centers, and are a concern during evacuation/notification during a hazard event.

Environmental Assets:

Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic, and functional ecosystem services for the community include Clackamette Park and Mill Creek Canyon.

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. Populations that have special needs or require special consideration include child care facilities and adult care facilities.

Cultural and Historic Assets

The cultural and historic heritage of a community is more than just tourist charm. For families that have lived in the city for generations and new resident alike, it is the unique places, stories, and annual events that make Oregon City an appealing place to live. The cultural and historic assets are both intangible benefits and obvious quality-of-life-enhancing amenities. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important. The following historic resources can be found in Oregon City:

- 7th Street Historic Fire Station
- 90 Historic Homes in Canemah, a National Registered Historic District
- 376 Individually Designated Historic Homes in McLoughlin Historic Conservation District
- 98 Individually Designated Historic Homes Outside of a Historic District
- Barclay House
- Carnegie Center
- Carnegie Library
- Clackamas County Courthouse
- End of the Oregon Trail Interpretive Center
- Ermatinger House
- McLoughlin House
- McLoughlin Promenade
- Museum of the Oregon Territory
- Oregon City Municipal Elevator
- Rose Farm
- Stevens-Crawford House
- Willamette Falls Locks
- Oregon City/West Linn (Hwy. 43) Bridge

The city's Historic Review Board reviews new development in the McLoughlin and Canemah historic districts and the city has adopted a Historic Overlay District to ensure that new development is compatible with existing historically designated structures.

Hazard Characteristics

Drought

The HMAC determined that the City's probability for drought is **moderate** and that their vulnerability to drought is **low**. *The probability rating increased and the vulnerability rating decreased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent and probability of a potential event. Due to the climate of Clackamas County, past and present weather conditions have shown an increasing potential for drought.

Oregon City provides water to most of its residents within a service area of approximately 4,134 acres; residents not within the services area are served by the [Clackamas River Water District](#). Oregon City draws its main water supply comes from the Clackamas River which is supplied by the South Fork Water Board (a wholesale water supplier that is equally owned

by Oregon City and West Linn). Water is provided via an intake and pumping station just to the north of the Oregon City boundary limits which is delivered to the SFWB water treatment plant located in the Park Place area. The City has a current surplus of 4.99 million gallons (MG), however, the city's Water Master Plan has identified the need for an additional storage to meet anticipated growth. To meet these needs the city plans to build two new ground level storage reservoirs (one 2 MG storage reservoir just beyond the Henrici Reservoir, and the other 3 MG storage reservoir near Holly Lane); additional storage will be needed if/when CRW facilities are incorporated into the City). The City has identified areas that will need to replace existing pipelines to meet the demand and flow requirements. For more information on the future of Oregon City's water supply visit their website: <https://www.orcity.org/publicworks/about-oregon-city-water-division>

Vulnerability Assessment

Due to insufficient data and resources, Oregon City is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables OC-5 through OC-7.

Mitigation Activities

The existing drought hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Earthquake (Cascadia Subduction Zone)

The HMAC determined that the City's probability for a Cascadia Subduction Zone (CSZ) earthquake is **moderate** and that their vulnerability to a CSZ earthquake is **high**. *The probability rating did not change, and the vulnerability rating increased, since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake and Crustal earthquake.*

Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent and probability of a potential event. Generally, an event that affects the County is likely to affect Oregon City as well. The causes and characteristics of an earthquake event are appropriately described within the Volume I, Section 2 as well as the location and extent of potential hazards. Previous occurrences are well documented within Volume I, Section 2 and the community impacts described by the County would generally be the same for Oregon City as well.

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Portland Hills Fault Zone, and Gales Creek-Newberg-Mt. Angel Structural Zone (discussed in the crustal earthquake section).

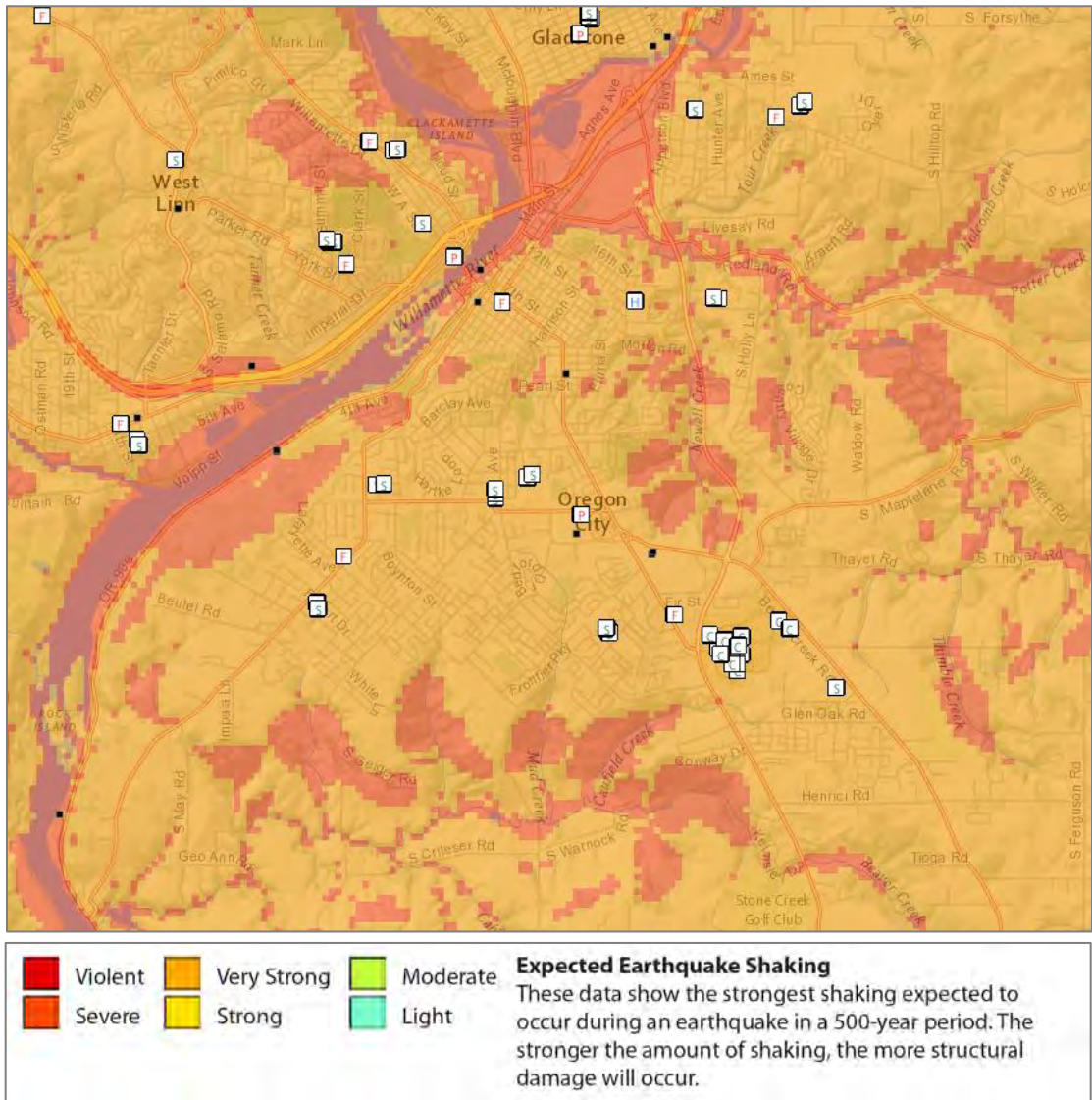
Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year. Scientists have found evidence that 11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These

earthquakes took place roughly between 300 and 5,400 years ago with an average occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D.⁹

Figure OC-2 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the city is expected to experience very strong shaking (orange), while areas near rivers and streams will experience severe (light red) to violent (dark red) shaking in a CSZ event.

Figure OC-2 Cascadia Subduction Zone Expected Shaking



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

Note: To view detail click the link above to access Oregon HazVu.

⁹ The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. <http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf>

An additional earthquake hazard map is available via the City website: [Earthquake Hazard Map](#) and [DOGAMI's Geologic Report and Map](#) (GMS-119). Ground shaking can mix groundwater and soil, liquefying and weakening the ground that supports buildings and severing utility lines. This is a special problem in low lying areas adjacent to rivers where the water table is shallow and the soils are subject to liquefaction. For example, the fine-grained alluvial soils along the banks of the Willamette and Clackamas Rivers and Abernethy Creek are likely subject to this hazard.

The city's proximity to the Cascadia Subduction Zone, potential slope instability and the prevalence of certain soils subject to liquefaction and amplification combine to give the city a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places the city predominately within the "Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades). Within the Northwest Oregon region, damage and shaking is expected to be strong and widespread - an event will be disruptive to daily life and commerce and the main priority is expected to be restoring services to business and residents.

Older buildings and the sewer system in the city are most vulnerable to damage. Earthquakes shift soil that could cause landslides. Transportation routes and economics within the City can also be affected. Demand on resources such as Police, Fire and Public Works would also increase.

Vulnerability Assessment

Due to insufficient data and resources, Oregon City is currently unable to perform a quantitative risk assessment for this hazard. However, in 2018 the Department of Geology and Mineral Industries (DOGAMI) completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)), findings from that report are provided at the end of the crustal earthquakes hazard section.

Seismic building codes were implemented in Oregon in the 1970s, however, stricter standards did not take effect until 1991 and early 2000s. As noted in the community profile, approximately 51% of residential buildings (primarily single-family residential) were built prior to 1990 (27% before 1970), which increases the City's vulnerability to the earthquake hazard. Information on specific public buildings' (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table OC-8; each "X" represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), one (1) has a very high (100% chance) collapse potential and two (2) have a high (greater than 10% chance) collapse potential. *Note: one fire station and two schools have been, or are scheduled to be, rebuilt and/or renovated.*

For a list of additional facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables OC-5 through OC-7. In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

Utility systems will be significantly damaged, including damaged buildings and damage to utility infrastructure, including water treatment plants and equipment at high voltage substations (especially 230 kV or higher which are more vulnerable than lower voltage substations). Buried pipe systems will suffer extensive damage with approximately one

break per mile in soft soil areas. There would be a much lower rate of pipe breaks in other areas. Restoration of utility services will require substantial mutual aid from utilities outside of the affected area.

Table OC-8 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Jackson Campus: CAIS (ca. 1939) (19761 Beaver Creek Rd)	None	2007 RVS report did not include structural appendix for this facility. Facility built 1939.			
Gaffney Ln Elementary (ca. 1965) (13521 S Gaffney Ln)	Clac_sch44	X		X	
Gardiner Middle (ca. 1954) (180 Ethel St)	Clac_sch49	School to be rebuilt per 2018 school bond.			
Holcomb Elementary (ca. 1966) (14625 S Holcomb)	Clac_sch43	X	X		
John McLoughlin Elem. (ca. 1975) (19230 S End Rd)	Clac_sch91	X		X	
King Campus: OCSLA (ca. 1959) (995 S End Rd)	Clac_sch46			X,X	
<i>Mt Pleasant Elementary (1232 Linn Ave) - CLOSED</i>	<i>Clac_sch47</i>		X	X	X
Ogden Middle (ca. 1965) (14133 S Donovan Rd)	Clac_sch50	Renovation planned per 2018 school bond.		X,X	
Oregon City High (ca. 2003) (19761 S Beaver Creek Rd)	Clac_sch51	X			
Alliance Charter Academy (16075 S Front Ave)	Clac_sch48			X	
Clackamas Community College (19600 S Molalla Ave)	Varies	See Note 2 below.			
Clackamas Fire District					
Station 9 – Holcomb (300 Longview Wy)	Clac_fir29	X			
Station 15 – John Adams (624 W 7 th St)	Clac_fir35	X			
Station 16 – Hilltop (19340 S Molalla Ave)	Clac_fir36	Mitigated per 2013-2014 SRGP grant.			
Station 17 – South End (19001 South End)	Clac_fir51	X			
Police					
Police Department (320 Warner Milne Rd)	Clac_pol11	X			
Hospital					
Providence Willamette Falls (1500 Division St)	Clac_hos4			X	

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#) "*" – Site ID is referenced on the [RVS Clackamas County Map](#)

Note 1: **Bold** indicates facilities that have been seismically retrofitted or rebuilt.

Note 2: Clackamas Community College buildings with ‘very high’ collapse potential include: Dye Learning Center, Family Residential Center, Gregory Forum ; and with ‘high’ collapse potential include: McLoughlin Hall, Pauling Center (east and south), Randall Hall (mitigated per 2015-2017 SRGP grant), and Streeter Hall.

Mitigation Activities

Many buildings in Oregon City have been seismically upgraded including the Carnegie Center, fire station #15 (John Adams, ca. 1998), the 10.5 million-gallon Mountainview drinking water reservoir, and numerous buildings at Clackamas Community College. New public buildings built for seismic activity include Oregon City High School and all water pump stations. Additionally, new water lines with flexible couplings at the joints were installed near the Newell Creek Apartments. Seismic retrofit grant awards per the [Seismic Rehabilitation Grant Program](#)¹⁰ have been funded to retrofit Clackamas Fire District’s Hilltop Fire Station #16 (2013-2014 grant award, \$483,062) and Clackamas Community College’s Randall Hall (Phase Two of 2015-2017 grant award, \$1,500,000). A \$158 million bond was passed in 2018 to improve security, address overcrowding, and finance and construction including the replacement of Gardiner Middle School and renovation of Ogden Middle School. The school district recently received a \$25,000 Seismic Assessment Grant from the Oregon Department of Education’s Office of School Facilities Technical Assistance Program for seismic assessments at Barclay School, Eastham Community Center and Park Place School. Clackamas Community College has seismically assessed their buildings.

Earthquake (Crustal)

The HMAC determined that the City’s probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**. *The probability rating decreased, and the vulnerability rating increased, since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Crustal earthquake, and Cascadia Subduction Zone (CSZ) earthquake.*

Volume I, Section 2 describes the causes and characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Oregon City as well. Figure OC-3 shows a generalized geologic map of the Oregon City area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows the areas of greatest concern within the City limits as red and orange. An additional earthquake hazard map is available via the City website: [Earthquake Hazard Map](#).

There are two potential crustal faults and/or zones near the City that can generate high-magnitude earthquakes. These include the Gales Creek-Mt. Angel Structural Zone and Portland Hills Fault Zone (discussed in greater detail below). Other nearby faults include the Bolton fault and Oatfield faults which run through the city west and east side respectively, Canby-Molalla structural zones located west of the city, and the Mt. Hood Fault in eastern Clackamas County. Historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe

¹⁰ The Seismic Rehabilitation Grant Program (SRGP) is a state of Oregon competitive grant program that provides funding for the seismic rehabilitation of critical public buildings, particularly public schools and emergency services facilities.

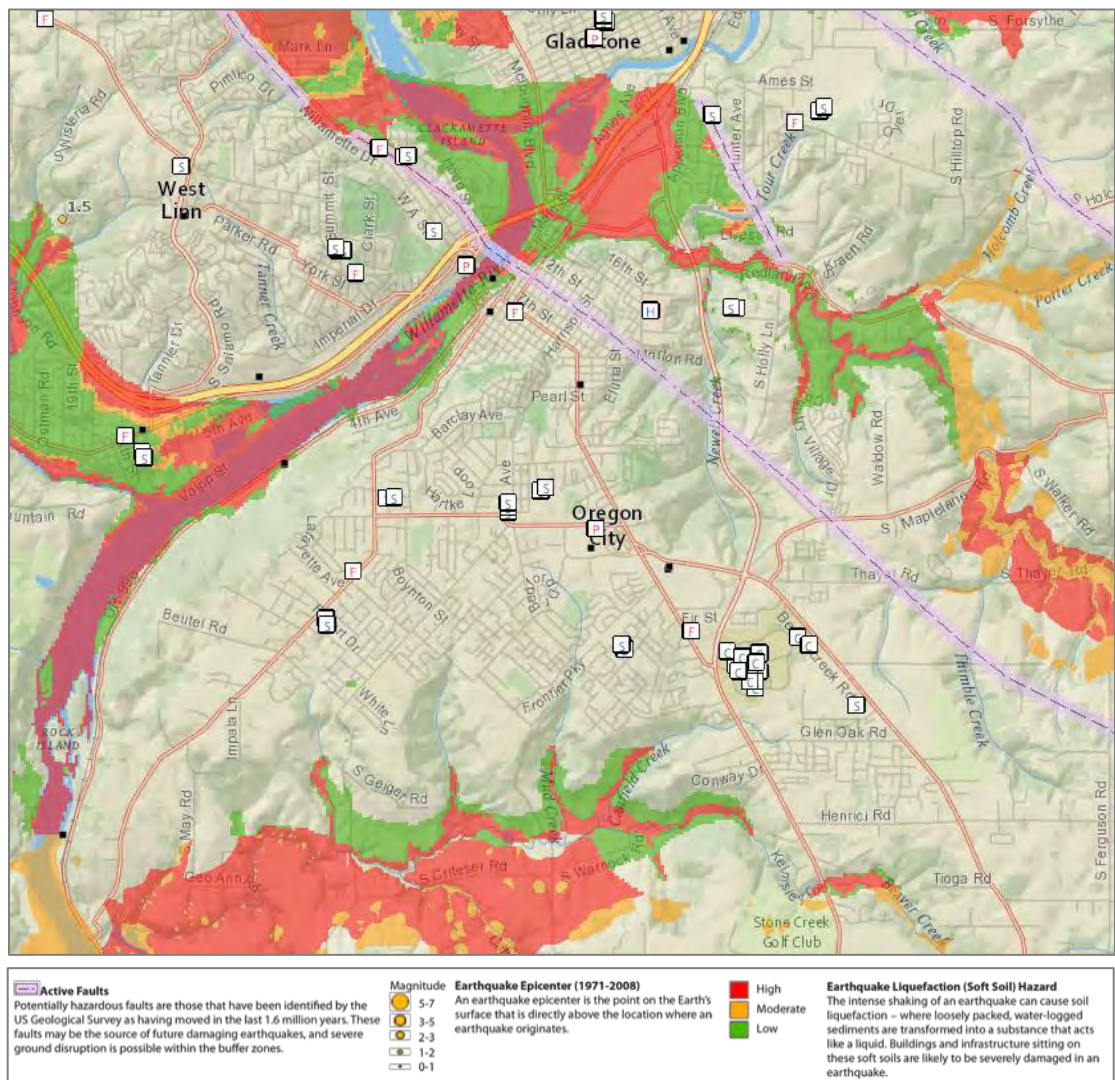
earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and lies about 11 miles northeast of Oregon City.

Figure OC-3 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



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

Note: To view detail click the link above to access Oregon HazVu

Earthquake Regional Impact Analysis

In 2018 DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)). Their study focused on damage to buildings, and the people that occupy them, and to two key infrastructure sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and night time (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damaged varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood structures that fare worse in an earthquake. The Portland Hills fault scenario created greater damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios, however, the impact is considerably less than it is to the transportation routes. Additional, capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts.

Table OC-9 shows the permanent resident population that are vulnerable to injury or death (casualty) and the buildings in the City that are susceptible to liquefaction and landslides, it does not predict that damage will occur in specific areas due to either liquefaction or landslide. More population and property are exposed to higher degrees of expected damage or casualty under the Portland Hills Fault “wet” scenario than in any other scenario.

Table OC-9 Expected damages and casualties for the CSZ fault and Portland Hills fault: earthquake, soil moisture, and event time scenarios

	Cascadia Subduction Zone (M9.0)		Portland Hills Fault (M6.8)	
	"Dry" Soil	"Wet" Saturated Soil	"Dry" Soil	"Wet" Saturated Soil
Number of Buildings	12,641	12,641	12,641	12,641
Building Value (\$ Million)	4,190	4,190	4,190	4,190
Building Repair Cost (\$ Million)	277	342	1,319	1,422
Building Loss Ratio	7%	8%	31%	34%
Debris (Thousands of Tons)	148	170	496	525
Long-Term Displaced Population	102	307	2,983	3,827
Total Casualties (Daytime)	258	318	1,286	1,364
Level 4 (Killed)	14	18	80	85
Total Casualties (Nighttime)	38	57	383	448
Level 4 (Killed)	1	2	11	13

Source: DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8, 12-9, 12-10, and 12-11.

Cascadia Subduction Zone Scenario

Oregon City is expected to have a 7% building loss ratio with a repair cost of \$277 million under the CSZ “dry” scenario, and an 8% building loss ratio with a repair cost of \$170 million under the CSZ “wet” scenario.¹¹ The city is expected to have around 258 daytime or 33 nighttime casualties during the CSZ “dry” scenario and 318 daytime or 57 nighttime casualties during the CSZ “wet” scenario. It is expected that there will be a long-term displaced population of around 102 for the CSZ “dry” scenario and 307 for the CSZ “wet” scenario.¹²

Portland Hills Fault Scenario

Oregon City is expected to have a 31% building loss ratio with a repair cost of \$1.32 billion under the CSZ “dry” scenario, and a 34% building loss ratio with a repair cost of \$1.42 billion under the CSZ “wet” scenario.¹³ The long-term displaced population and casualties are greatly increased for all the Portland Hills Fault scenarios. The city is expected to have around 1,286 daytime or 383 nighttime casualties during the Portland Hills Fault “dry” scenario and 1,364 daytime or 448 nighttime casualties during the Portland Hills Fault “wet” scenario. It is expected that there will be a long-term displaced population of around 2,983 for the Portland Hills Fault “dry” scenario and 3,827 for the Portland Hills Fault “wet” scenario.¹⁴

Recommendations from the report included topics within Planning, Recovery, Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMPs mitigation strategies (Table OC-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and the recommendations see: *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, [O-18-02](#)).

Please review Volume I, Section 2 for additional information on this hazard.

Flood

The HMAC determined that the City’s probability for flood is **high** and that their vulnerability to flood is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent and probability of a potential event. Portions of Oregon City have areas of floodplains (special flood hazard areas, SFHA). These include areas include along Willamette River, Clackamas River, and Abernethy Creek (Figure OC-4). Additional flood hazard maps are available via the City website: [100 Year Floodplain and 1996 Flood Area](#), [Water Quality and Flood Management Areas](#). Other portions of Oregon City, outside of the mapped floodplains, are also subject to flooding from local storm water drainage. Not all flood prone

¹¹ DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8 and 12-9.

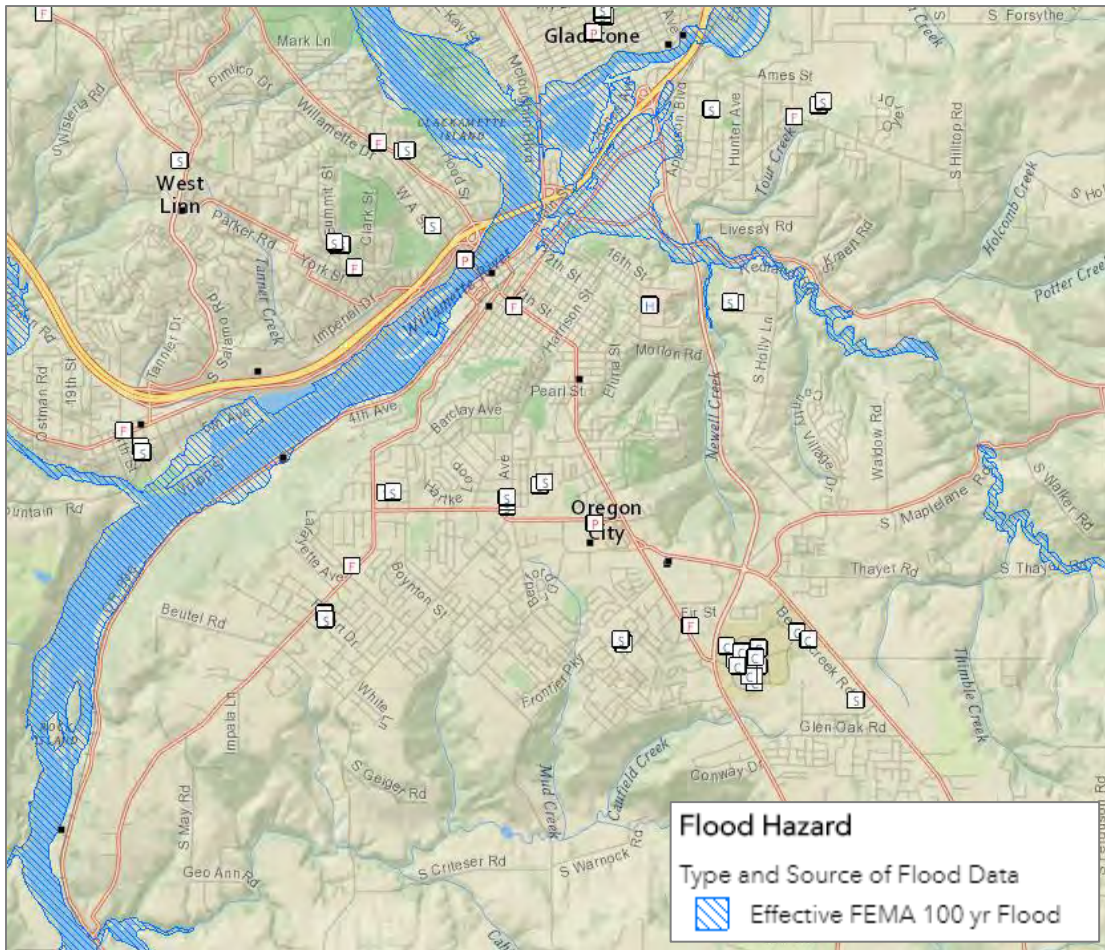
¹² Ibid, Tables 12-8 and 12-9.

¹³ Ibid, Tables 12-10 and 12-11

¹⁴ Ibid, Tables 12-10 and 12-11.

areas are subject to damage. Several valleys, such as the upper reaches of Abernethy Creek, are still in or near their natural state. Flooding of such areas causes no damage to human development and may help the riparian habitat.

Figure OC-4 Special Flood Hazard Area



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)
Note: To view detail click the link above to access Oregon HazVu

Vulnerability Assessment

Due to insufficient data and resources, Oregon City is currently unable to perform a quantitative risk assessment for this hazard. Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage and economic loss from business interruption. It is important for the City to be aware of flooding impacts and assess its level of risk. The City has been proactive in mitigating flood hazards by purchasing floodplain property.

The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of Oregon City

outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage.

The Willamette and Clackamas Rivers both flooded in January 1997 and from December 28th, 2005 to January 1st, 2006 following severe winter storms. The high water caused bank erosion and cleanup was required at Clackamette Park, for which FEMA provided some funding.

From January 1st to 2nd, 2009 a severe winter storm dropped over 3.5 inches of rain over a 24-hour period. The event led to localized flooding, land movement, traffic delays, and sewer line back-ups. Sections of Meyers Road, Beaver Creek Road, Linn Avenue, Abernethy Road, and Van Buren Street were closed because of the storm. Additional significant floods occurred in December 2015 and March 2017.

Finally, there is a rainfall pattern known as the “Pineapple Express” which brings very heavy and warm rains from the southwest. These warm rains begin their journey from parts of the Pacific near Hawaii, holding their heat and moisture until making landfall along the Oregon coast.

Most of the buildings affected by flooding are in the lowest part of the city, where the three waterways converge. The Floodplain Map shows 12.7 miles of the transportation network could be affected in a flood. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables OC-5 through OC-7.

National Flood Insurance Program (NFIP)

FEMA updated the Flood Insurance Study (FIS) and Flood Insurance Rate Maps (FIRMs) in 2018 (effective January 19, 2018). Table OC-10 shows that as of July 2018, Oregon City has 38 National Flood Insurance Program (NFIP) policies in force. Of those, 24 are for properties that were constructed before the initial FIRM. The last Community Assistance Visit (CAV) for Oregon City was on April 26th, 2016. Oregon City’s Class Rating within the Community Rating System (CRS) is 7. The table shows that the majority of flood insurance policies are for residential structures, primarily single-family homes. There has been a total of 18 paid claims for \$1,467,600. The City complies with the NFIP through enforcement of their flood damage prevention ordinance and their floodplain management program.

The Community Repetitive Loss record for Oregon City identifies one (1) Repetitive Loss Properties (RL)¹⁵ which is also considered a Severe Repetitive Loss Property (SRL)¹⁶. The SRL property is non-residential, located in zone A21, and has had two claims for a total of \$51,162.53. For additional detail and a map of its general location see Volume I, Section 2 and Figure 2-13.

¹⁵ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

¹⁶ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000 and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

Table OC-10 Flood Insurance Detail

	Clackamas County	Oregon City
Effective FIRM and FIS	6/17/2008	6/17/2008
Initial FIRM Date	-	2/15/1980
Total Policies	1,957	38
Pre-FIRM Policies	1,086	24
Policies by Building Type		
Single Family	1,761	16
2 to 4 Family	30	1
Other Residential	58	0
Non-Residential	9	0
Minus Rated A Zone	123	0
Insurance in Force	\$541,833,400	\$13,060,400
Total Paid Claims	590	18
Pre-FIRM Claims Paid	450	17
Substantial Damage Claims	83	3
Total Paid Amount	\$20,830,662	\$1,467,600
Repetitive Loss Structures	51	1
Severe Repetitive Loss Properties	4	1
CRS Class Rating	-	7
Last Community Assistance Visit	-	4/26/2016

Source: Information compiled by Department of Land Conservation and Development, July 2018.

Note: The portion of the cities of Portland and Tualatin that are within Clackamas County are not included in this table.

Mitigation Activities

Oregon City employs several mitigation strategies to reduce the city's risk to flood events. The city development code includes policies and regulations for flood prone areas including the Flood Management Overlay District (Chapter 17.42), stormwater master plans (Erosion Prevention and Sediment Control Planning and Design Manual, Drainage Master Plan, South End Basin Master Plan, Caulfield Basin Master Plan, and Park Place Basin Master Plan). Development review practices and conditions of development require developers to account for stormwater management onsite to reduce the risks of urban flooding in the future. Oregon City regularly inspects and maintains the stormwater facilities. Enclosed pipe sections and catch basins are routinely cleaned and inspected using the combination truck, and a regular street sweeping program reduces the amount of debris and contaminants entering the stormwater system. The Greater Oregon Watershed Council did plantings along Abernethy Creek. Sediment is regularly removed from culverts around the city to allow for better water flow. River bank stabilization and restoration work was done along the Willamette River at Jon Storm Park.

Please review Volume I, Section 2 for additional information on this hazard.

Landslide

The HMAC determined that the City's probability for landslide is **high** and that their vulnerability to landslide is **moderate**. *The probability rating did not change and the vulnerability rating increased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent and probability of a potential event within the region. The potential for landslide in Oregon City is high and the City's wastewater main lines, major water lines and fiber optic lines. The flooding of 1996 caused numerous landslide events in Oregon City. One of these events caused a sanitary sewer pump to begin sliding downhill. A report by Portland State University found that half of the 48 landslides that occurred in the region in 1996 were considered "natural," while the others were triggered by human activity. Oregon City experienced another series of landslides because of the December 28th, 2005 to January 1st, 2006 storm and flood on Trillium Drive, Morton Road, near the football field at Oregon City High School Jackson Campus, Newell Crest Drive and Newell Creek Village Apartments. In December 2015 landslides impacted the Forest Edge Apartment Complex, forcing the evacuation of all 41 apartments. Landslides in 2017 impacted Trillium Park, South End Road, Center Street, and OR-224.

Landslides destroy or damage anything on the sliding hillside or in the path of the slide. This includes buildings, houses and streets. Sometimes, a small amount of settlement occurs, giving the owner time to shore up or retrofit the building to prevent further damage. Many property owners in Oregon City have built retaining walls and replaced slide prone soils with rock to help prevent landslides. However, if an entire hillside fails, the buildings may be destroyed and the streets washed out or covered in debris.

Landslide susceptibility exposure for Oregon City is shown in Figure OC-6. Most of Oregon City demonstrates a moderate to high susceptibility to landslide exposure. Approximately 12% of Oregon City has very high or high and approximately 16% moderate, landslide susceptibility exposure.¹⁷

Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard and assets.

Vulnerability Assessment

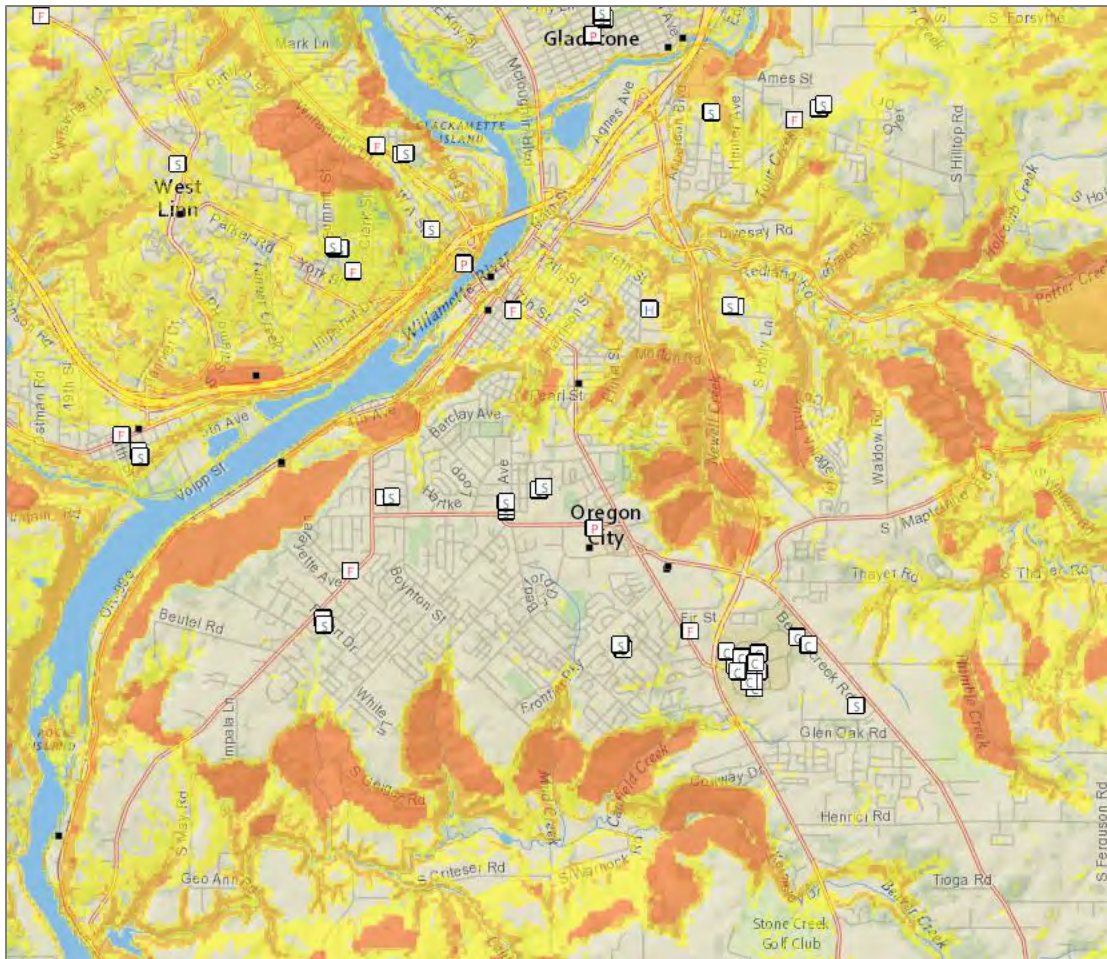
Due to insufficient data and resources, Oregon City is currently unable to perform a quantitative risk assessment for this hazard. However, DOGAMI completed a statewide landslide susceptibility assessment in 2016 ([O-16-02](#)), general findings from that report are provided above and within Figure OC-5. Additional landslide hazard maps are available via the City website: [Geological Hazards Map](#) (adopted by ordinance 10-1003), [Slope Map](#), and [DOGAMI's Landslide Inventory Maps](#).

Potential landslide-related impacts are adequately described within Volume I, Section 2 and include infrastructural damages, economic impacts (due to isolation and/or arterial road closures), property damages and obstruction to evacuation routes. Rain-induced landslides and debris flows can potentially occur during any winter in Clackamas County and

¹⁷ DOGAMI Open-File Report, O-16-02, Landslide Susceptibility Overview Map of Oregon (2016)

thoroughfares beyond City limits are susceptible to obstruction as well. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables OC-5 through OC-7.

Figure OC-5 Landslide Susceptibility Exposure



Low	Landsliding unlikely. Areas classified as Landslide Density = Low (less than 7%) and areas classified as Slopes Prone to Landsliding = Low.
Moderate	Landsliding possible. Areas classified as Landslide Density = Low to Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = Moderate OR areas classified as Landslide Density = Moderate (7%-17%) and areas classified as Slopes Prone to Landsliding = Low.
High	Landsliding likely. Areas classified as Landslide Density = High (greater than 17%) and areas classified as Slopes Prone to Landsliding = Low and Moderate OR areas classified as Landslide Density = Low and Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = High.
Very High	Existing landslides Landslide Density and Slopes Prone to Landsliding data were not considered in this category. Note: the quality of landslide inventory (existing landslides) mapping varies across the state.

Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)
 Note: To view detail click the link above to access Oregon HazVu

The most common type of landslides in Clackamas County are slides caused by erosion and flooding. Slides move in contact with the underlying surface, are generally slow moving and can be deep. Rainfall-initiated landslides tend to be smaller; while earthquake induced

landslides may be quite large. All soil types can be affected by natural landslide triggering conditions.

Mitigation Activities

Oregon City works to mitigate future landslide hazards. Oregon City uses percent slope as an indicator of hill slope stability. The city uses a 25% or greater threshold to identify potentially unstable hill slopes. Approximately, 518 acres in the city exceeds this 25% slope threshold (about 8.25% of the land in Oregon City). The city development code includes policies and regulations for landslide prone areas including Chapter 15.48 (Grading, Filling, and Excavating), Chapter 17.44 (US Geologic Hazards), and Chapter 17.47 (Erosion and Sediment Control).

After the 1996 landslide events, 20 of the 48 landslides were repaired by the city, meaning reconstruction or mitigation took place. These fixes varied and included constructing retaining walls, installing rockfill, and moving structures. The sanitary sewer pump station that began sliding downhill had seismic isolation piles installed under the foundation of the building to mitigate future slides.

Repairs and mitigation after the December 28th, 2005 to January 1st, 2006 landslides included:

- The storm sewer manhole that failed on Trillium Drive was repaired. The city installed monitoring wells with inclinometers to allow the city to continue to monitor the slope.
- The owner of the Morton Road apartment building installed a crib wall.
- A homeowner on Newell Crest Drive constructed a retaining wall, costing approximately \$100,000.
- Newell Creek Apartments had the most mitigation work done. The city temporarily repaired one of the water lines and permanently abandoned the waterline on the slope and reconfigured the second water line. The repaired line that remained at risk was later replaced with a new water line with flexible couplings at the joints. The city required relocation and reconstruction of the apartment complex's private sanitary sewer pump station.

The city additionally has many ongoing mitigation actions including a water pipe line leak detection system and annual assessments of slide hazard areas.

Please review Volume I, Section 2 for additional information on this hazard.

Severe Weather

Severe weather can account for a variety of intense and potentially damaging weather events. These events include windstorms and winter storms. The following section describes the unique probability and vulnerability of each identified weather hazard. Other more abrupt or irregular events such as hail are also described in this section.

Extreme Heat

The HMAC determined that the City's probability for extreme heat events is **high** and that their vulnerability is **low**. *The probability rating increased and the vulnerability rating did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the City as well.

A severe heat episode or "heat wave" occurs about every two to three years and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days we have temperatures greater than or equal to 90-degrees Fahrenheit and 100-degrees Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The Oregon City has not experienced any life-threatening consequences from the few extreme heat events in the past, though with the changing climate expect to see more extreme heat events with potentially greater risk to the City's population.

Please review Volume I, Section 2 for additional information on this hazard.

Windstorm

The HMAC determined that the City's probability for windstorm is **moderate** and that their vulnerability to windstorm is **low**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent and probability of a potential event within the region. On December 11th, 1995, a windstorm hit Oregon. Oregon City was one of the most severely damaged cities in Clackamas County. Winds tore off roofs from buildings, uprooted or damaged trees, and knocked out electrical and telephone service. Because windstorms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding and very rarely, snow. Other severe weather events that may accompany windstorms, including thunderstorms, hail, lightning strikes and tornadoes are generally negligible for Oregon City. Wind storms also impacted Oregon City in December 2015 and during December 2016 and January 2017 including cold weather and damaging winds.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages and storm-related debris. Additionally, transportation and economic disruptions result as well.

Damage from high winds generally has resulted in downed utility lines and trees usually limited to several localized areas. Electrical power can be out anywhere from a few hours to several days. Outdoor signs have also suffered damage. If the high winds are accompanied by rain (which they often are), blowing leaves and debris clog drainage-ways, which in turn causes localized urban flooding.

Please review Volume I, Section 2 for additional information on this hazard.

Winter Storm (Snow/Ice)

The HMAC determined that the City's probability for winter storm is **moderate** and that their vulnerability to winter storm is **moderate**. *The probability rating decrease and vulnerability rating did not change since the previous version of the NHMP.*

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter and early spring months. Severe winter storms affecting the City typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

Major winter storms can and have occurred in the Oregon City area. From January 9th to 12th, 1998, a severe winter storm included freezing rain and snow and was accompanied by high winds for two days. Most of the city lost power due to downed electrical lines and malfunctioning transformers. One emergency shelter was opened for those who could not stay in their homes. Off-duty firefighters were called in to help respond to the increased number of calls. Another winter storm happened in January 2009, which resulted in over 3.5 inches of rain in a 24-hour period. The snow and rain led to localized flooding, land movement, traffic delays, and sewer line back-ups. Sections of Meyers Road, Beaver Creek Road, Linn Avenue, Abernethy Road, and Van Buren Street were closed due to the effects of the storm. The storm led to significant power outages, eight water main breaks, and hazardous road conditions. The City contracted forces to assist in snow removal efforts. Another winter storm impacted the City during December 2016 and January 2017 including cold weather and damaging winds.

Most winter storms typically do not cause significant damage, they are frequent and have the potential to impact economic activity. Road and rail closures due to winter weather are an uncommon occurrence, but can interrupt commuter and commercial traffic.

Vulnerability Assessment

Due to insufficient data and resources, Oregon City is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Assets section and Tables OC-5 through OC-7.

Mitigation Activities

Mitigating severe weather can be difficult because storms affect all areas of the city, but Oregon City has made progress to reduce the effects of storms. Oregon City has a snow route priorities map. This map informs Public Works which roads should be cleared first and what roads require closure. The plan even includes sign placement procedures. The city has uses a combination of sand and a de-icing compound for use on its streets. The city has installed emergency generators for sanitary sewer pump stations in susceptible hazard areas. In winter storms, it is difficult for the city to bring portable generators to those sites. Most utilities are underground and all new utilities are required to be undergrounded, but in case of power outages the city's critical facilities have back up power generation. Clackamas County Public Health operates heating and cooling centers for the region.

Please review Volume I, Section 2 for additional information on this hazard.

Volcanic Event

The HMAC determined that the City's probability for a volcanic event is **low** (which is the same as the County's rating) and that their vulnerability to a volcanic event is **low**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of volcanic hazards, history, as well as the location, extent and probability of a potential event within the region. Generally, an event that affects the County is likely to affect Oregon City as well. Oregon City is very unlikely to experience anything more than volcanic ash during a volcanic event.

Vulnerability Assessment

Due to insufficient data and resources, Oregon City is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables OC-5 through OC-7.

Due to Oregon City's relative distance from volcanoes, the city is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Depending on wind patterns and which volcano erupts, however, the city may experience ashfall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city could experience a heavier coating of ash.

Mitigation Activities

The existing volcano hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Wildfire

The HMAC determined that the City's probability for wildfire is **low** and that their vulnerability to wildfire is **moderate**. *The probability rating did not change and the vulnerability rating increased since the previous version of this NHMP addendum.*

The [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) was completed in May 2018. The CWPP is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard: <https://www.clackamas.us/dm/CWPP.html>. Fire protection in Oregon City is provided by Clackamas Fire District #1, information specific to the fire district and Oregon City is found in the following chapter: [Chapter 10.3: Clackamas Fire District #1](#).

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions. Weather, and urbanization conditions are primarily at cause for the hazard level. Oregon City does not regularly experience wildfire within City limits, but the city has abundant wooded areas that are a concern in the case of a wildfire event. However, a major fire broke out near Rosemont Ridge in September 1967. The fire burned 300 acres and cut telephone

and electrical service, but fire fighters were able to save all threatened homes. Less than two weeks later another fire destroyed 500 acres. This fire took the efforts of over 150 firefighters to save the homes.

Clackamas County has two major physiographic regions: the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern Clackamas County. The Willamette River Valley, which includes Oregon City, is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range has a relatively small population and is characterized by heavily forested slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to its dense forest land. Human caused fires are responsible for most fires in Clackamas County. In Oregon City most instances of fire have been started by the railroads and I-5 but the fires have been small enough to contain quickly and easily.

The forested hills within, and surrounding Oregon City are interface areas. One area that's particularly susceptible to fires is the Canemah Bluffs area. This area has heavy tree coverage and a dense neighborhood sits atop a steep wooded area, increasing the threat of wildfire. In August 2005, a wildfire on the Canemah Bluffs burned down a non-occupied historic structure. Another fire began in this same area in 2007. The 2007 fire began at Highway 99E and spread up the rock cliff face. Two additional areas that are particularly susceptible to wildfires: Newell Creek Canyon and the Waterboard Park. Newell Creek Canyon is open space located outside the Metro UGB and is not part of a master plan. This area is a major wildland urban interface and has the potential for a catastrophic fire. Transients often have campfires in this area, creating a potential for fire to start. Highway 213 runs through this area and a cigarette thrown from a car is another potential source of ignition. If a fire were to break out along the highway, firefighters would have to fight it from the highway as there is limited access to the canyon. The Barclay Hills residential development on the west side of the canyon has very poor access, with only one way in and one way out. Waterboard Park is located along the bluff below Promontory Avenue. This area is considered a charter park, meaning trees and brush cannot be cut to reduce fuel load. Like Newell Creek Canyon, Waterboard Park is home to many transients and campfires pose a threat to igniting a fire. High and medium Priority Communities at Risk (CARs) within the City include: Canemah Bluffs (high) and Holcomb (medium).¹⁸

Most of the city has less severe (moderate or less) wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions.¹⁹ However, conditions vary widely and with local topography, fuels, and local weather (including wind) conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts.

Vulnerability Assessment

Due to insufficient data and resources, Oregon City is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and

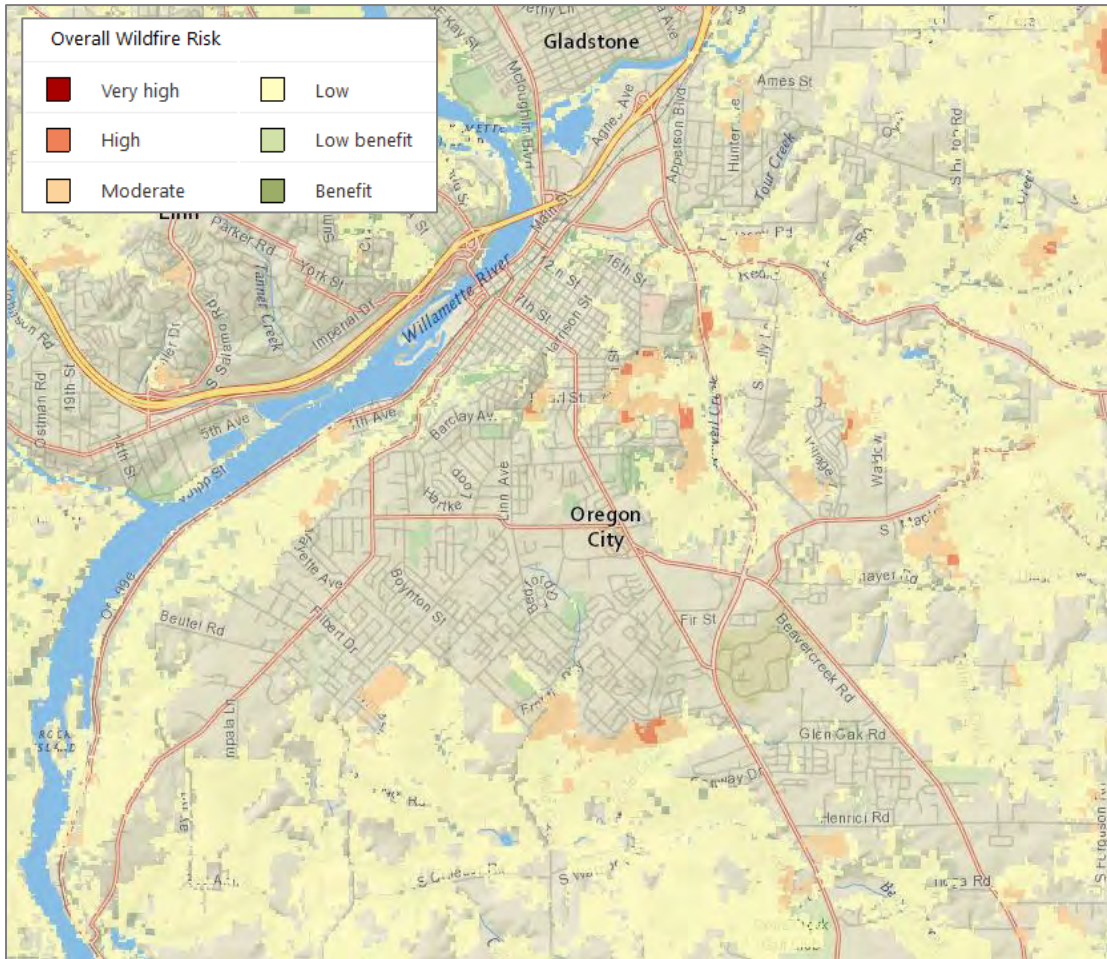
¹⁸ Clackamas County Community Wildfire Protection Plan, *Clackamas Fire District #1* (2018), Table 10.3-1.

¹⁹ [Oregon Wildfire Risk Explorer](#), date accessed November 19, 2018.

infrastructure vulnerable to this hazard see the Community Assets section and Tables OC-5 through OC-7.

The potential community impacts, and vulnerabilities described in Volume I, Section 2 are generally accurate for the City as well. Oregon City's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. Figure OC-6 shows overall wildfire risk in Oregon City. The City will update the City's wildfire risk assessment if the fire plan presents better data during future updates (an action item is included to participate in future updates to the CWPP).

Figure OC-6 Overall Wildfire Risk



Source: [Oregon Wildfire Risk Explorer](#), date accessed November 19, 2018.

Property can be damaged or destroyed with one fire as structures, vegetation, and other flammables easily merge to become unpredictable, and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

Mitigation Activities

Oregon City uses several mitigation tools to reduce the city's risk to wildfires. Oregon City's Fire Department, Clackamas County Fire District #1, has a Fire Prevention Division dedicated

to protecting and preserving life and property through education, engineering, and enforcement. The Fire Prevention Division offers numerous education opportunities including school programs, public presentations, media events, and safety fairs. They review pre-construction plans and develop fire codes. Additionally, this division inspects buildings for fire code compliance, enforces open burning regulations, and offers juvenile fire setter counseling and follow-up.

The Clackamas Fire District #1 (CFD #1) serves the cities of Happy Valley, Johnson City, Milwaukie, and Oregon City and the unincorporated areas of Barton, Beavercreek, Boring, Carus, Carver, Central Point, Clackamas, Clarkes, Damascus, Eagle Creek, Highland, Hillsview, Holcomb, Kelso, Jennings Lodge, Oak Grove, Redland, South End, Sunnyside, and Westwood. For more information on the fire district see their addendum.

Please review the [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#), Volume I, Section 2, and the Clackamas Fire District #1 Addendum in Volume II for additional information on this hazard.

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ATTACHMENT A: ACTION ITEM FORMS

ACTION ITEM FORMS

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* - Priority Action Item

Note: The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity.

Summary of Action Changes

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

Previous NHMP Actions: Completed

Multi-Hazard Action #8 (2012): “Update and maintain the Oregon City Emergency Operations Plan to provide a comprehensive multi-hazard emergency response program” is considered complete (last updated in 2017). In addition, the plan is routinely updated and the HMAC does not consider it necessary to retain the action in the mitigation plan that deals with ongoing hazards response planning.

See 2018 status identified in each action for activities that have been completed since the previous plan.

Previous NHMP Actions: Removed

Multi-Hazard Action #4 (2012): “Continue to update and improve hazard assessments in the Oregon City Natural Hazards Mitigation Plan Addendum” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Multi-Hazard Action #5 (2012): “Identify and pursue funding opportunities to develop and implement hazard mitigation activities” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Flood Action ST-FL #2 (2012): “Continue to implement and enhance the flood public education program designed to inform local residents about:” was removed from the list of actions. This action is included within MH #3.

Landslide Action ST-LS #3 (2012): “Educate the community about landslides, their associated risks and ways of reducing vulnerability” was removed from the list of actions. This action is included within MH #3.

Wildfire Action WF #1 (2012): “Enhance outreach and education programs aimed at mitigating wildfire hazards and reducing or preventing public exposure to hazards” was removed from the list of actions. This action is included within MH #3.

Note: 2012 Actions MH #3, MH #5, MH #7, ST-FL #1, ST-FL #3, LT-FL #1, ST-LS #1, and ST-LS #2 were renumbered to 2019 Actions MH #2, MH #3, MH #4, FL #1, FL #2, FL #3, LS #1, and LS #2 respectively.

New NHMP Actions (2019):

- Wildfire Action #3

See action item forms below for detail.

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 NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the County, participating cities, and special districts. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. The City 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, the City 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 several 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 HMAP but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and/or resources toward completion of the action items.

Internal partner organizations are departments within the City 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.

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:	
Maintain Certification and coordinate with Clackamas County and regional partners to identify and coordinate building officials that are qualified to conduct damage assessments.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • <u>2018 Status</u>: Oregon City continues to have trained personnel in the ATC 20 and 45 courses, which focus on the basic building assessments after hazard events. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Maintain certification in the ATC 20 and 45 courses. 			
Coordinating Organization:		Oregon City Emergency Management	
Internal Partners:		External Partners:	
Building		Clackamas County, Clackamas Fire District #1	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #2

Proposed Action Item:		Alignment with Plan Goals:	
Integrate the goals and action items from the Oregon City Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Zoning Ordinance, Emergency Operations Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating natural hazards plans into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community. <u>2018 Status</u>: The City last amended their development code in 2017. The floodplain ordinance was last updated in 2002 (new FIRMs are preliminary and effective maps are expected January 2019). The City updated their comprehensive plan in April 2012. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Use the mitigation plan to help the City's Comprehensive Land Use Plan meet 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; Use zoning codes to regulate development in hazard-prone areas; Integrate the city's mitigation actions into the current emergency operations plan and capital improvement plans (where appropriate); Partner with other organizations and agencies with similar goals to promote building codes that are more disaster resistant at the state level; Use citizen input for the creation of appropriate ordinances; and Use the natural hazard mitigation planning to learn how to better integrate the NHMP into existing documents and programs. 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
Public Works, City Commission		Department of Land Conservation and Development, Department of Geology and Mineral Industries, Oregon Department of Transportation, Department of Environmental Quality	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, DLCD Technical Assistance Grant		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #3

Proposed Action Item		Alignment with Plan Goals:	
Develop, enhance, and implement education programs aimed at mitigating natural hazards, and reducing risk.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Conducting public outreach campaigns raises awareness about natural hazards and helps illustrate what residents and businesses can do to reduce the impact of a natural disaster on their properties, thereby reducing the impact of natural hazards on Oregon City. • The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the county's actions to mitigate hazards. • 2018 Status: The City maintains a CERT, and utilizes the city's website to provide information on natural hazards: https://www.orcity.org/community/emergency-preparedness and hazards mitigation: https://www.orcity.org/publicworks/natural-hazards-mitigation-plan 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Maintain hazard related information and public information materials and disseminate to public through existing resources (newsletter, Trail News, website, social media, etc.); • Conduct public education as hazard seasons approach; • Target neighborhood associations to sponsor CERT teams; • Add emergency preparedness and response curriculum to school programs; • Partner with Clackamas County and other jurisdictions to develop public education flyers for all hazards; • Utilize Community Rating System publications for guidance on preparing effective public information; • Include hazard information on the city website; and • Include insurance information in public outreach and education materials. 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
Public Works		Clackamas County, Community Organizations Active in Disaster (COAD), Clackamas Fire District #1	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #4

Proposed Action Item:		Alignment with Plan Goals:	
Improve vegetation management throughout Oregon City.		Augment Emergency Services; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Parks Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Landscaping and vegetation make a difference in mitigating the impacts of natural hazards. Trees break the force of the wind and stabilize the soil. Wetlands absorb much of the overflow from stream channels. Fire-resistant vegetation can retard the spread of wildfires toward vulnerable buildings. Limiting or regulating the amount of vegetation cleared off a hillside lot reduces the risk of increasing the number of landslide-prone areas in a community. Planting vegetation or maintaining slope terraces can also reduce slope-runoff. Planners can use landscaping requirements to preserve or enhance the protection such natural features afford. These requirements may be part of site plan reviews or a separate set of zoning regulations and environmental performance standards. <u>2018 Status</u>: City properties actively managed, have a tree mitigation program (used for Friends of Trees), enforce requirements. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Partner with Union Pacific and ODOT to control vegetation along transportation corridors; Identify appropriate practices for eliminating English ivy and other invasive species; Maintain healthy urban canopy; Maintain vegetation coverage for slope stability; Identify hazardous trees for remediation or removal; Develop a written set of procedures to minimize damage from wildfires erosion, and downed power lines; and Coordinate with Greater Oregon City Watershed Council and others. 			
Coordinating Organization:		Community Services	
Internal Partners:		External Partners:	
Community Development, Public Works, Parks and Recreation, Code Enforcement		Clackamas Fire District #1, Oregon Department of Forestry, US Forestry Service, Clackamas County, Great Oregon City Watershed Council, Union Pacific Railroad, Oregon Department of Transportation	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Parks SDC		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Earthquake #1*

Proposed Action Item:		Alignment with Plan Goals:	
Conduct seismic evaluations on identified community assets and 'high risk' school and emergency service buildings and implement appropriate structural and non-structural mitigation strategies.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for earthquakes to cause damage can assist a community in mitigating its overall risk to earthquakes. Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. Refer to risk assessment, and DOGAMI's rapid visual assessment scores <u>2018 Status:</u> Many buildings in Oregon City have been seismically upgraded including: Carnegie Center, CFD John Adams Fire Station #15, CFD Hilltop Fire Station #16, the 10.5 million-gallon Mountainview drinking water reservoir, and numerous buildings at Clackamas Community College. New public buildings built for seismic activity include Oregon City High School and all water pump stations. Additionally, new water lines with flexible couplings at the joints were installed near the Newell Creek Apartments. A \$158 million bond was passed in 2018 to replace Gardiner Middle School and renovate Ogden Middle School. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Obtain funding to perform seismic evaluations; Conduct seismic evaluations on identified community assets (including shelters) for implementing appropriate structural and non-structural mitigation strategies; Prioritize seismic upgrades based on criticality of need and population served; Seismically retrofit critical government facilities to guarantee continuous operation during and after a natural disaster; Partner with appropriate organizations to implement seismic upgrades; and Create damage assessment procedures. 			
Coordinating Organization:		Oregon City Emergency Management	
Internal Partners:		External Partners:	
Community Development, Public Works		DOGAMI, Clackamas Fire District #1, Clackamas County	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund, Seismic Rehabilitation Grant Program, Hazard Mitigation Assistance Grants		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

* - High Priority Action Item

Flood #1

Proposed Action Item:		Alignment with Plan Goals:	
Promote and protect the use of naturally flood prone open space or wetlands as flood storage areas.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Flood Ordinance; Zoning Code, FEMA FIRMs, Comprehensive Plan, Parks and Recreation Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> One of the goals of the National Flood Insurance Program is to protect the natural and beneficial functions of floodplains. Natural and beneficial floodplain functions include both the natural infiltration capacities of floodplains, as well as minimizing the pollutants that can enter waters from floodplain development activities. A number of options local governments can choose from are: 1) Prohibit all activities in the floodplain that may be hazardous to public health or water quality (e.g. septic systems, storage of hazardous materials) 2) Require new floodplain developments to avoid or minimize disruption to stream channels and stream banks 3) Adopt regulations pursuant to a Habitat Conservation Plan approved by the US Fish and Wildlife Service or the National Marine Fisheries Service. <u>2018 Status</u>: The city continues to monitor the water quality and volume. The action item wording was updated. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Develop and implement flood protection alternatives for properties within and adjacent to the 100-year floodplain by considering city codes related to the floodplain. Gain support for protecting naturally flood prone open space by educating the public of its importance 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
Public Works		Clackamas Soil and Water Conservation District, Division of State Lands, Johnson Creek Watershed Council, Clackamas River Basin Council	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Capital Funds, FEMA HMA, OWEB		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Flood #2

Proposed Action Item:		Alignment with Plan Goals:	
Continue participating in the National Flood Insurance Program and develop strategies to reduce property damage and related financial impacts due to flooding.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Flood Ordinance; Zoning Code, FEMA FIRMs, Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The National Flood Insurance Program provides communities with federally backed flood insurance to homeowners, renters, and business owners, if communities develop and enforce adequate floodplain management ordinances. The benefits of adopting NFIP standards for communities are a reduced level of flood damage in the community and stronger buildings that can withstand floods. The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will help reduce the level of flood damage to new and existing buildings in communities while providing homeowners, renters and business owners additional flood insurance protection. <u>2018 Status</u>: The city continues to comply with the NFIP. New Flood Insurance Rate Maps (FIRMs). The City currently has a CRS Class 7 rating. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Continue to develop strategies to improve the city's current rating in the National Flood Insurance Program's Community Rating System; Community Assistance Visits (CAV) are scheduled visits to communities participating in the NFIP for the purpose of: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. Actively participate with DLCDC and FEMA during Community Assistance Visits. Assess the floodplain ordinances to ensure they reflect current flood hazards and situations and meet NFIP requirements. Mitigate areas that are prone to flooding and/or have the potential to flood. 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
Public Works		Department of Land Conservation and Development; Association of State Floodplain Managers	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Flood #3*

Proposed Action Item:		Alignment with Plan Goals:	
Complete periodic updates of the Surface Water Management Master Plan.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Stormwater Master Plans, Flood Ordinance; Zoning Code, FEMA FIRMs, Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The Surface Water Management Master Plan developed Capital Improvement Projects to address deficiencies in the stormwater system; • The Surface Water Management Master Plan promotes proper watershed management; and • Stormwater management is a key element in maintaining and enhancing a community's livability. There is a direct link between stormwater and a community's surface and ground waters. Protecting these waters is vital for a great number of uses, including fish and wildlife habitat, recreation, and drinking water. • <u>2018 Status:</u> The city expects the Surface Water Management Master Plan to be completed in 2019. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Identify staff or community members to lead participation efforts. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Community Development		Clackamas County Water Environment Services, METRO, Department of Environmental Quality, Department of Land Conservation and Development, Department of State Lands	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund		Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

* - High Priority Action Item

Landslide #1*

Proposed Action Item:		Alignment with Plan Goals:	
Continue to implement municipal codes and policies mitigating future landslide damage.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
U.S. Geologic Hazards (Chapter 17.44), Erosion and Sediment Control (Chapter 17.47), Natural Resource Overlay Zone (Chapter 17.49), Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for landslides to cause damage can assist a community in mitigating its overall risk to landslide events. <u>2018 Status:</u> Through city code 17.44, Oregon City's Overlay District has been greatly expanded. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Projects should be carefully engineered so: <ul style="list-style-type: none"> The most appropriate measures are used; Environmental impacts are avoided; There are no adverse impacts on other properties. Obtain funding to be engaged in more pro-active bank stabilization projects; Limit construction in known landslide areas; Regular water distribution system leak detection in geologic hazard areas. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Community Development		DOGAMI, Oregon Department of Transportation	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund, Capital Funds		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

* - High Priority Action Item

Landslide #2

Proposed Action Item:		Alignment with Plan Goals:	
Maintain an inventory of streets and properties threatened by landslides.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
U.S. Geologic Hazards (Chapter 17.44), Erosion and Sediment Control (Chapter 17.47), Natural Resource Overlay Zone (Chapter 17.49), Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Developing an inventory of landslide areas can help a community identify which streets might be more vulnerable to damage. Such information can help a community in better identifying and prioritizing projects that can assist a community in mitigating its overall risk to landslides. <u>2018 Status</u>: City adopted new maps. DOGAMI completed a landslide susceptibility report in 2016 using LiDAR (O-16-02); the data from the report is available to the City of Oregon City. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Conduct a study to identify appropriate mitigation strategies for problem areas including buildings and infrastructure in the problem areas; Develop public information to emphasize economic risk when building on potential or historical landslide areas; Update the landslide hazard map when LIDAR data becomes available; and Review the planning and building codes and make updates or changes, if necessary. 			
Coordinating Organization:		Mapping/GIS	
Internal Partners:		External Partners:	
Public Works, Community Development		DOGAMI, USGS, Clackamas County GIS	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Severe Weather #1

Proposed Action Item:		Alignment with Plan Goals:	
Reduce frequency and duration of power outages from the severe wind and winter storm hazards where possible.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure[201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to cause power outages can assist a community in mitigating its overall risk to wind and winter storms. <u>2018 Status:</u> This is a regular activity of the City and PGE. All new power lines are required to be underground. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Reduce power outages by partnering with PGE to obtain funding to bury power lines subject to frequent failures; Encourage burial of power lines for existing development; Ensure that there are back up underground lines to major businesses & employers; Develop partnerships to implement programs to keep trees from threatening lives, property, and public infrastructure; Continue regular tree trimming practices; Partner with PGE to continue hazardous tree inventory and mitigation programs; Create sheltering programs; and Promote safe installation and use of generators. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Community Development		PGE, Bonneville Power Administration, private landowners	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

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; Enhance Natural Systems; Augment Emergency Services; 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:			
The wildfire mitigation action items provide direction on specific activities that organizations and residents in Oregon City can take to reduce wildfire hazards. 2018 Status: CWPP updated in 2018.			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
Wildfire Risk Assessment (Ch. 4):			
<ol style="list-style-type: none"> Maintain and update the Fuels Reduction (FR) and Communities at Risk (CAR) maps and databases. Continue to track structure vulnerability data throughout the County through structural triage assessments. Update the Overall Wildfire Risk Assessment as new data becomes available. 			
Hazardous Fuels Reduction and Biomass Utilization (Ch. 5):			
<ol style="list-style-type: none"> Develop and maintain an inventory of potential and successful FR projects by meeting with parks and natural lands managers quarterly. Continue securing funding to implement projects/hire seasonal ODF staff. 			
Emergency Operations (Ch. 6):			
<ol style="list-style-type: none"> Develop and FDB Communications Works Group. Conduct a Conflagration Exercise. 			
Education and Community Outreach (Ch. 7):			
<ol style="list-style-type: none"> Develop Firewise toolkit for CAR's. Create incentives for fuels reduction. Update and distribute the Burn Permitting and Fire Restrictions Brochure. Continue to improve address signage throughout the County. 			
Structural Ignitability Policies and Programs (Ch. 8):			
<ul style="list-style-type: none"> Identify a DTD representative for the WFEP. Improve coordination with Rural Fire Agencies. Integrate WU into Plan Map and include a public outreach strategy. 			
Coordinating Organization:		Clackamas Fire District #1	
Internal Partners:		External Partners:	
Public Works, Community Development		Clackamas Fire Defense Board, ODF, U.S. Forest Service, public land management agencies	
Potential Funding Sources:		Estimated cost:	Timeline:
ODF, operating budgets		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	High (CWPP identified priority actions listed above)		

* - High Priority Action Item

Wildfire #2*

Proposed Action Item:		Alignment with Plan Goals:	
Complete periodic updates of the Water Master Plan.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Water Distribution System Master Plan, Clackamas County Community Wildfire Protection Plan (2018), Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • <u>2018 Status</u>: The water master plan was last updated in 2012. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Maintain inventory of water lines and fire hydrants and continue to prioritize improvements based on criticality of need for fire protection; • Implement standards to ensure appropriate sizing of water lines for efficient and effective use of fire hydrants; and • Complete periodic rate studies and implement rate increases as necessary. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Community Development		Clackamas Fire District #1	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund		Low to Medium	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

* - High Priority Action Item

Wildfire #3

Proposed Action Item:		Alignment with Plan Goals:	
Promote fire resistant strategies and the use of non-combustible roofing materials by evaluating and making recommendations to current code to encourage noncombustible roofing standards in high fire-hazard areas.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The City and Clackamas Fire District #1 already encourage the use of non-combustible roofing materials. They also encourage neighborhood associations to stop requiring cedar shake roofs. • Programs focus on fuel reduction and defensible space. • <u>2018 Status</u>: The Oregon City building code continues to be updated every 3 years in alignment with the State Building Code updates. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Require fuel breaks in site plans, describe the procedures for ongoing maintenance, and place information on the Oregon City website for public view; • Review street designs that facilitate the movement of fire fighting equipment; • Review roofing standards and develop recommendations for promoting non-combustible roofing; • Promote use of sprinkler systems in residential construction; and • Maintain awareness of potential City growth into the wildland urban interface. 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
Public Works		Clackamas Fire District #1	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

ATTACHMENT B: PUBLIC INVOLVEMENT SUMMARY

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

To provide the public information regarding the draft NHMP addendum, and provide an opportunity for comment, announcements (see below) were provided on the city's website and social media pages including a method for the public to provide comment.

During the public review period there were comments provided at a city commission hearing and through Facebook. The City addressed comments via Facebook and at the city commission meeting. It should be noted that the City has two action items intended to address landslide issues in the City via implementation of landslide municipal codes and developing and maintaining inventories of at risk properties.

In addition to the web site news posting, Oregon City staff reviewed the addendum, held meetings with the Oregon City School District and Clackamas Community College. The school district and Clackamas Community College provided updates on their hazard assessments and seismic resiliency work that they have performed.

Public Comment - City Commission, May 1, 2019

Oregon City Addendum to the NHMP
Public Comment Given at City Commission on May 1, 2019
[Synopsis of Verbal Comments]

Christine Kazinski – lives in Clackamas County [25:31-30:15]

- Saw news page notice of Oregon City addendum to the NHMP request for public comment on the Oregon City web page.
- She gave a copy of the draft Oregon City Addendum to the NHMP to the City Commission.
- She stated that she is interested in annexation and has reviewed every concept plan – plans do not meet annexation factors, specifically Land Use Goal 7 which is designed to protect life and property from natural disasters and hazards. City answered in staff report by stating that the Land Use Goal 7 had been met and sent to LCDC.
 - Page 46 of OC Addendum – Ideas for Implementation
 - First bullet states to use the mitigation plan to help the City's Comprehensive Land Use Plan meet State Land Use Planning Goal 7 – has Goal 7 been met or not?
- How does this NHMP link to equitable housing?
- Has given two testimonies in the last two months regarding landslides and the catastrophic losses borne by property owners from these landslides.
- Has requested that Oregon City have tougher standards regarding slopes. Current slopes of 25% or greater are regulated, but there is proof that landslides in Oregon City happen on slopes of 5%-18%.
- Requesting that Oregon City has policies governing the requirements of Land Use Goal 7. Homeowners should be notified if they are living in a landslide area. There is no landslide insurance in the United States. Losses are borne by the property owners. They need to be notified before they buy the property.

Press Release



CITY OF OREGON CITY

625 Center Street
P. O. Box 3040
Oregon City, Oregon 97045

503.657.0891
www.orcity.org

PRESS RELEASE

For Immediate Release
April 17, 2019

Contact: Kristin Brown
Communications Coordinator
503.496.1547
kbrown@orcity.org

Oregon City seeks additional public input on update to Natural Hazard Mitigation Plan

(Oregon City, OR) – Oregon City is in the process of updating their existing Natural Hazard Mitigation Plan (NHMP). This work is being performed in cooperation with the University of Oregon’s Institute for Policy Research and Engagement - Oregon Partnership for Disaster Resilience and the Oregon Military Department’s Office of Emergency Management utilizing funds obtained from the Federal Emergency Management Agency’s (FEMA) Pre-Disaster Mitigation Grant Program. With re-adoption of the plan this spring, Oregon City will maintain its eligibility to apply for federal funding towards natural hazard mitigation projects. This local planning process includes a wide range of representatives from city and county government, emergency management personnel, and outreach to members of the public.

A natural hazard mitigation plan provides communities with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities, and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

An electronic version of the updated draft Oregon City NHMP addendum will be available, for two weeks, formal public comment beginning **April 18, 2019**. To view the draft please visit:

<https://www.orcity.org/publicworks/what-do-you-think-about-natural-hazard-mitigation-plan>

To see the previously adopted NHMP <https://www.orcity.org/publicworks/natural-hazards-mitigation-plan>

If you have any questions or comments regarding the Oregon City NHMP addendum or the update process in general, please email Oregon City Public Works at pharris@orcity.org; or Michael Howard, Assistant Program Director for the Oregon Partnership for Disaster Resilience at (541) 346-8413 or mrhoward@uoregon.edu.

###

Oregon City Website: April 17 & May 9 (posted twice)

1/2019

What do you think about the Natural Hazard Mitigation Plan? | City of Oregon City



Public Works

What do you think about the Natural Hazard Mitigation Plan?

Oregon City Public Works is seeking public comment regarding an update to the Natural Hazard Mitigation Plan (NHMP). Many jurisdictions have worked to update this document, but we would like to know what you think. Please review the NHMP (link below) and let us know if you have any suggestions to make it even better. We will be collecting public comments for two weeks: April 17 - May 2, 2019.

This plan provides our community with a set of goals, action items, and resources designed to reduce the risk from future natural disaster events. Preparation and mitigation for these types of events is our best defense to protect our community in the event of natural disasters.

If you have any questions or comments regarding the Oregon City NHMP addendum or the update process in general, please email Oregon City Public Works at pharris@orc.org; or Michael Howard, Assistant Program Director for the Oregon Partnership for Disaster Resilience at (541) 346-8413 or mrhoward@uoregon.edu.

feedback


1: //www.orcity.org/publicworks/what-do-you-think-about-natural-hazard-mitigation-plan

1/2

1/2019

What do you think about the Natural Hazard Mitigation Plan? | City of Oregon City

Supporting Documents

 [Oregon City Addendum to the Natural Hazard Mitigation Plan \(NHMP\) \(3 MB\)](#)

 [Press Release - Oregon City 2019 NHMP Addendum \(22 KB\)](#)

Social Media Posts: Facebook: April 18 & 25 (posted twice)

Oregon City - City Hall
Published by Kristin Brown [?] · April 18 at 3:24 PM · 🌐

The Oregon City Natural Hazards Mitigation Plan includes resources and information to assist city residents, public and private sector organizations, and others interested in participating in planning for natural hazards.

The mitigation plan provides a list of activities that may assist the City of Oregon City in reducing risk and preventing loss from future natural hazard events.

Oregon City has developed this plan as an addendum to the multi-jurisdictional Clackamas Count... See More



ORCITY.ORG
What do you think about the Natural Hazard Mitigation Plan? | City of Oregon City
Oregon City Public Works is seeking public comment regarding an update to the Natural...

389 People Reached 17 Engagements [Boost Post](#)

Lisa Peters Novak

Like Comment Share

Most Relevant ▾

Write a comment...

Jackie Hammond-Williams May be don't approve 12467 h further up Holcomb in multiple developments and annexatio one 2 lane road out of the area?! Kinda scary in a brush fire emergency. I will be commenting officially.
Like · Reply · Message · 1w


Oregon City - City Hall Hey Jackie - thanks for your comment. This document is more about how we work other jurisdictions during a natural disaster but I will fi your comments to our Community Development Dep...
Like · Reply · Commented on by Kristin Brown [?] · 1w

Jackie Hammond-Williams Oregon City - City Hall Ahh...have not read it through yet. But still, very worry access into Parkplace neighborhood ..in the event of disaster.
Like · Reply · Message · 1w

Write a reply...

Oregon City - City Hall
Published by Kristin Brown [?] · April 25 at 9:39 AM · 🌐

Oregon City is prepared for natural disasters and we work to maintain a plan that crosses jurisdictions. Our Natural Hazard Mitigation Plan outlines the way we work with our partners such as Clackamas County, Oregon in case of a major event. Read more about the plan here <https://www.orcity.org/.../what-do-you-think-about-natural-ha...>



ORCITY.ORG
What do you think about the Natural Hazard Mitigation Plan? | City of Oregon City
Oregon City Public Works is seeking public comment regarding an update to the Natural...

664 People Reached 37 Engagements [Boost Post](#)

Johnnie Sanfilippo, Denise Evans and 5 others 2 Comments 1 Share

Like Comment Share

Most Relevant ▾

Write a comment...

Jason Richard's Less unmarked \$60,000 police vehicles and more fixing the roads. You can fix a lot of road for one of those sneaky weezle overpriced pretty cars. No Wonder there's no money to fix the roads. Unmarked Police cars swarm this city and use the same horrible pothole riddled roads. What are repair costs over road repair. With ticket revenue in this city it should be no problem to fix all the roads.
Like · Reply · Message · 3d

Oregon City - City Hall Jason, thank you for responding. It might surprise you, but Oregon City's Pavement Condition Index (PCI) is a 76 out of 100. 100 being the best! The PCI is a tool used by cities and counties to gauge the condition of their streets and the progress of their pavement preservation programs. In 2013 Oregon Ci... See More
Like · Reply · Commented on by Kristin Brown [?] · 3d

Social Media Posts: NextDoor



Communications Coordinator Kristin Brown, City of Oregon City AGENCY

May News and Events

May is Preservation Month

In order to spotlight grassroots preservation efforts in America, the National Trust for Historic Preservation created Preservation Month to be celebrated in May.

Oregon City, joining hundreds of thousands of people throughout the country celebrating the places that are meaningful to them, has the following events planned:

- Awarding the Ruth McBride Powers Preservation Award and Preservation Month Proclamation

May 1, 7 p.m. City Commission Meeting, City Hall, 625 Center Street

- Archaeological Discoveries - New and Old**

May 30, 7 p.m., Midway Pub, 1003 7th Street, Oregon City

An Oregon Parks and Recreation Department archaeologist will provide an archaeological overview of some new discoveries in Oregon and revisit a few known archaeological sites.

- Municipal Elevator and McLoughlin Promenade Tours

Thursday, May 9, 4 p.m.

Saturday, May 11, 1 p.m. and 2:30 p.m.

Tours are limited to 20 per group, sign up <https://www.eventbrite.com/e/oregon-city-historic-elevator-and-promenade-tour-tickets-60958057190>

May the 4th be with You

May 4, 5:30 – 7 p.m., Library, 606 John Adams St.

In a Library not so far away...we're celebrating Star Wars Day! Drop in for an evening of free activities, games, and prizes for kids of all ages. Costumes highly recommended.

The Library will be closing at 4 p.m. to set up for the program.

Natural Hazard Mitigation Plan Review

This plan provides our community with a set of goals, action items, and resources designed to reduce the risk from future natural disaster events. Preparation and mitigation for these types of events is our best defense to protect our community in the event of natural disasters. Review the document and provide any comments or feedback by May 9 to pharris@orcity.org; or Michael Howard, Assistant Program Director for the Oregon Partnership for Disaster Resilience at (541) 346-8413 or mrhoward@uoregon.edu.

<https://www.orcity.org/publicworks/what-do-you-think-about-natural-hazard-mitigation-plan>

Social Media Posts: Twitter



City of Oregon City @orcity - Apr 18

Oregon City has developed the Natural Hazards Mitigation Plan as an addendum to the multi-jurisdictional Clackamas County Natural Hazards Mitigation Plan, please review and provide us with feedback. [orcity.org/publicworks/wh...](https://www.orcity.org/publicworks/wh...)



1



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City of Sandy Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan



Photo Credit: City of Sandy

March 2019

Volume II: Sandy Addendum



Prepared for:

City of Sandy

Prepared by:

**University of Oregon
Institute for Policy Research and Engagement
Oregon Partnership for Disaster Resilience**

Planning grant funding provided by:



FEMA

Federal Emergency Management Agency (FEMA)
Pre-Disaster Mitigation Program
Grant: EMS-2017-PC-0005
Sub-grant Application Reference: PDMC-PL-10-OR-2016-001, and

Additional Support Provided by:



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FEMA

December 16, 2019

The Honorable Jim Bernard
Chair, Clackamas County Commissioners
2020 Kaen Road Suite A
Oregon City, Oregon 97045

Dear Chairman Bernard:

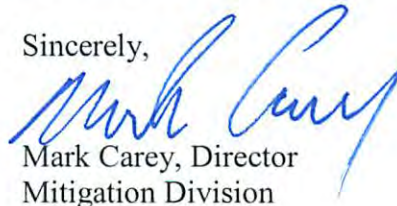
On April 12, 2019, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance (HMA) grants through April 11, 2024, through your state.

Clackamas County	City of Estacada	City of Lake Oswego
City of West Linn	City of Wilsonville	City of Johnson City
City of Oregon City	City of Happy Valley	City of Canby
Clackamas Fire District	City of Gladstone	City of Sandy

The updated list of approved jurisdictions includes the cities of Sandy and Gladstone which recently adopted the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval, please contact Joseph Murray, State Hazard Mitigation Planner with the Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities. If you have questions regarding FEMA's mitigation grant programs, please contact Amie Bashant, State Hazard Mitigation Officer with the Oregon Military Department, Office of Emergency Management, at 503-378-4660.

Sincerely,



Mark Carey, Director
Mitigation Division

Enclosure

JG:vl



NO. 2019-23

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

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

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

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

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

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

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

Whereas, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the City of Sandy addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan and pre-approved it (dated, July 24, 2019) contingent upon this official adoption of the participating governments and entities;

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

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

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

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Sandy that the City of Sandy adopts the Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan; and

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

This resolution is adopted by the Common Council of the City of Sandy and approved by the Mayor this 02 day of December 2019



Stan Pulliam, Mayor

ATTEST:



Karey Milne, City Recorder

Purpose

This is an update of the Sandy addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation and Volume III (Appendices) which provide additional information. This addendum meets the following requirements:

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

Updates to Sandy's addendum are further discussed throughout the NHMP and within Volume III, Appendix B, which provides an overview of alterations to the document that took place during the update process.

Sandy adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on **December 2, 2019**. FEMA Region X approved the Clackamas County NHMP on April 12, 2019 and the City's addendum on **December 16, 2019**. With approval of this NHMP the City is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **April 11, 2024**.

Mitigation Plan Mission

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

The City concurs with the mission statement developed during the Clackamas County planning process (Volume I, Section 3):

Promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

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

The City concurs with the goals developed during the Clackamas County planning process (Volume I, Section 3). All NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Below is a list of the NHMP goals:

GOAL #1: PROTECT LIFE AND PROPERTY

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

GOAL #2: ENHANCE NATURAL SYSTEMS

- Balance watershed planning, natural resource management, and land use planning with natural hazards mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

GOAL #3: AUGMENT EMERGENCY SERVICES

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, and business, and industry.
- Coordinate and integrate natural hazards mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL #4: ENCOURAGE PARTNERSHIPS FOR IMPLEMENTATION

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

GOAL #5: PROMOTE PUBLIC AWARENESS

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

NHMP Process, Participation and Adoption

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

Sandy first developed an addendum to Clackamas County's Natural Hazards Mitigation Plan in 2009. This plan was updated in 2013 and in 2018. The last update of the Sandy addendum to the Clackamas County NHMP was approved by FEMA on April 8, 2013.

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

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research, and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM), Clackamas County, and Sandy to update their NHMP. This project is funded through the Federal Emergency Management Agency's (FEMA) Fiscal-Year 2016 (FY16) Pre-Disaster Mitigation (PDM) Competitive Grant Program EMS-2017-PC-0005 (PDMC-PL-10-OR-2016-001). Members of the Sandy NHMP Hazard Mitigation Advisory Committee (HMAC) also participated in the County NHMP update process (Volume III, Appendix B).

The Clackamas County NHMP, and Sandy addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. The Sandy HMAC guided the process of developing the NHMP.

Convener

The Sandy Police Chief serves as the NHMP addendum convener. The convener of the NHMP will take the lead in implementing, maintaining and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the City of Sandy HMAC met formally and informally, to discuss updates to their addendum (Volume III, Appendix B). The HMAC reviewed and revised the City's addendum, with focus on the NHMP's risk assessment and mitigation strategy (action items).

This addendum reflects decisions made at the designated meetings and during subsequent work and communication with Clackamas County Resilience Coordinator, and the OPDR. The changes are highlighted with more detail throughout this document and within Volume III, Appendix B. Other documented changes include a revision of the City's risk assessment and hazard identification sections, NHMP mission and goals, action items, and community profile.

The Sandy HMAC was comprised of the following representatives:

- Convener, Kim Yamashita, City Manager
- Andi Howell, Transit Director

- Ernie Roberts, Police Chief

Public participation was achieved with the establishment of the HMAC, which was comprised of City officials representing different departments and sectors and members of the public. The HMAC served as the local review body for the NHMP's development. Community members were provided an opportunity for comment via the NHMP review process, and through a survey administered by Clackamas County (Volume III, Appendix G).

NHMP Implementation and Maintenance

The City Council will be responsible for adopting the Sandy addendum to the Clackamas County NHMP. This addendum designates a HMAC and a convener to oversee the development and implementation of action items. Because the City addendum is part of the County's multi-jurisdictional NHMP, the City will look for opportunities to partner with the County. The City's HMAC will convene after re-adoption of the Sandy NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The City's Police Chief will serve as the convener and will be responsible for assembling the HMAC. The HMAC will be responsible for:

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating and training new HMAC members on the NHMP and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement; and
- Documenting successes and lessons learned during the year.

The convener will also remain active in the County's implementation and maintenance process (Volume I, Section 4).

The City will utilize the same action item prioritization process as the County (Volume I, Section 4).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, and Building Codes, as well as the [Clackamas County NHMP](#), and the [State of Oregon NHMP](#).

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the city. Plans and policies already in existence have support from residents, businesses and policy makers. Where possible, Sandy will implement the NHMP's recommended actions through existing plans and

policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Sandy's acknowledged comprehensive plan is the City of Sandy Comprehensive Plan (1997, updated 2012). The Oregon Land Conservation and Development Commission first acknowledged the plan in 1982. The City implements the plan through the Development Code.

Sandy currently has the following plans, regulations, and programs that relate to natural hazard mitigation. For a complete list visit the City's [website](#):

- [Comprehensive Plan](#)
 - [Comprehensive Plan Map](#)
- [Municipal Code](#)
 - [Title 8 Health and Safety](#)
 - [Title 10 Vehicles and Traffic](#)
 - [Title 12 Streets Sidewalks and Public Property](#)
 - [Title 13 Water and Sewer](#)
 - [Title 15 Building, Construction, and Signs](#)
 - [Title 17 Development Code](#)
 - [Section 17.56 Hillside Development](#)
 - [Section 17.60 Flood and Slope Hazard Overlay District](#)
 - [Flood and Slope Hazard Map](#)
 - [Slopes and Geologic Hazards Map](#)
 - [Section 17.62 Cultural and Historic Resources](#)
 - [Section 17.64 Planned Development](#)
 - [Section 17.102 Urban Forestry](#)
- [Sandy Transit Master Plan](#)
- [Transportation Systems Plan](#)
- Stormwater Management Plan (*expected to be complete in 2019*)
 - [Stormwater Management Incentive Program](#)
- Water System Master Plan (*expected to be complete in 2019*)

Other plans:

- [Clackamas County Community Wildfire Protection Plan](#)
 - [Sandy Rural Fire Protection District](#)

Government Structure

The governing body for the City of Sandy is the City Council. The Council is composed of the mayor and six City Council members. All Council members are elected at-large. As with most Oregon cities, Sandy uses the "council-manager" form of government. The City Council members are unpaid volunteers who typically hold full time jobs in other areas. They are responsible for all city policies, legislation, and the city budget. The City Council appoints a city manager, who is assigned responsibility of day-to-day operation of the city, consistent with the policy direction set by the Council.

The **Development Services Department** is composed of three divisions: Planning, Building, and Economic Development. The **Planning Division** is responsible for long- and short-term planning, including review and approval of development projects. The division guides the city's land use development process. Planning staff implement the city's comprehensive plan, ensuring that all development projects conform to the municipal code. The **Building Division** provides consultation, plan review, permit and inspection services to the construction industry and the public. The division administers building, mechanical, and plumbing permits and inspections. The **Economic Development Division** provides business licenses, and resources and services to local businesses.

The **Public Works Department** is responsible for public services including water, sanitary sewer, stormwater, streets and traffic, and park maintenance.

The **Police Department** is responsible for public safety in the city of Sandy and as such responds to all types of emergency situations. It also provides Code Enforcement function for the City of Sandy.

The **Department of Community Services** includes the Community/Senior Center, Recreation Department, and Public Libraries.

The **Sandy Transit Department** provides transportation options to residents through an integrated transit system.

Continued Public Participation

An open public involvement process is essential to the development of an effective NHMP. To develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunity for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the NHMP during review.¹ Keeping the public informed of the City's efforts to reduce its risk to future natural hazard events is important for successful NHMP implementation and maintenance. The City is committed to involving the public in the NHMP review and update process (Volume I, Section 4). The City posted the plan update for public comment before FEMA approval, and after approval will maintain the plan on the City's website:

<https://www.ci.sandy.or.us/>

NHMP Maintenance

The Clackamas County NHMP and City addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the County NHMP update process, the City will also review and update its addendum (Volume I, Section 4). The convener will be responsible for convening the HMAC to address the questions outlined below.

- Are there new partners that should be brought to the table?
- Are there new local, regional, state or federal policies influencing natural hazards that should be addressed?

¹ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

- Has the community successfully implemented any mitigation activities since the NHMP was last updated?
- Have new issues or problems related to hazards been identified in the community?
- Are the actions still appropriate given current resources?
- Have there been any changes in development patterns that could influence the effects of hazards?
- Have there been any significant changes in the community's demographics that could influence the effects of hazards?
- Are there new studies or data available that would enhance the risk assessment?
- Has the community been affected by any disasters? Did the NHMP accurately address the impacts of this event?

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

Mitigation Strategy

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

The City's mitigation strategy (action items) were first developed during the 2009 NHMP planning process and revised during subsequent NHMP updates. During these processes, the HMAC assessed the City's risk, identified potential issues, and developed a mitigation strategy (action items).

During the 2018 update process the City re-evaluated their mitigation strategy (action items). During this process action items were updated, noting what accomplishments had been made and whether the actions were still relevant; any new action items were identified at this time (see Volume III, Appendix B for more information on changes to action items).

Priority Action Items

Table SA-1 presents a list of mitigation actions. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity. High priority actions are shown in **bold** text with grey highlight. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity. The City will focus their attention, and resource availability, upon these achievable, high leverage, activities over the next five-years. Although this methodology provides a guide for the HMAC in terms of implementation, the HMAC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for detailed information for each action. Full text of the plan goals referenced in Table SA-1 is located on page SA-2.

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Table SA-I Sandy Action Items

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
MH #1	Maintain public education programs to inform the public about methods for mitigating the impacts of natural hazards.	HMAC	Fire, Public Works	Ongoing	✓		✓	✓	✓
MH #2	Integrate the goals and action items from the Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	Planning	Public Works	Ongoing	✓	✓	✓	✓	✓
MH #3	Improve vegetation management throughout the city.	Planning	Public Works, Code Enforcement, HMAC	Ongoing			✓		✓
MH #4	Encourage structural mitigation practices in developments at risk to natural hazards.	Planning	Public Works, Fire, HMAC	Ongoing	✓	✓		✓	✓
EQ #1	Reduce negative impacts of earthquakes by performing seismic evaluations and retrofits (structural and non-structural).	HMAC	Planning, Building, Public Works	Long Term	✓		✓	✓	
EQ #2	Seismically retrofit (structural and non-structural) the Sandy Community Center to exceed life safety standards in order to operate as a possible shelter.	Community Services	Planning, Building, Public Works	Long Term	✓		✓	✓	
EQ #3	Seismically retrofit (structural and non-structural) City Hall in order to continue operations post-earthquake and to protect city and county IT infrastructure (servers).	SandyNet, City Administration	Planning, Building, Public Works	Long Term	✓		✓	✓	
FL #1	Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.	Development Services	HMAC	Ongoing	✓	✓		✓	✓

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
FL #2	Explore participation in the NFIP's Community Rating System (CRS).	Planning	Public Works, HMAC	Short Term	✓	✓		✓	✓
FL #3	Promote and protect the use of naturally flood prone open space or wetlands as flood storage areas.	Planning	Public Works, HMAC	Ongoing	✓	✓		✓	✓
LS #1	Maintain and update an inventory of streets and properties threatened by landslides.	Planning	Public Works, GIS	Ongoing				✓	✓
LS #2	Reduce the vulnerability of property owners in landslide-prone areas.	Planning	Public Works, GIS, HMAC	Ongoing	✓	✓		✓	✓
SW #1	Reduce negative effects from severe windstorm and severe winter storm events.	Public Works	Planning, Building, HMAC	Ongoing	✓	✓	✓	✓	✓
WF #1	Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan.	Fire	Public Works, Planning, Building	Ongoing	✓	✓	✓	✓	✓

Source: City of Sandy HMAC, 2018.

Note: Full text of the plan goals referenced in this table is located on page SA-2.

Risk Assessment

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

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

The local level rationale for the identified mitigation strategies (action items) is presented herein and within Volume I, Section 3 and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure SA-1. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure SA-1 Understanding Risk



Hazard Analysis

The Sandy HMAC developed their hazard vulnerability assessment (HVA), using their previous HVA and the County’s HVA as a reference. Changes from their previous HVA and the County’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Sandy, which are discussed throughout this addendum.

Table SA-2 shows the HVA matrix for Sandy listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for

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

Two catastrophic hazards (Cascadia Subduction Zone earthquake and Crustal earthquake) and one chronic hazard (winter storm) rank as the top hazard threats to the City (Top Tier). Flood, wildfire, and windstorm comprise the next highest ranked hazards (Middle Tier), while volcanic event, drought, landslide, and extreme heat hazards comprise the lowest ranked hazards (Bottom Tier).

Table SA-2 Hazard Analysis Matrix – Sandy

Hazard	Maximum				Total Threat Score	Hazard Rank	Hazard Tiers
	History	Vulnerability	Threat	Probability			
Earthquake - Cascadia	4	45	100	49	198	#1	Top Tier
Earthquake - Crustal	6	50	100	21	177	#2	
Winter Storm	10	30	70	63	173	#3	
Flood	16	30	60	56	162	#4	Middle Tier
Wildfire	6	40	70	42	158	#5	
Windstorm	14	30	50	63	157	#6	
Volcanic Event	2	40	80	14	136	#7	Bottom Tier
Drought	10	15	50	56	131	#8	
Landslide	14	30	20	63	127	#9	
Extreme Heat	2	20	40	14	76	#10	

Source: Sandy HMAC, 2018.

Table SA-3 categorizes the probability and vulnerability scores from the hazard analysis for the City and compares the results to the assessment completed by the Clackamas County HMAC. Variations between the City and County are noted in **bold** text within the city ratings.

Table SA-3 Probability and Vulnerability Comparison

Hazard	Sandy		Clackamas County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	High	Low	High	Low
Earthquake - Cascadia	Moderate	High	Moderate	High
Earthquake - Crustal	Low	High	Low	High
Extreme Heat	Low	Moderate	Low	High
Flood	High	Moderate	High	Moderate
Landslide	High	Moderate	High	Low
Volcanic Event	Low	High	Low	Moderate
Wildfire	Moderate	High	High	Moderate
Windstorm	High	Moderate	Moderate	Low
Winter Storm	High	Moderate	Moderate	Moderate

Source: Sandy and Clackamas County HMAC, 2018.

Community Characteristics

Table SA-4 and the following section provides information on City specific demographics and assets. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation.

Considering the City specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation. Between 2010 and 2016 the City grew by 1,000 people (10%; as of 2018 the population was 10,990) and median household income increased by about 8%.² Between 2018 and 2040 the population is forecast to grow by 90% to 20,911.³ To accommodate expected population growth the city [expanded its Urban Growth Boundary in 2017](#) and included an Urban Reserve Boundary to accommodate future needs. New development has complied with the standards of the [Oregon Building Code](#) and the city's development code.

Transportation/Infrastructure

Downtown Sandy is an asset to the community and the city has undertaken several urban renewal projects to increase the community's prosperity by enabling an economically viable and vibrant city. The 3/4 mile stretch between Bluff Road and Ten Eyck Road is the heart of the city and offers shopping, dining and entertainment. Sandy's downtown is also home to a variety of city services including City Hall, Sandy Fire and Police, the City Library and Community Center.

Sandy's commercial sector is centered along Highway 26. Industry is primarily located in the western portion of the city. Most residential properties are in the southern part of town, although the northern part of town is also zoned for residential use.

Transportation is an important consideration when planning for emergency service provisions. Growth within the city will put pressure on both major and minor roads, especially if the main mode of travel is by single occupancy vehicles.

Motor vehicles represent the dominant mode of travel through and within Sandy. The City's public transit is provided by Sandy Area Metro system and Mt. Hood Express.

Economy

Sandy is dominated by small businesses, with more than 80% of businesses employing fewer than five employees. The city's residents work in a variety of industries, with "professional and related occupations" (25% of workforce), "management, business, and financial operations occupations" (13%), "sales and related occupations" (12%), and "office and administrative support occupations" (12%) accounting for the top occupations.⁴

The five largest employers in Sandy are Oregon Trail School District, US Forest Service, Safeway, US Metal Works (truck bins, air pneumatic systems, conveyers), and AEC Incorporated (computer and software).

² Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018 and Social Explorer, Table T57, U.S. Census Bureau, 2012-2016 and 2006-2010 American Community Survey Estimates.

³ Portland State University, Population Research Center, "Population Forecast Tables", 2017.

⁴ Social Explorer, Table 50, U.S. Census Bureau, 2012-2016 American Community Survey Estimates

Table SA-4 Community Characteristics

Population Characteristics		
2010 Population	9,655	
2016 Population [2018 Population]	10,655	[10.990]
2040 Forecasted Population*	20,911	
Race (non-Hispanic) and Ethnicity (Hispanic)		
White		87%
Black/ African American		0%
American Indian and Alaska Native		< 1%
Asian		1%
Native Hawaiian and Other Pacific Islander		0%
Some Other Race		0%
Two or More Races		3%
Hispanic or Latino		8%
Limited or No English Spoken		3%
Vulnerable Age Groups		
Less than 15 Years	2,566	25%
65 Years and Over	1,275	12%
Disability Status		
Total Population	1,249	12%
Children	62	2%
Seniors	442	35%
Income Characteristics		
Households by Income Category		
Less than \$15,000	186	5%
\$15,000-\$29,999	613	16%
\$30,000-\$44,999	496	13%
\$45,000-\$59,999	580	15%
\$60,000-\$74,999	614	16%
\$75,000-\$99,999	588	15%
\$100,000-\$199,999	671	17%
\$200,000 or more	114	3%
Median Household Income	\$61,687	
Poverty Rates		
Total Population	880	9%
Children	293	10%
Seniors	86	7%
Housing Cost Burden		
Owners with Mortgage	804	31%
Renters	700	56%

Source: U.S. Census Bureau, 2012-2016 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018; Portland State University, Population Research Center, "Population Forecast Tables", 2017.

Housing Characteristics		
Housing Units		
Single-Family	3,248	78%
Multi-Family	644	16%
Mobile Homes	268	6%
Year Structure Built		
Pre-1970	485	12%
1970-1989	1,052	25%
1990 or later	2,623	63%
Housing Tenure and Vacancy		
Owner-occupied	2,601	63%
Renter-occupied	1,261	30%
Seasonal	0	0%
Vacant	298	7%

Located on Highway 26, Sandy is a scenic community with beautiful views and vast outdoor recreational opportunities and serves as a gateway for tourists visiting Mount Hood and the Mount Hood National Forest. Sandy's residents enjoy a rural lifestyle while still having the urban amenities of Portland, located just 25 miles to the northwest. Sandy incorporated in 1911 and has doubled its population since 2000 and is expected to double its population again by 2040.

Sandy's largest body of water is the Sandy River. Smaller tributaries include Tickle Creek, Cedar Creek, and Badger Creek. The topography in Sandy is quite diverse, ranging from the steep Sandy River canyon to relatively flat farmland. The areas to the east and south of the city are mostly forested land, and areas to the north and west of the city are primarily farmland.

The City is within the Sandy River watershed at 967 feet above sea level. Because of its location Sandy's climate is consistent with the Marine west coast climate zone, with warm summers and cool, wet winters. Sandy receives most of its precipitation between October and May, averaging 79 inches of rain, and about one (1) inch of snow, per year.⁵

⁵ ["Monthly Average for Sandy, OR"](#) The Weather Channel Interactive, Inc. Retrieved November 1, 2018.

Community Assets

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of Sandy. It is important to note that the facilities identified as “critical” and “essential” are characterized differently than the structural code that identifies buildings as “essential” and “non-essential.” The structural code uses different language and criteria and therefore have completely different meanings than the buildings identified in this addendum.

Critical Facilities

Facilities that are critical to government response, and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include: 911 Centers, Emergency Operations Centers, Police, and Fire Stations, Public Works facilities, sewer, and water facilities, hospitals, bridges, roads, shelters, and more.

Table SA-5 Critical Facilities in Sandy

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Facilities									
City Hall		X				X	X	X	X
Sandy Fire District - Main Station						X	X	X	X
Sandy Police Department						X	X	X	X
City Maintenance Shops, Equipment, Operations Center						X		X	X

Hazardous Materials:

Facilities that, if damaged, could cause serious secondary impacts may also be considered “critical.” Hazardous materials sites are particularly vulnerable to earthquake, landslide, volcanic event, wildfire, and winter storm hazards. A hazardous material facility is one example of this type of critical facility. Those sites that store, manufacture, or use potentially hazardous materials include:

Fuel Storage

Chevron
Leathers Oil Co.
Mt. Hood Arco
(East and West)
Pacific Pride Fuel
Sandy Market and Shell

Other:

Advanced Plastics, Inc
Bi-Mart
Champion Collision
Fred Meyer
Hearth Classics
Independent Diesel
Jiffy Lube
Les Schwab Tire Center
Mt. Hood Cleaners and Laundry
NAPA Auto Parts

Olin Aquatic Center
O'Reilly Auto Parts
Performance Auto Body
Sandy Auto Body
Sandy Funeral Home
Suburban Chevrolet
Suburban Ford
US Metal Works Inc./US
Meat & Restaurant Supply
Web Steel

Essential Facilities

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public's ability to recover from the emergency. These facilities may include: City buildings such as the Public Services Building, the City Hall, and other public facilities such as schools.

Table SA-6 Essential Facilities in Sandy

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Essential Facilities									
Schools									
Cedar Ridge Middle School						X	X	X	X
Firwood Grade School		X				X	X	X	X
Oregon Trail Primary Academy		X				X	X	X	X
Oregon Trail School District Offices		X				X		X	X
Sandy Grade School		X				X	X	X	X
Sandy Head Start		X				X		X	X
Sandy High School		X				X		X	X
Food Providers									
Fred Meyer's (+ pharmacy)									
Safeway (+ pharmacy)									
Hospitals and Pharmacies									
Adventist Health Clinic and Urgent Care									
Clackamas County Public Health		X							
Bi-Mart (pharmacy)									
Other Essential Facilities									
Churches*									
Mt. Hood National Forest Headquarters									
Olin Bignall Aquatic Center									
U.S. Post Office		X							

Note: * Churches include: Aims Community, Assembly of God, Church of Christ, Church of Latter Day Saints, Community Presbyterian, Dover Community, Immanuel Lutheran, Jehovah's Witness, Living Way Fellowship, Orient Drive Baptist, Sandy Baptist, Church of Nazarene, Seventh Day Adventist, and St Michael's Catholic

Critical Infrastructure:

Infrastructure that provides necessary services for emergency response include:

Table SA-7 Critical Infrastructure in Sandy

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Infrastructure									
AT&T Cellular									
PGE Substation - Hwy 26 and Bluff Rd.									
Sprint/Nextel Cellular Tower									
State Highway 211		X							
US Highway 26		X							
Water Reservoirs									
Water Treatment Plant		X							
Watershed		X		X	X	X	X		X

Vulnerable Populations:

Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, often experience the impacts of natural hazards and disasters more acutely. Populations that have special needs or require special consideration include:

Senior Living Centers and Disabled Housing

Avamere Assisted Living	Evans Street Senior Apartments
Cascadia Village	Firwood Village Apartments
Cedar Park Garden Apartments	Harlon Garden Apartments
Country Garden Apartments	Hummingbird Apartments

Other

Best Western Sandy Inn	Mt. Hood Hospice
Fresenius Kidney Care (Dialysis Clinic)	Sandy Vista Apartments (large Spanish speaking pop.)
Hood Chalet Mobile Estates	Schools
Medical Clinics	

Cultural and Historic Assets

The cultural and historic heritage of a community is more than just tourist charm. For families that have lived in the city for generations and new resident alike, it is the unique places, stories, and annual events that make Sandy an appealing place to live. The cultural and historic assets are both intangible benefits and obvious quality-of-life- enhancing amenities. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important.

Table SA-8 Cultural or Historic Assets in Sandy

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Cultural or Historic Assets									
Barlow Ridge Park					X		X	X	
Bell Street Fields					X		X	X	
Cascadia Park					X		X	X	
Hamilton Ridge Park					X		X	X	
Jonsrud Viewpoint					X		X		
Junker Business Building	X	X	X	X	X	X	X	X	X
Meining Memorial Park									
R.S. Smith Building					X		X	X	
Sandy Bluff Park							X		
Sandy Civic Plaza and Museum		X							
Sandy Historical Museum		X			X		X	X	
Sandy River Park				X	X		X		
Sandy River Trail									
Sandy Skate Park				X	X		X	X	
The Meining Park					X		X	X	
Tickle Creek Park/Trail				X	X		X		
Tupper Park				X	X		X		
Veterans Memorial Square				X	X		X		

Hazard Characteristics

Drought

The HMAC determined that the City's probability for drought is **high** and that their vulnerability to drought is **low**. *The probability rating increased, and the vulnerability rating did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent and probability of a potential event. Due to the climate of Clackamas County, past and present weather conditions have shown an increasing potential for drought.

The City of Sandy has three water sources: Alder Creek (small tributary of the Sandy River), Brownell Springs (city-owned natural spring on Lenhart Butte), and Portland Water Bureau. During the spring, fall, and winter approximately 50% of the supply comes from the Portland Water Bureau, while during the summer each source provides about one-third of the total supply. The Alder Creek site, located within the Alder Creek watershed (3,915 acres), provides about 2.6 MGD (million gallons per day, equal to water rights the city has on Alder Creek). The site includes a treatment plant, reservoirs, piping, and pump stations built in 1977 and last updated in 2001. Brownell Springs provides about 60,000 to 500,000 gallons per day and is located on 22 acres of City-owned land on the north face of Lenhart Butte. The Portland Water Bureau source has been providing about 500,000 gallons per day (up to a maximum of 3 MGD) since 2008. In addition, the city holds water rights to withdraw up to 25 CFS (cubic feet per second – roughly 16 MGD) from the Salmon River near the Mount Hood National Forest Boundary (current agreements limit future withdrawal to 16.3 CFS – roughly 1-.5 MGD). The existing water rights and system is considered adequate to supply the City's expected growth through at least 2040.

Vulnerability Assessment

Due to insufficient data and resources, Sandy is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables SA-5 through SA-8.

Mitigation Activities

The existing drought hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Earthquake (Cascadia Subduction Zone)

The HMAC determined that the City's probability for a Cascadia Subduction Zone (CSZ) earthquake is **moderate** and that their vulnerability to a CSZ earthquake is **high**. *These ratings did not change since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake and Crustal earthquake.*

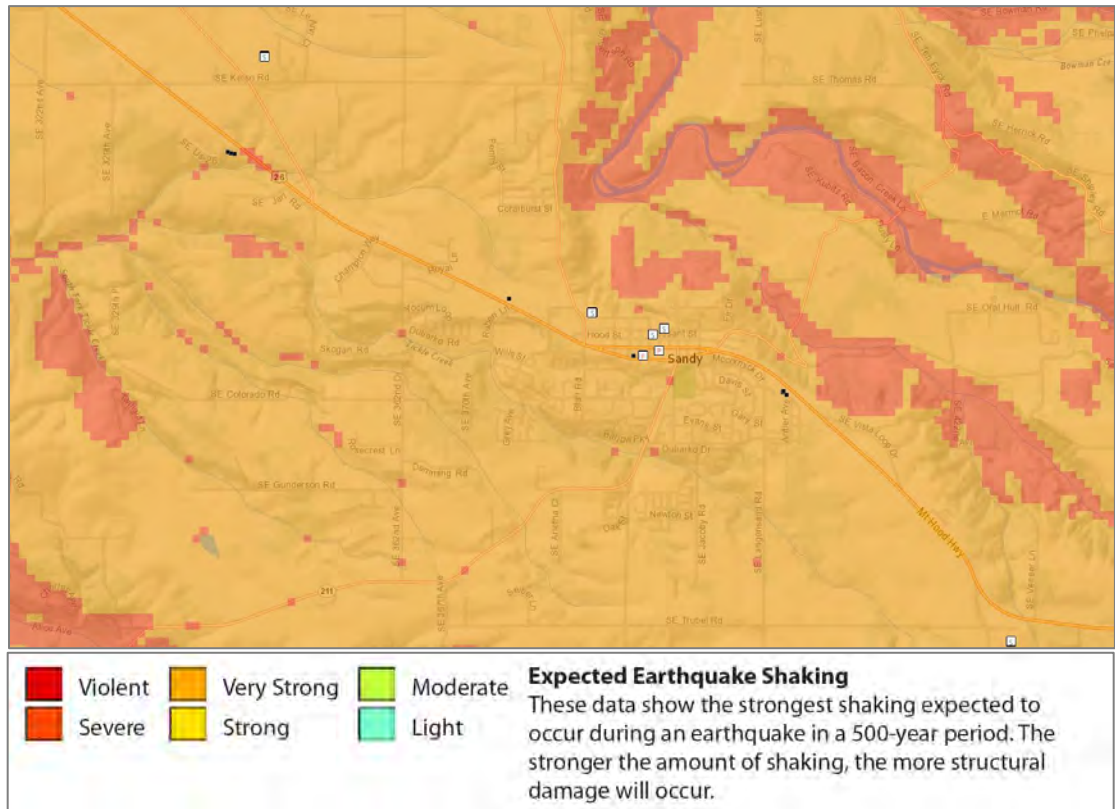
Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent and probability of a potential event. Generally, an event that affects the

County is likely to affect Sandy as well. The causes and characteristics of an earthquake event are appropriately described within the Volume I, Section 2 as well as the location and extent of potential hazards. Previous occurrences are well documented within Volume I, Section 2 and the community impacts described by the County would generally be the same for Sandy as well.

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Portland Hills Fault Zone, Gales Creek-Newberg-Mt. Angel Structural Zone, and Mount Hood Fault (discussed in the crustal earthquake section).

Figure SA-2 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the city is expected to experience very strong shaking (orange), while areas near rivers and streams will experience severe (light red) to violent (dark red) shaking in a CSZ event.

Figure SA-2 Cascadia Subduction Zone Expected Shaking



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

Note: To view detail click the link above to access Oregon HazVu.

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year. Scientists have found evidence that 11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average

occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D.⁶

The city's proximity to the Cascadia Subduction Zone, potential slope instability and the prevalence of certain soils subject to liquefaction and amplification combine to give the city a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places the city predominately within the "Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades). Within the Northwest Oregon region, damage and shaking is expected to be strong and widespread - an event will be disruptive to daily life and commerce and the main priority is expected to be restoring services to business and residents.

Earthquake (Crustal)

The HMAC determined that the City's probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**. *The probability rating decreased, and the vulnerability rating did not change, since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Crustal earthquake, and Cascadia Subduction Zone (CSZ) earthquake.*

Volume I, Section 2 describes the causes and characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Sandy as well. Figure SA-3 shows a generalized geologic map of the Sandy area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows that the City is mostly outside of the areas of greatest liquefaction concern.

There are three potential crustal faults and/or zones near the City that can generate high-magnitude earthquakes. These include the Gales Creek-Mt. Angel Structural Zone, Portland Hills Fault Zone, and Mt Hood Fault (discussed in greater detail below). Historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late

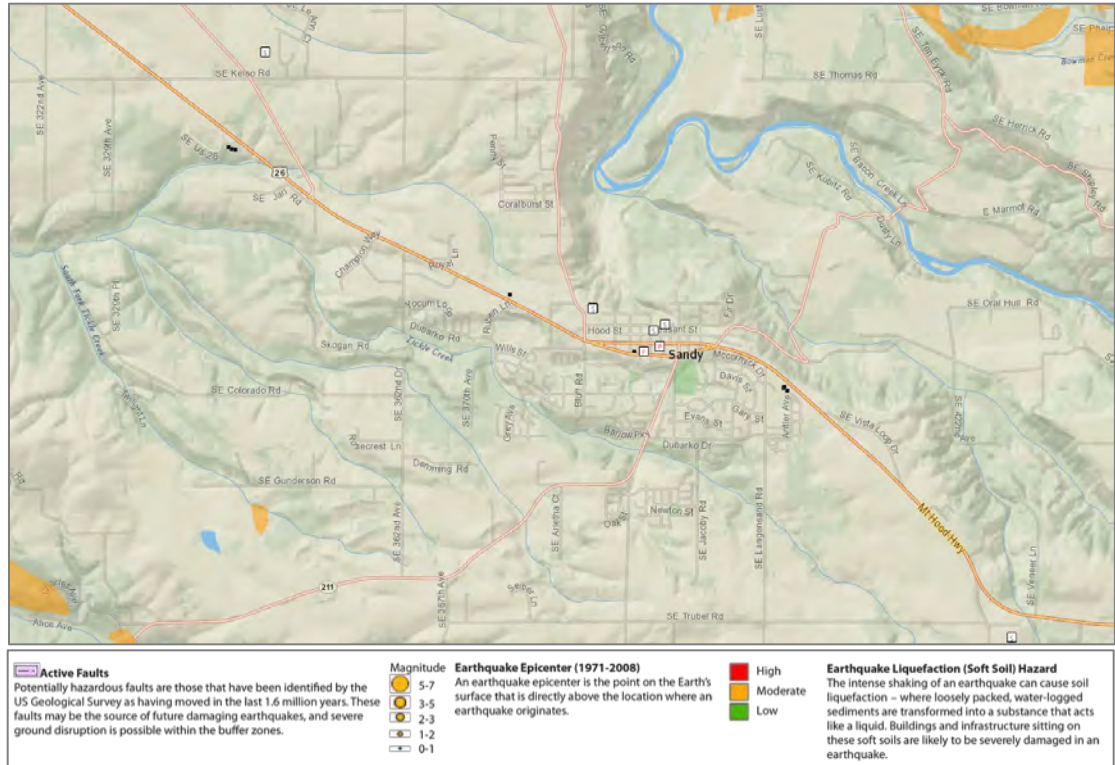
⁶ The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. <http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf>

Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and lies about 11 miles northeast of Sandy.

Mount Hood Fault Zone

The Mount Hood Fault Zone is a series of four north-trending faults that extend approximately 34 miles north from Clear Lake to the Columbia River, its major segments include the Blue Ridge and the Twin Lakes faults.⁷

Figure SA-3 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)
Note: To view detail click the link above to access Oregon HazVu

Vulnerability Assessment

The Department of Geology and Mineral Industries (DOGAMI) conducted a multi-hazard risk assessment (Risk Report) for the Lower Columbia-Sandy Watershed including the City of Sandy. The Risk Report provides a quantitative risk assessment for the earthquake, hazard. Additionally, DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults.

⁷ Madin, I. P., Streig, A. R., Burns, W. J., and Ma, L., 2017, The Mount Hood Fault Zone – Late Quaternary and Holocene fault features newly mapped with high-resolution lidar Imagery, in Scott, W. E., and Gardner, C. A. (eds.), Field-trip guide to Mount Hood, Oregon, highlighting eruptive history and hazards: U.S. Geological Survey Scientific Investigations Report 2017-5022-G, p. 100-109.
<https://pubs.usgs.gov/sir/2017/5022/g/sir20175022g.pdf>

Earthquake Regional Impact Analysis

In 2018 DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)). Their study focused on damage to buildings, and the people that occupy them, and to two key infrastructure sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and night time (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damaged varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood structures that fare worse in an earthquake. The Portland Hills fault scenario created greater damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios, however, the impact is considerably less than it is to the transportation routes. Additional, capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts.

Table SA-9 shows the permanent resident population that are vulnerable to injury or death (casualty) and the buildings in the City that are susceptible to liquefaction and landslides, it does not predict that damage will occur in specific areas due to either liquefaction or landslide. More population and property are exposed to higher degrees of expected damage or casualty under the Portland Hills Fault “wet” scenario than in any other scenario.

Table SA-9 Expected damages and casualties for the CSZ fault and Portland Hills fault: earthquake, soil moisture, and event time scenarios

	Cascadia Subduction Zone (M9.0)		Portland Hills Fault (M6.8)	
	"Dry" Soil	"Wet" Saturated Soil	"Dry" Soil	"Wet" Saturated Soil
Number of Buildings	3,734	3,734	3,734	3,734
Building Value (\$ Million)	1,077	1,077	1,077	1,077
Building Repair Cost (\$ Million)	11	12	20	21
Building Loss Ratio	1%	1%	2%	2%
Debris (Thousands of Tons)	5	5	8	8
Long-Term Displaced Population	4	6	4	16
Total Casualties (Daytime)	5	5	8	9
Level 4 (Killed)	0	0	0	0
Total Casualties (Nighttime)	2	2	3	4
Level 4 (Killed)	0	0	0	0

Source: DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8, 12-9, 12-10, and 12-11.

Cascadia Subduction Zone Scenario

The City of Sandy is expected to have a 1% building loss ratio with a repair cost of \$11 million under the CSZ “dry” scenario, and an 1% building loss ratio with a repair cost of \$12 million under the CSZ “wet” scenario.⁸ The city is expected to have around 5 daytime or 2 nighttime casualties during the CSZ “dry” scenario and 5 daytime or 2 nighttime casualties during the CSZ “wet” scenario. It is expected that there will be a long-term displaced population of around 4 for the CSZ “dry” scenario and 6 for the CSZ “wet” scenario.⁹

Portland Hills Fault Scenario

The City of Sandy is expected to have a 2% building loss ratio with a repair cost of \$20 million under the CSZ “dry” scenario, and a 2% building loss ratio with a repair cost of \$21 million under the CSZ “wet” scenario.¹⁰ The long-term displaced population and casualties are slightly increased for all the Portland Hills Fault scenarios. The city is expected to have around 8 daytime or 3 nighttime casualties during the Portland Hills Fault “dry” scenario and 9 daytime or 4 nighttime casualties during the Portland Hills Fault “wet” scenario. It is expected that there will be a long-term displaced population of around 4 for the Portland Hills Fault “dry” scenario and 16 for the Portland Hills Fault “wet” scenario.¹¹

Recommendations from the report included topics within Planning, Recovery, Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMPs mitigation strategies (Table SA-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and the recommendations see: *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, [O-18-02](#)).

Lower Columbia-Sandy Watershed Natural Hazard Risk Report

The **Risk Report** ([DOGAMI, IMS-59](#)) provides hazard analysis summary tables that identify populations and property within the Lower Columbia-Sandy River Watershed Study Area that are vulnerable to the Cascadia subduction zone earthquake and a local crustal earthquake event associated with the Mount Hood fault. The Risk Report provides a distinct profile for the City of Sandy. According to the Risk Report the following populations and property are vulnerable to the studied earthquake hazards:

City of Sandy¹²

Cascadia Subduction Zone event (M9.0 Deterministic): 1 building is expected to be damaged for a total potential loss of \$1,817,000 (a loss ratio of < 1%). No residents are expected to be displaced.

Crustal event (Mt Hood M6.9 Probabilistic): 1 building is expected to be damaged for a total potential loss of \$1,402,000 (a loss ratio of < 1%). No residents are expected to be displaced.

⁸ DOGAMI, *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, O-18-02), Tables 12-8 and 12-9.

⁹ Ibid, Tables 12-8 and 12-9.

¹⁰ Ibid, Tables 12-10 and 12-11

¹¹ Ibid, Tables 12-10 and 12-11.

¹² DOGAMI, *Lower Columbia-Sandy Watershed Natural Hazard Risk Report* (March 2018 Draft), Table 9-11.

DOGAMI Rapid Visual Survey (2007)

Seismic building codes were implemented in Oregon in the 1970s, however, stricter standards did not take effect until 1991 and early 2000s. As noted in the community profile, approximately 36% of residential buildings were built prior to 1990, which increases the City’s vulnerability to the earthquake hazard. Information on specific public buildings’ (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table SA-10; each “X” represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), one (1) has a very high (100% chance) collapse potential. In addition, Sandy’s water treatment building is constructed of cinder blocks and could be damaged or collapse during an earthquake. Park Street is built entirely on fill, and areas built on fill are subject to liquefaction in an earthquake event. Bluff Road is another area where homes could be impacted. *Note: the main fire station has been seismically retrofitted.*

For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables SA-5 through SA-8. In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

Table SA-10 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Cedar Ridge Middle^^ (17225 Smith Ave)	Clac_sch38	X	Property sold to City of Sandy for aquatic and community center.		
Sandy Grade (38955 Pleasant St)	Clac_sch36	X			
Sandy High – Frazier^ (17100 Bluff Rd)	Clac_sch6 7	X	Facility renovated, older buildings demolished and rebuilt via 2008 bond. Now houses Cedar Ridge Middle. New High located at 37400 Bell.		
Public Safety					
Police Department (38970 Proctor Blvd)	Clac_pol07	X			
Sandy Fire 72 – Main Station (17460 Bruns Ave)	Clac_fir37	Seismic retrofit via 2013-14 SRGP.			

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#) “*” – Site ID is referenced on the [RVS Clackamas County Map](#)

Note 1: Bold indicates facilities that have been seismically retrofitted or rebuilt.

Note 2: ^ High school was rebuilt in 2012, as of 2017 the school is to be renovated and used as Cedar Ridge Middle school.

Utility systems will be significantly damaged, including damaged buildings and damage to utility infrastructure, including water treatment plants and equipment at high voltage

substations (especially 230 kV or higher which are more vulnerable than lower voltage substations). Buried pipe systems will suffer extensive damage with approximately one break per mile in soft soil areas. There would be a much lower rate of pipe breaks in other areas. Restoration of utility services will require substantial mutual aid from utilities outside of the affected area.

Mitigation Activities

Sandy has taken mitigation steps to reduce the city's vulnerability in earthquake events. Seismic retrofit grant awards per the [Seismic Rehabilitation Grant Program](#)¹³ have been used to retrofit the Main Fire Station (2013-2014 grant award, \$1,186,393). In 2008 voters approved a \$115 million education bond, \$75 million was used to build a new high school. In 2012 the high school opened at its new location at 37400 Bell Street. In 2017, the Cedar Ridge Middle school was relocated to the former Sandy High property which has been renovated and retrofitted for its new use. The former Cedar Ridge Middle school has been purchased by the City of Sandy and houses the city's aquatic and community center.

Please review Volume I, Section 2 for additional information on this hazard.

Flood

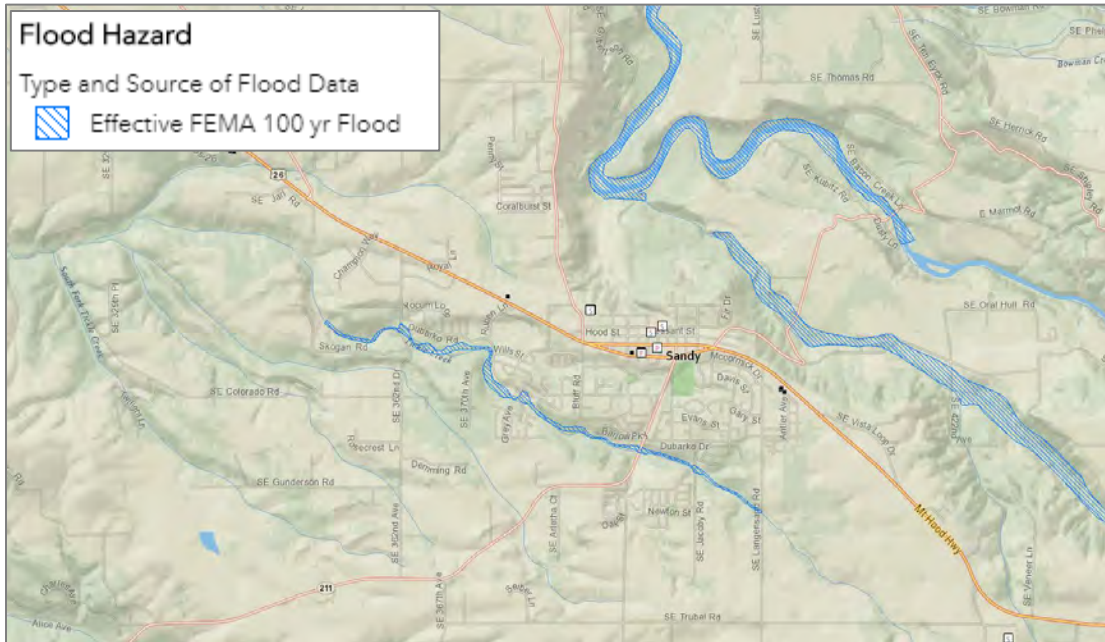
The HMAC determined that the City's probability for flood is **high** and that their vulnerability to flood is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent, and probability of a potential event. Figure SA-4 illustrates the flood hazard area for Sandy, which covers five percent (5%) of the city.

The main sources of flooding in Sandy are Tickle Creek, Cedar Creek, Badger Creek, and numerous drainage ways. Regionally, the Sandy River is a flooding source as well. The largest flooding event to affect Sandy was in January 2009. From January 1-2, 2009 a winter storm event led to flooding throughout many of the smaller tributaries and drainage ways. Some homeowners rerouted the culverts and drainage ways near their homes to protect their property, but this resulted in more damage and flooding to neighbors downstream and to other parts of the city. Some Sandy residents depend on small bridges over culverts to access their homes. A few of these culverts were washed out, damaging the bridges and essentially cutting citizens off from their homes. Two trailers were lost, and many homes had crawlspace flooding. The City of Sandy believes the January 2009 flooding event was worse than the 1996 flooding events.

¹³ The Seismic Rehabilitation Grant Program (SRGP) is a state of Oregon competitive grant program that provides funding for the seismic rehabilitation of critical public buildings, particularly public schools and emergency services facilities.

Figure SA-4 Special Flood Hazard Area



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

Note: To view detail click the link above to access Oregon HazVu

Vulnerability Assessment

The Oregon Department of Geology and Mineral Industries (DOGAMI) conducted a multi-hazard risk assessment (Risk Report) for the Lower Columbia-Sandy Watershed including the City of Sandy. The Risk Report provides a quantitative risk assessment for the flood (including channel migration) hazard along the Sandy River. Due to insufficient data and resources, Sandy is currently unable to perform a quantitative risk assessment for the Tickle Creek flood hazard area.

Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage, and economic loss from business interruption. It is important for the City to be aware of flooding impacts and assess its level of risk.

The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners, and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

The only mapped floodplain hazard within city limits is the area surrounding Tickle Creek, which runs along the southern end of the city. A few homes are located within this mapped floodplain (Figure SA-4). A steep bluff protects the northern areas of the city from the Sandy River, but Revenue Bridge (northeast of the city) is in the Sandy River floodplain. The Sandy Fish Hatchery is very near the Cedar Creek floodplain as well. For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of Sandy outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage.

The HMAC identified Sandy’s sewage treatment plant as a potential vulnerability in severe flooding situations. Portions of the road that lead to the sewage plant are in the floodplain; as such, access to the sewage treatment plant could be isolated in a flooding event. Additionally, any transportation closures within the region will be difficult for Sandy’s residents. The city is largely a bedroom community, and residents rely upon transportation routes for work.

Lower Columbia-Sandy Watershed Natural Hazard Risk Report

The **Risk Report** ([DOGAMI, IMS-59](#)) provides hazard analysis summary tables that identify populations and property within the Lower Columbia-Sandy River Watershed Study Area that are vulnerable to the flood hazards including channel migration. The Risk Report provides a distinct profile for the City of Sandy. According to the Risk Report there is minimal risk to buildings and population within the city from the channel migration or flooding of the Sandy River (note: The Risk Report did not assess flood risk from the Tickle Creek).¹⁴

National Flood Insurance Program (NFIP)

FEMA’s Flood Insurance Study (FIS), and Flood Insurance Rate Maps (FIRMs) are effective as of June 17, 2008. Preliminary maps for portions of the County within the Lower Columbia-Sandy River Watershed were released March 28, 2016 (expected to be effective January 18, 2019). Table SA-11 shows that as of July 2018, Sandy has 15 National Flood Insurance Program (NFIP) policies in force. Of those, two (2) are for properties that were constructed before the initial FIRMs. The last Community Assistance Visit (CAV) for Sandy was on April 28, 1994. Sandy does not participate in the Community Rating System (CRS). The table shows that most flood insurance policies are for residential structures, primarily single-family homes. There has been one (1) paid claims for \$574. The City complies with the NFIP through enforcement of their flood damage prevention ordinance and their floodplain management program. The Community Repetitive Loss record for Sandy identifies no Repetitive Loss Properties¹⁵ or Severe Repetitive Loss Properties¹⁶.

Mitigation Activities

To mitigate the city’s flooding issues, the city has installed storm water detention basins that store water for limited periods of time. The basins slowly release water into streams to avoid flooding. The stormwater utility recently completed a detention facility in Meining Park. This detention facility will prevent flooding during seasons of heavy flow. The city is also developing a “disaster series” for the residents of east Clackamas County which will include a class focusing on flood mitigation practices.

¹⁴ DOGAMI, *Lower Columbia-Sandy Watershed Natural Hazard Risk Report* (March 2018 Draft), Table 9-11.

¹⁵ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

¹⁶ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP, and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000, and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

Table SA-1 | Flood Insurance Detail

	Clackamas County	Sandy
Effective FIRM and FIS	6/17/2008	6/17/2008*
Initial FIRM Date	-	12/11/1979
Total Policies	1,957	15
Pre-FIRM Policies	1,086	2
Policies by Building Type		
Single Family	1,761	13
2 to 4 Family	30	1
Other Residential	58	1
Non-Residential	9	0
Minus Rated A Zone	123	1
Insurance in Force	\$541,833,400	\$2,856,800
Total Paid Claims	590	1
Pre-FIRM Claims Paid	450	0
Substantial Damage Claims	83	0
Total Paid Amount	\$20,830,662	\$574
Repetitive Loss Structures	51	0
Severe Repetitive Loss Properties	4	0
CRS Class Rating	-	NP
Last Community Assistance Visit	-	4/28/1994

Source: Information compiled by Department of Land Conservation, and Development, July 2018.

Note 1: * New flood maps are expected for the Sandy River January 18, 2019. NP = Not Participating

Note 2: The portion of the cities of Portland and Tualatin that are within Clackamas County are not included in this table.

For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables SA-5 through SA-8.

Please review Volume I, Section 2 for additional information on this hazard.

Landslide

The HMAC determined that the City's probability for landslide is **high** and that their vulnerability to landslide is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Areas within Sandy that have experienced landslides in the past include Ten Eyck Road, Highway 26, Bluff Road, Barlow Trail, Laughing Water Road, Coalman Road, and Salmon River Road. In 1980, a landslide on Ten Eyck Road closed Highway 26 for 3-4 months. This was one of the biggest impacts that Sandy has experienced because of sliding activity. More recently landslides occurred on January 1 and 2, 2009. On the night of January 1st, a large mudslide to the east of Sandy closed Highway 26 at milepost 35. At about 1:00am on January 2nd, a bank above Bill's Automotive on the south side of Highway 26 gave way and destroyed the building. The slide also damaged a fiber optic cable and took out 9-1-1 service for part of the early morning.

Vulnerability Assessment

DOGAMI conducted a multi-hazard risk assessment (Risk Report) for the Lower Columbia-Sandy Watershed including the City of Sandy. The Risk Report provides a quantitative risk assessment for the landslide hazard. Additionally, DOGAMI completed a statewide landslide susceptibility assessment in 2016, general findings from that report are provided above and within Figure SA-5.

Potential landslide-related impacts are adequately described within Volume I, Section 2, and include infrastructure damages, economic impacts (due to isolation, and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides, and debris flows can potentially occur during any winter, and thoroughfares beyond City limits are susceptible to obstruction as well. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables SA-5 through SA-8.

The most common type of landslides are slides caused by erosion. Slides move in contact with the underlying surface, are generally slow moving, and can be deep. Rainfall-initiated landslides tend to be smaller; while earthquake induced landslides may be quite large. All soil types can be affected by natural landslide triggering conditions.

Landslide susceptibility exposure for Sandy is shown in Figure SA-5. Most of Sandy demonstrates a low to moderate landslide susceptibility exposure. Approximately 18% of Sandy has very high or high, and approximately 30% moderate, landslide susceptibility exposure.¹⁷ *Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard, and assets.*

Hood Hospice, Sandy High School, Verizon Wireless Cell Tower, Thrifty Auto Supply, and Pacific Pride Fuel are located near steep slopes. The local slump and earthflow hazards are located at the hill on Tupper Road between Sandy Heights Road and Strawbridge Parkway, and another hazard is on the Bluff Road hill between Nettie Connett Drive and the entrance to Hood Chalet Mobile Estates. The Hood Chalet Mobile Villa is located at the base of the hill and a slide in this area could devastate a large portion of the mobile home park. The mudflow and debris flow hazard is located on the hill covering Dubarko Road, Melissa Ave, and Solso Drive.

Past landslide-incurred damages are proof that landslides can cause adverse effects upon residents, transportation systems, and local businesses. In the future, the HMAC expects that a slide could pollute the city water supply if sediment enters streams and rivers. Sandy's citizens are very dependent on Highway 26 for transporting to and from work, and Sandy's stores are similarly dependent on Highways 26 for inventory. If a large slide impacted this arterial Sandy could be cut off from neighboring communities.

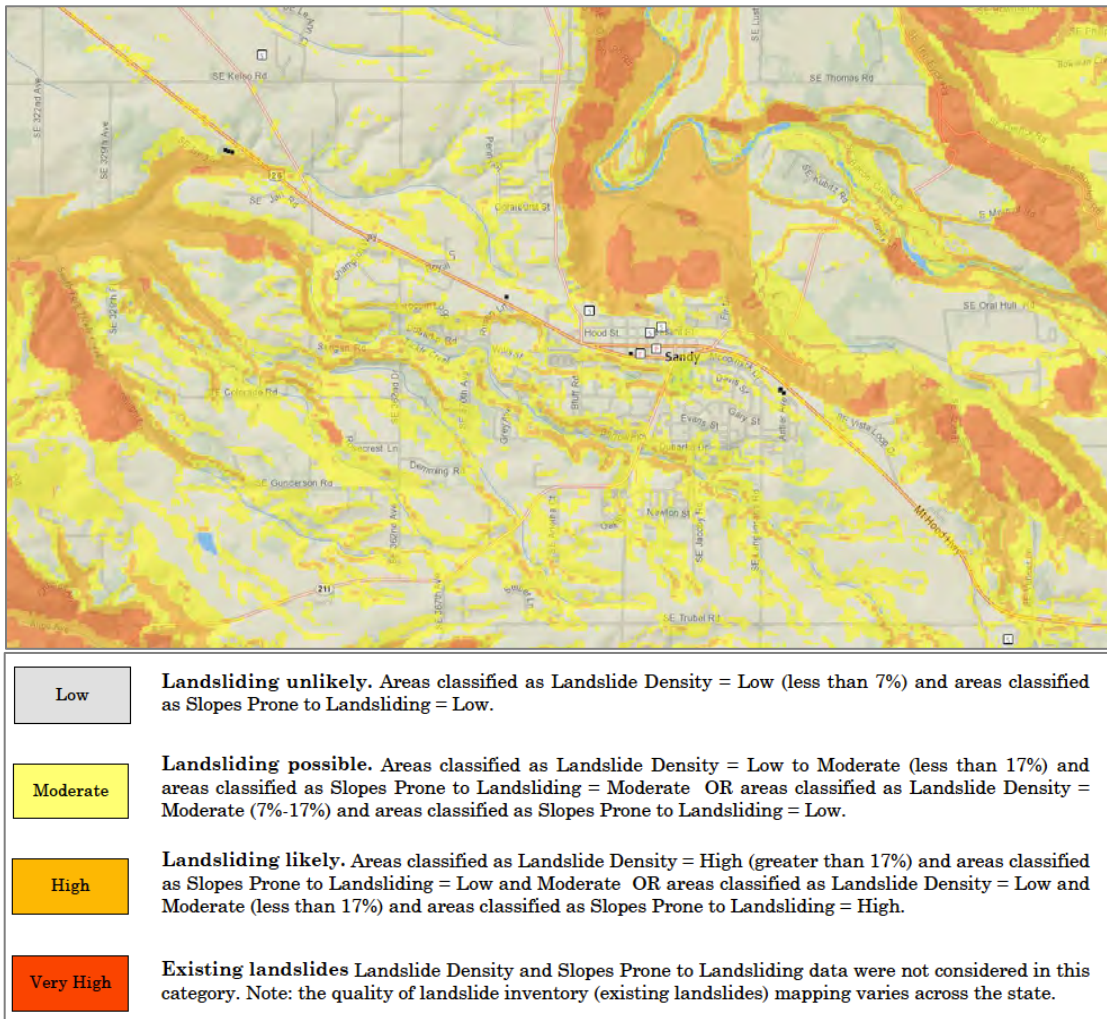
Likewise, Park Street is built entirely on fill. While this area has not been impacted in the past, it could be the location of a future landslide, especially because areas built on fill are subject to liquefaction in an earthquake event. A water diversion dam located on Alder Creek is accessible only by helicopter or driving through Alder Creek. A slide could bring trees down into the dam and plug the diversion intake. It would be difficult to bring equipment to the area within a reasonable amount of time because the dam is so remote.

¹⁷ DOGAMI. [Open-File Report, O-16-02](#), *Landslide Susceptibility Overview Map of Oregon* (2016)

Bluff Road has a few homes built on it and a slide could take out the water line to those homes. However, few customers live on Bluff Road so the impact would not be widely felt.

Lastly, tourism surrounding Mount Hood has a great impact on Sandy’s economy. If roads leading to Mt. Hood are altered by a landslide, tourism would be severely impaired. In addition to skiing, Sandy is home to a large mountain biking and hiking community. A landslide could block access to these activities or create an unsightly environment and reduce tourism in the area.

Figure SA-5 Landslide Susceptibility Exposure



Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](#)
 Note: To view detail click the link above to access Oregon HazVu

Lower Columbia-Sandy Watershed Natural Hazard Risk Report

The **Risk Report** ([DOGAMI, IMS-59](#)) provides hazard analysis summary tables that identify populations and property within the Lower Columbia-Sandy River Watershed Study Area that are vulnerable to the landslide hazard. The Risk Report provides a distinct profile for the City of Sandy. According to the Risk Report the following populations and property are exposed to the landslide hazard:

City of Sandy¹⁸

Landslide event (High and Very High Susceptibility): 18 buildings are exposed (0 critical facilities) for a total potential loss of \$4,488,000 (an exposure ratio of 2%). In addition, 53 residents may be displaced (about 5% of the population).

Mitigation Activities

Sandy works to mitigate future landslide hazards. The city development code includes several policies and regulations to protect development on steep slopes including hillside development code (Section 17.56) and the flood and slope hazard overlay district (Section 17.60). Maps are provided for [flood and slope hazards](#) and [slopes and geologic hazards](#).

Please review Volume I, Section 2 for additional information on this hazard.

Severe Weather

Severe weather can account for a variety of intense, and potentially damaging hazard events. These events include extreme heat, windstorms, and winter storms. The following section describes the unique probability, and vulnerability of each identified weather hazard.

Extreme Heat

The HMAC determined that the City's probability for extreme heat events is **low** and that their vulnerability is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the City as well.

A severe heat episode or "heat wave" occurs about every two to three years, and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days with temperatures greater than or equal to 90-degrees, or 100-degrees, Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit, and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The City of Sandy has not experienced any life-threatening consequences from the few historical extreme heat events, although changes in climate indicate that the area should expect to see more extreme heat events.

Please review Volume I, Section 2 for additional information on this hazard.

¹⁸ DOGAMI, *Lower Columbia-Sandy Watershed Natural Hazard Risk Report* (March 2018 Draft), Table 9-11.

Windstorm

The HMAC determined that the City's probability for windstorm is **high** and that their vulnerability to windstorm is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent, and probability of a potential event within the region. Because windstorms typically occur during winter months, they are sometimes accompanied by flooding and winter storms (ice, freezing rain, and very rarely, snow). Other severe weather events that may accompany windstorms, including thunderstorms, hail, lightning strikes, and tornadoes are generally negligible for Sandy.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation, and economic disruptions result as well.

Damage from high winds generally has resulted in downed utility lines, and trees usually limited to several localized areas. Electrical power can be out anywhere from a few hours to several days. Outdoor signs have also suffered damage. If the high winds are accompanied by rain (which they often are), blowing leaves, and debris clog drainage-ways, which in turn may cause localized urban flooding. The city's utilities are still above ground and vulnerable to falling tree branches and debris. The city, for example, frequently loses power to the water plant due to fallen trees. The water plant now has a back-up generator to reduce the impact of power outages.

Please review Volume I, Section 2 for additional information on this hazard.

Winter Storm (Snow/Ice)

The HMAC determined that the City's probability for winter storm is **high** and that their vulnerability to winter storm is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent, and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the City typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

The biggest impact of winter storms is congestion on roadways. Highway 26 bisects Sandy and is used as the main route to the Mount Hood region for residents of the Portland metro area. When highway 26 backs up many of Sandy's transportation networks become congested. This is especially true if snow on the highway is not plowed.

Most winter storms typically do not cause significant damage, they are frequent, and have the potential to impact economic activity. Road, and rail closures due to winter weather are an uncommon occurrence but can interrupt commuter, and commercial traffic as noted above.

Vulnerability Assessment

Due to insufficient data and resources, Sandy is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Assets section and Tables SA-5 through SA-8.

Mitigation Activities

Because severe weather can affect all areas of a city, mitigation can be difficult. Sandy has made progress, however, in building the city's resilience to severe weather events. Sandy has begun work on undergrounding the overhead utility lines along Pioneer and Proctor Boulevards in the city's downtown area, and all new construction is required to have utilities placed underground. The power company has a regular schedule for trimming trees around power lines, and the city has taken steps to improve response efforts during and after storm events. The Fire Department has two 4-wheel drive fire engines which maneuver well in ice and snow. The Transit Department also has a 4-wheel drive vehicle which was used to help transport citizens in the recent winter storm event. The city has a CERT team which could be utilized for response and public outreach efforts. Finally, Sandy has a database where citizens can register to volunteer and list resources they own and are willing to use in emergency events, such as snowmobiles.

Please review Volume I, Section 2 for additional information on this hazard.

Volcanic Event

The HMAC determined that the City' probability for a volcanic event is **low** and that their vulnerability to a volcanic event is **high**. *These ratings did not change since the previous version of this NHMP addendum.*

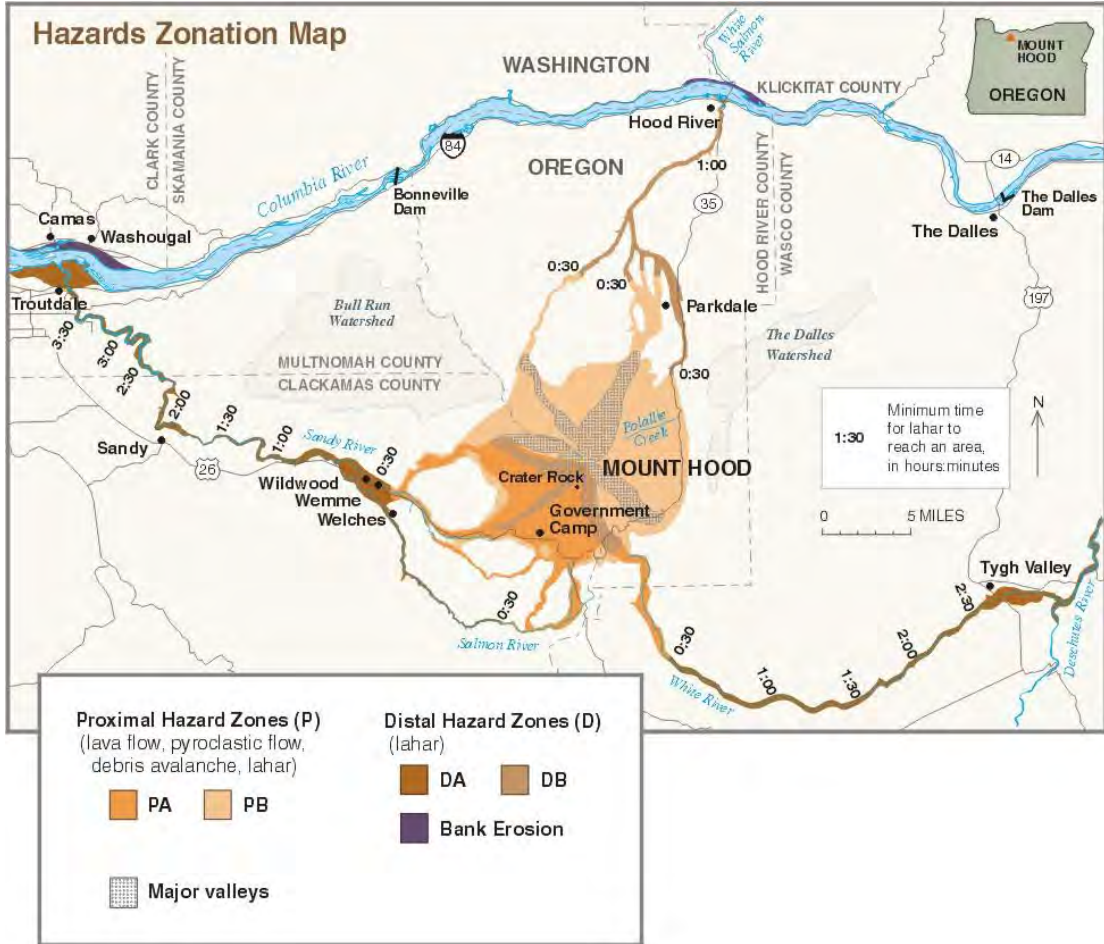
Volume I, Section 2 describes the characteristics of volcanic hazards, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the western portion of the County is likely to affect Sandy as well. Several volcanoes are located near Sandy, the closest of which are Mount Hood, Mount Adams, Mount Saint Helens, Mount Rainier, and the Three Sisters.

Vulnerability Assessment

DOGAMI conducted a multi-hazard risk assessment (Risk Report) for the Lower Columbia-Sandy Watershed including the City of Sandy. The Risk Report provides a quantitative risk assessment for the lahar (volcanic event) hazard.

Due to Sandy's location on the Sandy River and proximity to Mount Hood, the city is likely to experience some of the immediate effects that eruptions have on surrounding areas. It is estimated that Sandy will have two hours before a lahar reaches the city (Figure SA-6 and Figure SA-7), allowing time for individuals to evacuate if needed.

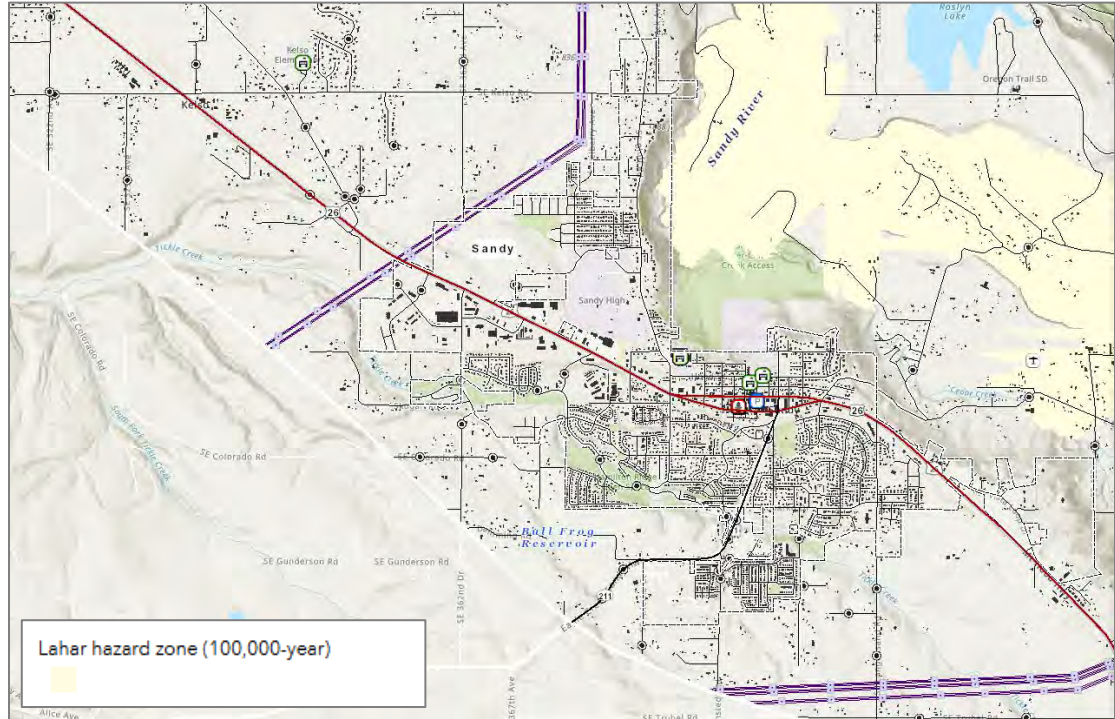
Figure SA-6 Mount Hood Hazards Map



Source: USGS Mount Hood – History and Hazards of Oregon’s Most Recently Active Volcano.

A steep bluff shields the city from the Sandy River so a lahar should not affect assets within city limits. Additionally, depending on wind patterns and which volcano erupts, the city may experience ashfall (tephra). The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city could experience a heavier coating of ash.

Figure SA-7 Lahar Hazard Zone and Critical Facilities



Source: [Mount Hood Hazards and Assets Viewer \(DOGAMI\)](#)

Note: To view detail click the link above to access Oregon HazVu

Lower Columbia-Sandy Watershed Natural Hazard Risk Report

The **Risk Report** ([DOGAMI, IMS-59](#)) provides hazard analysis summary tables that identify populations and property within the Lower Columbia-Sandy River Watershed Study Area that are vulnerable to the profiled natural hazards. The Risk Report provides a distinct profile for the City of Sandy. According to the Risk Report there is minimal risk to buildings and population within the city from the medium (1% annual chance) lahar volcanic event.¹⁹

For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables SA-5 through SA-8.

Mitigation Activities

The existing volcano hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

¹⁹ DOGAMI, *Lower Columbia-Sandy Watershed Natural Hazard Risk Report* (March 2018 Draft), Table 9-11.

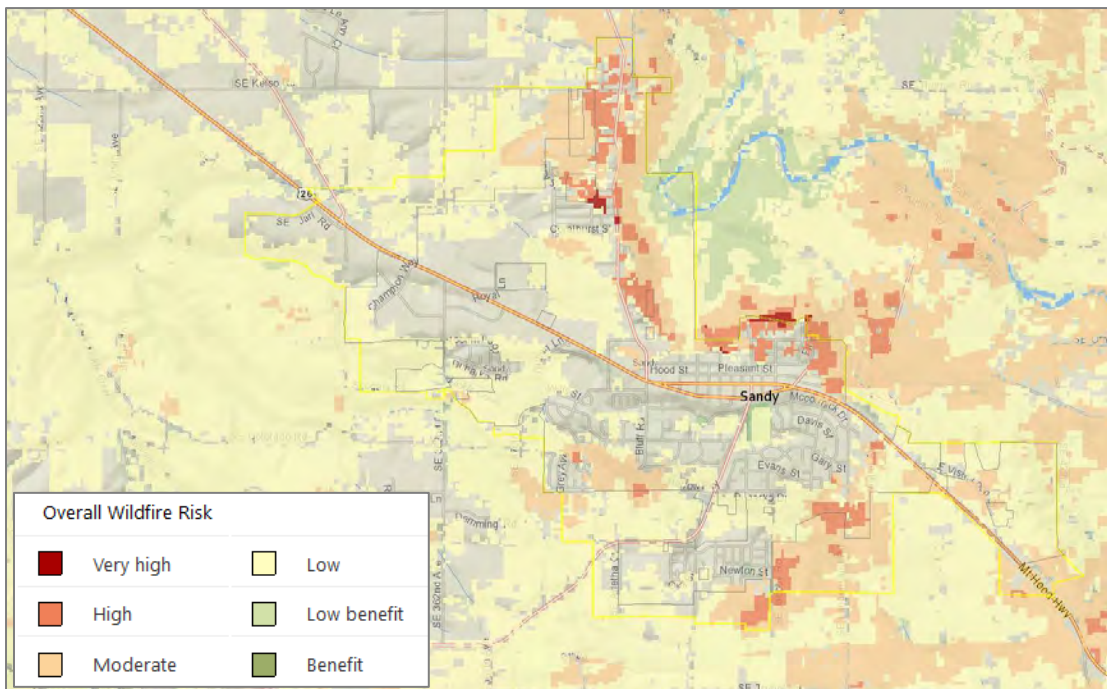
Wildfire

The HMAC determined that the City’s probability for wildfire is **moderate**, and that their vulnerability to wildfire is **high**. *The probability rating did not change, and the vulnerability rating increased, since the previous version of this NHMP addendum.*

The [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) was completed in May 2018. The CWPP is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard: <https://www.clackamas.us/dm/CWPP.html>. Information specific to Sandy is found in the following chapter: [Chapter 10.11: Sandy Rural Fire Protection District #72](#).

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions. Weather, and urbanization conditions are primarily at cause for the hazard level. Sandy has not experienced a wildfire within City limits, but the city has wooded areas that are a concern in the case of a wildfire event. Figure SA-8 shows overall wildfire risk in Sandy.

Figure SA-8 Overall Wildfire Risk



Source: [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

Clackamas County has two major physiographic regions: the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern Clackamas County. The Willamette River Valley, which includes Sandy, is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range has a relatively small population and is characterized by heavily forested slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to its dense forest land. Human caused fires are responsible for most fires in

Clackamas County. In eastern Clackamas County the most common human induced wildfire source is debris burn escape. Homeless camps are another source of wildfires.

While the history of wildfires in Clackamas County is minimal, it does not provide a proper indication of the level of risk. According to the Clackamas County Community Wildfire Protection Plan (CWPP), the forests have accumulated an unnatural buildup of fuel because of decades of timber harvest and aggressive fire suppression. Additionally, residential development near the wildland urban interface has increased the community's overall exposure to wildfire hazards. Many of the developments within the city have only one road in and one road out, and some areas of Sandy do not have evacuations plans. The potential for loss of life is great because of this accessibility issue. Communities at Risk (CARs) within the City include: Bluff Road (northeast) and Cedar Creek (southeast).²⁰

Most of the city has less severe (moderate or less) wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions.²¹ However, conditions vary widely and with local topography, fuels, and local weather (including wind) conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts.

Vulnerability Assessment

DOGAMI conducted a multi-hazard risk assessment (Risk Report) for the Lower Columbia-Sandy Watershed including the City of Sandy. The Risk Report provides a quantitative risk assessment for the wildfire hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables SA-5 through SA-8.

The potential community impacts, and vulnerabilities described in Volume I, Section 2 are generally accurate for the City as well. Sandy's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. The City will update the City's wildfire risk assessment if the fire plan presents better data during future updates (an action item is included to participate in future updates to the CWPP).

Property can be damaged or destroyed with one fire as structures, vegetation, and other flammables easily merge to become unpredictable, and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

Lower Columbia-Sandy Watershed Natural Hazard Risk Report

The **Risk Report** ([DOGAMI, IMS-59](#)) provides hazard analysis summary tables that identify populations and property within the Lower Columbia-Sandy River Watershed Study Area that are vulnerable to the wildfire hazard. The Risk Report provides a distinct profile for the City of Sandy. According to the Risk Report the following populations and property are exposed to the wildfire hazard:

²⁰ Clackamas County Community Wildfire Protection Plan, *Sandy Rural Fire Protection District* (2018), Table 10.11-1.

²¹ [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

City of Sandy²²

Wildfire event (High Risk): 2 buildings are exposed (0 critical facilities) for a total potential loss of \$535,000 (an exposure ratio of < 1%). In addition, 4 residents may be displaced (< 1% of the population).

Mitigation Activities

Sandy uses several mitigation tools to reduce the city's risk to wildfires. Nuisance ordinances prohibit the growth of tall grasses within city limits. Sandy Fire District #72 identifies homes with branch overhangs that create access issues for fire equipment and increase wildfire vulnerability to the structures. Homes with overhanging branches do not have defensible space, increasing their exposure to fuel sources. The district stays current on issues by participating in the Clackamas County Fire Prevention Cooperative, a group consisting of the fire districts within the county. The district also contributed in creating the CWPP and created a Sandy Rural Fire District #72 annex to the CWPP. The fire district also purchased handheld GPS units that can be used for a fire risk assessment in the future.

Public outreach is a primary mitigation tool used by Sandy Fire District #72. A regular "Ask Alice" column appears in the local newspaper which provides citizens the opportunity to ask questions about fire and other hazards. The Sandy Fire District website includes ample information about fire safety and prevention. The district teaches fire safety in grade schools and hosts community safety fairs. Additionally, the Sandy Fire District offers classes on defensible land space, creates a media awareness campaign during fireworks season, and posts signs at nurseries to inform citizens of fire-resistant plants and proper pruning techniques. The Sandy and Boring Fire Districts share a "fire safety house" trailer that serves as an education and outreach tool for fire-safe practices. The district brings the fire safety house to public events to educate children on safe evacuations. Children enter the safety house to watch a movie about fire safety and then practice climbing out windows and down ladders. This provides kids with a safe and supervised environment to practice evacuation procedures.

Please review the [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) and Volume I, Section 2 for additional information on this hazard.

²² DOGAMI, *Lower Columbia-Sandy Watershed Natural Hazard Risk Report* (March 2018 Draft), Table 9-11.

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ATTACHMENT A: ACTION ITEM FORMS

ACTION ITEM FORMS

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Wildfire #1*	58

* - Priority Action Item

Note: The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity.

Summary of Action Changes

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

Previous NHMP Actions: Completed

No actions were completed.

See 2018 status identified in each action for activities that have been completed since the previous plan.

Previous NHMP Actions: Removed

Multi-Hazard Action #3 (2012): “Identify and pursue funding opportunities to develop and implement hazard mitigation activities” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Multi-Hazard Action #4 (2012): “Continue to update and improve hazard assessments in the Natural Hazards Mitigation Plan as new information becomes available” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Flood Action #1 (2012): “Continue to implement and enhance the flood public education program designed to inform local residents about :..” was combined with the education programs included within MH #1. As such the activities of this action will continue as a component of MH #1.

Wildfire Action #1 (2012): “Promote fire-resistant strategies for existing and new developments” was combined with WF #2. As such, the activities of this action will continue as a component of WF #1 (2019).

Wildfire Action #2 (2012): “Mitigate life loss due to wildfires” was combined with WF #1. As such, the activities of this action will continue as a component of WF #1 (2019).

Note: 2012 Actions MH #5, MH #6, and FL #2, FL #3, and FL #4 were renumbered to 2019 Actions MH # 3, MH #4, FL #1, FL #2, and FL #3 respectively.

New NHMP Actions (2019):

- Earthquake Action #2
- Earthquake Action #3
- Wildfire Action #1

See action item forms below for detail.

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 NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the County, participating cities, and special districts. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. The City 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, the City 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 several 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 HMAP but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and/or resources toward completion of the action items.

Internal partner organizations are departments within the City 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.

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:	
Maintain public education programs to inform the public about methods for mitigating the impacts of natural hazards.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Conducting public outreach campaigns raises awareness about natural hazards and helps illustrate what residents and businesses can do to reduce the impact of a natural disaster on their properties, thereby reducing the impact of natural hazards on the City of Sandy. • The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the county's actions to mitigate hazards. • <u>2018 Status:</u> The City utilizes the city's website to provide information on natural hazards: https://www.ci.sandy.or.us/disaster-preparedness 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Maintain hazard related information and public information materials. Disseminate through existing resources: city website, newsletter, Sandy Post, Sandy Time, brochures, etc.; • Partner with Clackamas County/other jurisdictions to develop education outreach materials; • Conduct education as hazard seasons approach: earthquake awareness month in April, wildfire prevention in summer, and flood and severe storm information in winter; • Identify property owners in flood and landslide hazard zones, and conduct a target mailing; • Prepare and distribute an informational brochure on unstable slopes, historical landslide areas, and mitigation strategies. • Encourage individual homeowners to implement mitigation practices; • Promote purchase of appropriate insurance coverage through outreach and education; • Educate the public about the resources available for hazard mitigation, response, and preparedness; • Use faith based, civic and humanitarian, and business groups to affiliate volunteers; and • Create an unmet needs committee and long-term recovery committee to create a pool of volunteers that can take in needs requests during a small event. 			
Coordinating Organization:		HMAC	
Internal Partners:		External Partners:	
Public Works		Clackamas County, Community Organizations Active in Disaster (COAD), Sandy Fire District #72	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High		

* - High Priority Action Item

Multi-Hazard #2

Proposed Action Item:		Alignment with Plan Goals:	
Integrate the goals and action items from the Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Zoning Ordinance			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating natural hazards plans into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community. <u>2018 Status</u>: The City of Sandy continues to adhere to all state and national building codes. The NHMP was integrated into the city's EOP that was updated in 2012. The City last amended their development code in 2017. The floodplain ordinance was last updated in 2002 (new FIRMs are preliminary and effective maps are expected March 2019). The City updated their comprehensive plan in April 2012. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Use the mitigation plan to help the City's Comprehensive Land Use Plan meet 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; Use zoning codes to regulate development in hazard-prone areas; Integrate the city's mitigation actions into the current emergency operations plan and capital improvement plans (where appropriate); Partner with other organizations and agencies with similar goals to promote building codes that are more disaster resistant at the state level; Use citizen input for the creation of appropriate ordinances; and Use the natural hazard mitigation planning resources provided by the Oregon Partnership for Disaster Resilience to learn how to better integrate the NHMP into existing documents and programs. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works		Department of Land Conservation and Development, Department of Geology and Mineral Industries, Oregon Department of Transportation, Department of Environmental Quality	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, DLCD Technical Assistance Grant		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #3

Proposed Action Item:		Alignment with Plan Goals:	
Improve vegetation management throughout the city.		Augment Emergency Services; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Parks Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Landscaping and vegetation make a difference in mitigating the impacts of natural hazards. Trees break the force of the wind and stabilize the soil. Wetlands absorb much of the overflow from stream channels. Fire-resistant vegetation can retard the spread of wildfires toward vulnerable buildings. Limiting or regulating the amount of vegetation cleared off a hillside lot reduces the risk of increasing the number of landslide-prone areas in a community. Planting vegetation or maintaining slope terraces can also reduce slope-runoff. Planners can use landscaping requirements to preserve or enhance the protection such natural features afford. These requirements may be part of site plan reviews or a separate set of zoning regulations and environmental performance standards. <u>2018 Status</u>: Sandy improves vegetation management via code enforcement, brush clearing (annual SOLV program), defensible space, and fuels reduction via public outreach. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Partner with Clackamas County, Oregon Department of Forestry, US Forestry Service, ODOT, and citizens to control vegetation along transportation corridors; Identify appropriate practices for eliminating invasive species; Maintain healthy urban canopy; Maintain vegetation coverage for slope stability; Identify hazardous trees for remediation or removal; Coordinate with watershed councils and others; Review and update existing ordinances to incorporate and improve vegetation management on private property; Develop mechanism to review vegetation on a case by case basis; Provide education to the public about justifications for, and benefits of vegetation mitigation practices; and Encourage fuels reduction on private property by providing education for pruning and remove trees and using native vegetation. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works, HMAC, Code Enforcement		Clackamas Soil and Water Conservation District, Fire Co-op, Oregon Department of Forestry, US Forestry Service, Clackamas County, Clackamas River Basin Council	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Parks SDC		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #4

Proposed Action Item:		Alignment with Plan Goals:	
Encourage structural mitigation practices in developments at risk to natural hazards.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Parks Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Strengthening facilities will improve recovery capacity and reduce risk and loss of life. A hazard event may negatively impact a local economy, especially if a community's businesses are located in the floodplain, near steep slopes, in the wildland-urban interface, or in unreinforced masonry buildings. Promoting structural mitigation can assist property owners in identifying their vulnerability to hazards and identifying mitigation activities. Encouraging property owners with this may increase the likelihood that property owners would share responsibility for mitigation on their properties and implement mitigation activities. Incentive programs include a variety of benefits to building owners or developers that help to offset the cost of mitigation. Examples of possible incentive programs include: density bonuses, tax credits, property tax incentives or deferrals, real estate disclosures, property acquisition or purchase of development rights, increased funding of public infrastructure programs, and phasing retrofitting programs over a longer period of time. <u>2018 Status:</u> In August 2011, a new Sandy Police Station was built to seismic standards. In March 2012, the Sandy Library was seismically upgraded. See EQ #1 for status for earthquake affected infrastructure. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Earthquake – retrofit buildings to meet seismic standards Flood – construct retention ponds, swales, and dikes/ditches/culverts; elevated buildings Landslide – construct retention ponds and retaining walls; enforce proper drainage; contract for geological studies Severe Storms – encourage construction of sloped roofs; improve chimney bracing; store deicing agents Volcano – encourage construction of sloped roofs Wildfire – create defensible space; reduce fuels; construct streets wide enough to allow for easy emergency vehicle maneuverability 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works, HMAc		Clackamas County, Clackamas Fire District #72	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Earthquake #1

Proposed Action Item:		Alignment with Plan Goals:	
Reduce negative impacts of earthquakes by performing seismic evaluations and retrofits (structural and non-structural).		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for earthquakes to cause damage can assist a community in mitigating its overall risk to earthquakes. • Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. • Refer to risk assessment, and DOGAMI's rapid visual assessment scores • <u>2018 Status</u>: In August 2011, a new Sandy Police Station was built to seismic standards. In March 2012, the Sandy Library was seismically upgraded. Sandy Fire District #72 was retrofitted in 2013-2014 with a SRGP grant; Sandy High was retrofitted in 2017 and is now Cedar Ridge Middle School; Sandy High has a new facility built at 37400 Bell Street per 2008 voter approved bond. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Obtain funding to perform seismic evaluations; • Conduct seismic evaluations on identified community assets (including shelters) for implementing appropriate structural and non-structural mitigation strategies; • Prioritize seismic upgrades based on criticality of need and population served; • Seismically retrofit critical government facilities to guarantee continuous operation during and after a natural disaster; • Partner with appropriate organizations to implement seismic upgrades; • Update COOP plans; and • Create damage assessment procedures. 			
Coordinating Organization:		HMAC	
Internal Partners:		External Partners:	
Planning, Building, Public Works		DOGAMI, Sandy Fire District #72, Clackamas County	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Seismic Rehabilitation Grant Program, Hazard Mitigation Assistance Grants		Moderate to High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Earthquake #2*

Proposed Action Item		Alignment with Plan Goals:	
Seismically retrofit (structural and non-structural) the Sandy Community Center to exceed life safety standards in order to operate as a possible shelter.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The City of Sandy Community Center (also referred to as the Senior Center) is home base for the City's Community Services Department. The Community Center offers a variety of services for Sandy's seniors, including meal, health, transportation and social programs, and also provides a venue for social service and other community events The Sandy Community Center is located at the site of the former Cedar Ridge Middle School (17225 Smith Ave). The site includes the city's aquatic center and community center. The Community Center was built in 1955, and is not built to current seismic standards; Seismic design criteria have changed since this facility was constructed. Given the changes in the USGS data, projected ground accelerations in the region have increased, significantly adding to the structural design requirements; The facility has both structural and non-structural vulnerabilities that may affect the facilities performance in a regional catastrophic seismic event. Seismic retrofits (structural and non-structural) are needed to ensure performance after a catastrophic event; and Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. <u>2018 Status</u>: New action. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Gain funding to retrofit/replace this facility; and Partner with appropriate organizations to implement seismic upgrades; and Seismically retrofit this facility to guarantee continuous operation during and after a natural disaster. 			
Coordinating Organization:		Community Services	
Internal Partners:		External Partners:	
Planning, Building, Public Works		Infrastructure Finance Authority, DOGAMI	
Potential Funding Sources:		Estimated cost:	Timeline:
SRGP, HMA (PDM, HMGP), General Fund		High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	New Action Item (2018)		
Priority:	High		

* - High Priority Action Item

Earthquake #3*

Proposed Action Item		Alignment with Plan Goals:	
Seismically retrofit (structural and non-structural) City Hall in order to continue operations post-earthquake and to protect city and county IT infrastructure (servers).		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The City of Sandy City Hall is home base for City Administration. The building also houses SandyNet and backup Clackamas County IT infrastructure (servers, etc.). • SandyNet staff is based out of City Hall. SandyNet is a municipal internet service provider owned and operated by the residents of Sandy. The staff of SandyNet is responsible for the day to day operation and maintenance of SandyNet’s network, as well as providing all information technology services for the City. • The City Hall building is not built to current seismic standards; Seismic design criteria have changed since this facility was constructed. Given the changes in the USGS data, projected ground accelerations in the region have increased, significantly adding to the structural design requirements; • The facility has both structural and non-structural vulnerabilities that may affect the facilities performance in a regional catastrophic seismic event. Seismic retrofits (structural and non-structural) are needed to ensure performance after a catastrophic event; and • Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. • <u>2018 Status:</u> New action. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Gain funding to retrofit/replace this facility; and • Partner with appropriate organizations to implement seismic upgrades; and • Seismically retrofit this facility to guarantee continuous operation during and after a natural disaster. 			
Coordinating Organization:		City Administration, SandyNet	
Internal Partners:		External Partners:	
Planning, Building, Public Works		Infrastructure Finance Authority, DOGAMI, Clackamas County	
Potential Funding Sources:		Estimated cost:	Timeline:
HMA (PDM, HMGP), General Fund		High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	New Action Item (2018)		
Priority:	High		

* - High Priority Action Item

Flood #1

Proposed Action Item:		Alignment with Plan Goals:	
Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Flood Ordinance; Zoning Code, FEMA FIRMs, Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The National Flood Insurance Program provides communities with federally backed flood insurance to homeowners, renters, and business owners, provided that communities develop and enforce adequate floodplain management ordinances. The benefits of adopting NFIP standards for communities are a reduced level of flood damage in the community and stronger buildings that can withstand floods. The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will help reduce the level of flood damage to new and existing buildings in communities while providing homeowners, renters and business owners additional flood insurance protection. <u>2018 Status</u>: The city continues to comply with the NFIP. New Flood Insurance Rate Maps (FIRMs) for the Sandy River become effective January 18, 2019. The City will update their flood ordinance as appropriate to comply with requirement of the NFIP and new FIRMs. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Community Assistance Visits (CAV) are scheduled visits to communities participating in the NFIP for the purpose of: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. Actively participate with DLCD and FEMA during Community Assistance Visits. Conduct an assessment of the floodplain ordinances to ensure they reflect current flood hazards and situations and meet NFIP requirements. Coordinate with the county to ensure that floodplain ordinances and NFIP regulations are maintained and enforced. Mitigate areas that are prone to flooding and/or have the potential to flood. These areas include properties along Tickle Creek. 			
Coordinating Organization:		Development Services	
Internal Partners:		External Partners:	
HMAC		Department of Land Conservation and Development; Association of State Floodplain Managers	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Flood #2

Proposed Action Item:		Alignment with Plan Goals:	
Explore participation in the NFIP's Community Rating System (CRS).		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Flood Ordinance; Zoning Code, FEMA FIRMs, Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Community Rating System (CRS) is operated under the National Flood Insurance Program (NFIP). The NFIP provides flood insurance to homes and businesses located in floodplains at a reasonable cost and encourages the movement of development away from the floodplain. The program is based upon mapping areas of flood risk, and requiring local implementation to reduce that risk, primarily through restrictions on new development in floodplains. CRS recognizes community efforts that go beyond the minimum standards of the NFIP. This recognition is in the form of reduced flood insurance premiums for communities that adopt such standards. CRS encourages community activities that reduce flood losses, facilitate accurate insurance rating, and promote flood insurance awareness. <u>2018 Status</u>: The city does not currently participate in the CRS. Properties along Tickle Creek remain the city's top priority for flood protection. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Identify staff or community members to lead participation efforts; and Review CRS participation requirements and take steps towards reaching the first ranking. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works, HMAC		FEMA, DLCD, OEM, Clackamas County Planning Department	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Flood #3

Proposed Action Item:		Alignment with Plan Goals:	
Promote and protect the use of naturally flood prone open space or wetlands as flood storage areas.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Flood Ordinance; Zoning Code, FEMA FIRMs, Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> One of the goals of the National Flood Insurance Program is to protect the natural and beneficial functions of floodplains. Natural and beneficial floodplain functions include both the natural infiltration capacities of floodplains, as well as minimizing the pollutants that can enter waters from floodplain development activities. A number of options local governments can choose from are: 1) Prohibit all activities in the floodplain that may be hazardous to public health or water quality (e.g. septic systems, storage of hazardous materials) 2) Require new floodplain developments to avoid or minimize disruption to stream channels and stream banks 3) Adopt regulations pursuant to a Habitat Conservation Plan approved by the US Fish and Wildlife Service or the National Marine Fisheries Service. <u>2018 Status</u>: Tickle Creek Trail was just completed. Meinig Park added a stormwater project that included the development of chambers beneath the parking lot to prevent flooding. Meinig Memorial Park is used as flood storage. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Develop and implement flood protection alternatives for properties within and adjacent to the 100-year floodplain by taking into account city codes related to the floodplain. Gain support for protecting naturally flood prone open space by educating the public of its importance 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works, HMAc		Clackamas Soil and Water Conservation District, Division of State Lands, Johnson Creek Watershed Council, Clackamas River Basin Council	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Landslide #1

Proposed Action Item:		Alignment with Plan Goals:	
Maintain and update an inventory of streets and properties threatened by landslides.		Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Hillside Development (Section 17.56), Flood and Slope Hazard Overlay District (Section 17.60), Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Developing an inventory of landslide areas can help a community identify which streets might be more vulnerable to damage. Such information can help a community in better identifying and prioritizing projects that can assist a community in mitigating its overall risk to landslides. Areas that have experienced landslides in the past include: Ten Eyck Road, Highway 26, Bluff Road, Barlow Trail, Laughing Water Road, Coalman Road, and Salmon River Road. <u>2018 Status</u>: Ongoing. DOGAMI completed a landslide susceptibility report in 2016 using LiDAR (O-16-02); the data from the report is available to the City of Sandy. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Utilize technology, geologic resources, and other available data to identify areas of slope risk; Identify areas where strategic planting could assist in soil stabilization; and Coordinate with DOGAMI to receive LiDAR data. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works, GIS		DOGAMI, Clackamas County GIS, Oregon Department of Transportation	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Landslide #2

Proposed Action Item:		Alignment with Plan Goals:	
Reduce the vulnerability of property owners in landslide-prone areas.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Hillside Development (Section 17.56), Flood and Slope Hazard Overlay District (Section 17.60), Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for landslides to cause damage can assist a community in mitigating its overall risk to landslide events. Areas that have experienced landslides in the past include: Ten Eyck Road, Highway 26, Bluff Road, Barlow Trail, Laughing Water Road, Coalman Road, and Salmon River Road. <u>2018 Status</u>: Ongoing. Accomplished through the city's hillside development and flood and slope hazard overlay district ordinances. LiDAR data provided to city from DOGAMI as part of their report on landslide susceptibility (O-16-02). 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Conduct a study to identify appropriate mitigation strategies for problem areas including buildings and infrastructure in the problem areas; Develop public information to emphasize economic risk when building on potential or historical landslide areas; Update the landslide hazard map when LIDAR data becomes available; and Review the planning and building codes and make updates or changes, if necessary. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works, GIS, HMAC		DOGAMI, Clackamas County GIS, Oregon Department of Transportation	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Severe Weather #1

Proposed Action Item:		Alignment with Plan Goals:	
Reduce negative effects from severe windstorm and severe winter storm events.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure[201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to cause power outages can assist a community in mitigating its overall risk to wind and winter storms. <u>2018 Status</u>: New developments and all of the downtown area have underground utility and power lines. The city provides a chipper checkout for free. The city provides storm debris removal services. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Reduce power outages by partnering with PGE to obtain funding to bury power lines subject to frequent failures; Encourage burial of power lines for existing development; Ensure that there are back up underground lines to major businesses & employers; Develop partnerships to implement programs to keep trees from threatening lives, property, and public infrastructure; Continue regular tree trimming practices; Partner with PGE to continue hazardous tree inventory and mitigation programs; Create sheltering programs; and Promote safe installation and use of generators. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Planning, Building, HMAP		PGE, Bonneville Power Administration, private landowners	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Wildfire #1*

Proposed Action Item:		Alignment with Plan Goals:	
Coordinate wildfire mitigation action items through the Clackamas Community Wildfire Protection Plan .		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Clackamas 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 Sandy can take to reduce wildfire hazards.			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
<u>Wildfire Risk Assessment (Ch. 4):</u>			
<ol style="list-style-type: none"> Maintain and update the Fuels Reduction (FR) and Communities at Risk (CAR) maps and databases. Continue to track structure vulnerability data throughout the County through structural triage assessments. Update the Overall Wildfire Risk Assessment as new data becomes available. 			
<u>Hazardous Fuels Reduction and Biomass Utilization (Ch. 5):</u>			
<ol style="list-style-type: none"> Develop and maintain an inventory of potential and successful FR projects by meeting with parks and natural lands managers quarterly. Continue securing funding to implement projects/hire seasonal ODF staff. 			
<u>Emergency Operations (Ch. 6):</u>			
<ol style="list-style-type: none"> Develop and FDB Communications Works Group. Conduct a Conflagration Exercise. 			
<u>Education and Community Outreach (Ch. 7):</u>			
<ol style="list-style-type: none"> Develop Firewise toolkit for CAR's. Create incentives for fuels reduction. Update and distribute the Burn Permitting and Fire Restrictions Brochure. Continue to improve address signage throughout the County. 			
<u>Structural Ignitability Policies and Programs (Ch. 8):</u>			
<ol style="list-style-type: none"> Identify a DTD representative for the WFEP. Improve coordination with Rural Fire Agencies. Integrate WU into Plan Map and include a public outreach strategy. 			
Coordinating Organization:		Sandy Fire District #72	
Internal Partners:		External Partners:	
Public Works, Planning		Clackamas Fire Defense Board, Oregon Department of Forestry, U.S. Forest Service, U.S. Bureau of Land Management, public land management agencies	
Potential Funding Sources:		Estimated cost:	Timeline:
ODF, operating budgets		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	High (CWPP identified priority actions listed above)		

ATTACHMENT B: PUBLIC INVOLVEMENT SUMMARY

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

To provide the public information regarding the draft NHMP addendum, and provide an opportunity for comment, an announcement (see text below) was provided on the city's [website](#) and social media ([Facebook](#)). The opportunity to review the draft plan and to comment was left open from April 25, 2019 through June 10, 2019.

During the public review period there were no formal comments provided.

Press Release

The image shows two overlapping screenshots. The top screenshot is a press release titled "Clackamas County Pre-Disaster Mitigation Planning PRESS RELEASE" dated April 25, 2019. The subject is a press release for Sandy addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan Update. The bottom screenshot is a website page titled "NHMP Update" with the sub-heading "Sandy seeks additional public input on update to Natural Hazard Mitigation Plan". The text on the website is identical to the press release, detailing the city's process of updating the NHMP in cooperation with the University of Oregon and FEMA, and inviting public input through an electronic survey.

Press Release - Sandy seeks public input for addendum to Natural Hazard Mitigation Plan
Published on Apr 25, 2019 at 11:28a.m.

**Clackamas County
Pre-Disaster Mitigation Planning
PRESS RELEASE**

DATE: April 25, 2019
TO: Sandy Post
FROM: City of Sandy
SUBJECT: Press Release for Sandy addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan Update – Notice and Opportunity for Public Comment

For Immediate Release

Sandy seeks additional public input on update to Natural Hazard Mitigation Plan

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

A natural hazard mitigation plan provides communities with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities, and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

An electronic version of the updated draft Sandy NHMP addendum will be available for formal public comment beginning April 25, 2019. To view the draft, please click on the document below.

If you have any questions regarding the Sandy NHMP addendum or the update process in general, please contact: Ernie Roberts, Police Chief at (503) 489-2189 or eroberts@ci.sandy.or.us; or Michael Howard, Assistant Program Director for the Oregon Partnership for Disaster Resilience at (541) 346-8413 or mrhoward@uoregon.edu.

More: City News

NHMP Update

Sandy seeks additional public input on update to Natural Hazard Mitigation Plan

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


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Sandy Addendum - ClackCo Multi-Jurisdictional NHMP Update - DRAFT.pdf

Social Media

 **City of Sandy, Oregon – City Government** ...
May 3 at 9:55 AM · 🌐

NHMP AVAILABLE FOR PUBLIC INPUT
Public Input Requested – Natural Hazard Mitigation Plan

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

A natural hazard mitigation plan provides communities with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities, and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

An electronic version of the updated draft Sandy NHMP addendum will be available for formal public comment beginning April 25, 2019. To view the draft please visit: <https://www.ci.sandy.or.us/NHMP-Update/>

If you have any questions regarding the Sandy NHMP addendum or the update process in general, please contact: Ernie Roberts, Police Chief at (503) 489-2189 or eroberts@ci.sandy.or.us; or Michael Howard, Assistant Program Director for the Oregon Partnership for Disaster Resilience at (541) 346-8413 or mrhoward@uoregon.edu



City of West Linn Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan



Photo Credit: Gary Halvorson, Oregon State Archives

March 2019

Volume II: West Linn Addendum

Prepared for:

City of West Linn

Prepared by:

**University of Oregon
Institute for Policy Research and Engagement
Oregon Partnership for Disaster Resilience**

Planning grant funding provided by:



FEMA

Federal Emergency Management Agency (FEMA)
Pre-Disaster Mitigation Program
Grant: EMS-2017-PC-0005
Sub-grant Application Reference: PDMC-PL-10-OR-2016-001, and

Additional Support Provided by:



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FEMA

August 6, 2019

The Honorable Jim Bernard
Chair, Clackamas County Commissioners
2020 Kaen Road Suite A
Oregon City, Oregon 97045

Dear Chairman Bernard:

On April 12, 2019, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan* as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance (HMA) grants through April 11, 2024, through your state.

Clackamas County	City of Estacada	City of Lake Oswego
City of West Linn	City of Wilsonville	

The updated list of approved jurisdictions includes the cities of West Linn and Wilsonville which recently adopted the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan*. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Joseph Murray, State Hazard Mitigation Planner with Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities.

Sincerely,

Mark Carey, Director
Mitigation Division

Enclosure

JG:vl

RESOLUTION 2019 - 12

A RESOLUTION ADOPTING UPDATES TO THE CITY OF WEST LINN ADDENDUM TO THE CLACKAMAS COUNTY MULTI-JURISDICTIONAL NATURAL HAZARD MITIGATION PLAN

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

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

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

WHEREAS, the City of West Linn adopted the City of West Linn Addendum to the Clackamas County Natural Hazard Mitigation Plan on July 15, 2013;

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

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

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

WHEREAS, the City of West Linn has updated its addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation plan to reflect new information contained therein through the creation of a new addendum; and

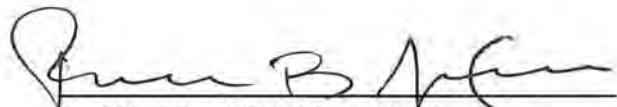
WHEREAS, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the updated *City of West Linn addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan* and approved it (dated, April 25, 2019) contingent upon this official adoption of the participating governments and entities.

NOW, THEREFORE, THE CITY OF WEST LINN RESOLVES AS FOLLOWS:

SECTION 1. The City of West Linn adopts the *City of West Linn addendum to the Clackamas County Natural Hazard Mitigation Plan March 2019*.

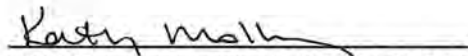
SECTION 2. The City of West Linn will submit this Adoption to the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the *Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan*.

This resolution was PASSED and ADOPTED this 8th day of July, 2019, and takes effect upon passage.



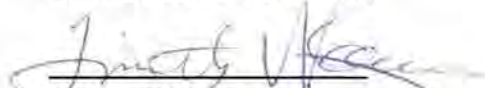
RUSSELL B. AXELROD, MAYOR

ATTEST:



KATHY MOLLUSKY, CITY RECORDER

APPROVED AS TO FORM:



CITY ATTORNEY

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Purpose

This is an update of the West Linn addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation and Volume III (Appendices) which provide additional information. This addendum meets the following requirements:

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

Updates to West Linn's addendum are further discussed throughout the NHMP and within Volume III, Appendix B, which provides an overview of alterations to the document that took place during the update process.

West Linn adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on **July 8, 2019**. FEMA Region X approved the Clackamas County NHMP on April 12, 2019 and the City's addendum on **August 6, 2019**. With approval of this NHMP the City is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **April 11, 2024**.

Mitigation Plan Mission

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

The City concurs with the mission statement developed during the Clackamas County planning process (Volume I, Section 3):

Promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

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

The City concurs with the goals developed during the Clackamas County planning process (Volume I, Section 3). All NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Below is a list of the NHMP goals:

GOAL #1: PROTECT LIFE AND PROPERTY

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

GOAL #2: ENHANCE NATURAL SYSTEMS

- Balance watershed planning, natural resource management, and land use planning with natural hazards mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

GOAL #3: AUGMENT EMERGENCY SERVICES

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, and business, and industry.
- Coordinate and integrate natural hazards mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL #4: ENCOURAGE PARTNERSHIPS FOR IMPLEMENTATION

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

GOAL #5: PROMOTE PUBLIC AWARENESS

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

NHMP Process, Participation and Adoption

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

West Linn first developed an addendum to Clackamas County's Natural Hazards Mitigation Plan in 2007. This plan was updated in 2013 and in 2018. The last update of the West Linn addendum to the Clackamas County NHMP was approved by FEMA on April 8, 2013.

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

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research, and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM), Clackamas County, and West Linn to update their NHMP. This project is funded through the Federal Emergency Management Agency's (FEMA) Fiscal-Year 2016 (FY16) Pre-Disaster Mitigation (PDM) Competitive Grant Program EMS-2017-PC-0005 (PDMC-PL-10-OR-2016-001). Members of the West Linn NHMP Hazard Mitigation Advisory Committee (HMAC) also participated in the County NHMP update process (Volume III, Appendix B).

The Clackamas County NHMP, and West Linn addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. The West Linn HMAC guided the process of developing the NHMP.

Convener

The West Linn Director of Public Works serves as the NHMP addendum convener. The convener of the NHMP will take the lead in implementing, maintaining and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the City of West Linn HMAC met formally and informally, to discuss updates to their addendum (Volume III, Appendix B). The HMAC reviewed and revised the City's addendum, with focus on the NHMP's risk assessment and mitigation strategy (action items).

This addendum reflects decisions made at the designated meetings and during subsequent work and communication with Clackamas County Resilience Coordinator, and the OPDR. The changes are highlighted with more detail throughout this document and within Volume III, Appendix B. Other documented changes include a revision of the City's risk assessment and hazard identification sections, NHMP mission and goals, action items, and community profile.

The West Linn HMAC was comprised of the following representatives:

- Convener, Lance Calvert, Director of Public Works
- John Boyd, Planning Manager

- Jim Clark, Building Official
- Megan Fursdon, GIS Coordinator

Public participation was achieved with the establishment of the HMAc, which was comprised of City officials representing different departments and sectors. The HMAc served as the local review body for the NHMP's development. Community members were provided an opportunity for comment via the NHMP review process, and through a survey administered by Clackamas County (Volume III, Appendix G).

NHMP Implementation and Maintenance

The City Council will be responsible for adopting the West Linn addendum to the Clackamas County NHMP. This addendum designates a HMAc and a convener to oversee the development and implementation of action items. Because the City addendum is part of the County's multi-jurisdictional NHMP, the City will look for opportunities to partner with the County. The City's HMAc will convene after re-adoption of the West Linn NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The City's Director of Public Works will serve as the convener and will be responsible for assembling the HMAc. The HMAc will be responsible for:

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating and training new HMAc members on the NHMP and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement; and
- Documenting successes and lessons learned during the year.

The convener will also remain active in the County's implementation and maintenance process (Volume I, Section 4).

The City will utilize the same action item prioritization process as the County (Volume I, Section 4).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, and Building Codes, as well as the [Clackamas County NHMP](#), and the [State of Oregon NHMP](#).

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the city. Plans and policies already in existence have support from residents, businesses and policy makers. Where possible, West Linn will implement the NHMP's recommended actions through existing plans and

policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Future development without proper planning may result in worsening problems associated with natural hazards. Metro, the regional government for Clackamas, Multnomah, and Washington counties, determines many land use laws for the tri-county region and sets the urban growth boundary. The entire Portland Metro area is subject to tremendous growth pressures due to its desirable location and the restrictions on urban sprawl placed by urban growth boundary requirements.

West Linn's acknowledged comprehensive plan is the City of West Linn Comprehensive Plan (1983, last amended in October 2016). The Oregon Land Conservation and Development Commission first acknowledged the plan in 1984. The City implements the plan through the Development Code.

West Linn currently has the following plans, regulations, and projects that relate to natural hazard mitigation. For a complete list visit the City's [website](#):

- [Comprehensive Plan](#)
 - [Neighborhood Plans](#)
- [Development Code](#) (Ord. 1686, July 9, 2018)
 - Chapter 27: Flood Management Areas
 - Chapter 32: Water Resource Area Protection
- Capital Improvement Projects
- [Emergency Operations Plan](#)
- Debris Management Plan
- [Web Mapping Applications](#)
- [Parks Recreation and Open Space Master Plan](#)
- [Trails Master Plan](#)
- [Transportation Systems Plan](#)
 - [Portland Metro 2014 Regional Transportation Plan](#)
- [Sewer Master Plan](#)
 - [Sanitary Sewer Atlas](#)
- [Surface Water Management Plan](#)
 - [Stormwater Atlas](#)
- [Water System Master Plan](#)
 - [Water Atlas](#)

Other plans:

- [Clackamas County Community Wildfire Protection Plan](#)
 - [Tualatin Valley Fire and Rescue](#)

Government Structure

The City of West Linn has a council-manager form of government. The City Council consists of five members; a mayor and four councilors. The mayor presides over Council meetings. The mayor and City Council members are elected to four-year terms of office through a

general election. The City Council is responsible for identifying problems and needs within the community and then addressing those problems through community goals and objectives.

The City of West Linn currently has the following departments which have a role in natural hazard mitigation:

Building is responsible for plan review and inspections on commercial, industrial and residential developments, as well as fire life and safety plan review.

Engineering manages the design and construction of the City's infrastructure, including surface water, water, wastewater collection, and transportation. In addition, the engineering division also provides GIS mapping services.

Parks and Recreation is responsible for providing more than 600 acres of safe, attractive, and well-maintained parks, facilities, trails, open spaces, and recreation programs.

Planning is responsible for all long range and current planning for new development, as well as the City's natural resource, geologic hazard and floodplain overlay zones. It is also responsible for implementation of the Comprehensive Plan.

Police is a full-service law enforcement organization dedicated to the citizens of the City of West Linn. The Department is made up sworn officers and non-sworn personnel.

Public Works provides many of the basic urban services to the citizens of West Linn including water, sanitary sewer, and storm drainage systems, and their maintenance and repair. The Department is also responsible for streets.

Fire and Ambulance Service. Tualatin Valley Fire and Rescue (TVF&R) provides emergency response and fire protection services to the City of West Linn and adjacent unincorporated areas of Clackamas County. TVF&R has a large service area, providing hazardous material and other specialty response, as well as fire and EMS response, fire prevention, and related services. AMR Ambulance Transport also provides emergency medical response and transport to West Linn residents, through a contract covering all of Clackamas County. TVF&R responds to calls from the Bolton, Rosemont, and Willamette fire stations, which are staffed 24 hours a day.

Continued Public Participation

An open public involvement process is essential to the development of an effective NHMP. To develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunity for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the NHMP during review.¹ Keeping the public informed of the City's efforts to reduce its risk to future natural hazard events is important for successful NHMP implementation and maintenance. The City is committed to involving the public in the NHMP review and update process (Volume I, Section 4). The City posted the plan update for public comment before FEMA

¹ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

approval, and after approval will maintain the plan on the City's website:
<https://westlinnoregon.gov/planning/natural-hazards-mitigation-plan>

NHMP Maintenance

The Clackamas County NHMP and City addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the County NHMP update process, the City will also review and update its addendum (Volume I, Section 4). The convener will be responsible for convening the HMAC to address the questions outlined below.

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

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

Mitigation Strategy

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

The City's mitigation strategy (action items) were first developed during the 2009 NHMP planning process and revised during subsequent NHMP updates. During these processes, the HMAC assessed the City's risk, identified potential issues, and developed a mitigation strategy (action items).

During the 2018 update process the City re-evaluated their mitigation strategy (action items). During this process action items were updated, noting what accomplishments had been made and whether the actions were still relevant; any new action items were identified at this time (see Volume III, Appendix B for more information on changes to action items).

Priority Action Items

Table WL-1 presents a list of mitigation actions. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity. High priority actions are shown in **bold** text with grey highlight. The City will focus their attention, and resource availability, upon these achievable, high leverage,

activities over the next five-years. Although this methodology provides a guide for the HMAc in terms of implementation, the HMAc has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for detailed information for each action. Full text of the plan goals referenced in Table WL-1 is located on page WL-2.

Table WL-I West Linn Action Items

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
MH #1	Reduce threat to critical and essential public facilities.	Parks and Recreation	Public Works, Engineering	Ongoing	✓	✓	✓	✓	
MH #2	Enhance recognition of hazards, and appropriate mitigation and response activities through public education.	HMAC	Tualatin Valley Fire & Rescue, Planning, Public Safety Advisory Board	Ongoing	✓		✓	✓	✓
MH #3	Identify, protect, and enhance natural resources in accordance with Goal 5.	Planning	Public Works, GIS	Ongoing	✓	✓	✓	✓	
MH #4	Maintain and incorporate available natural hazard data into City GIS databases and applications.	Engineering - GIS	Public Works, Planning	Ongoing	✓	✓	✓	✓	✓
MH #5	Integrate the goals and action items from the Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	Planning	Public Works, Building, City Council	Ongoing	✓	✓	✓	✓	✓
EQ #1	Conduct seismic evaluations on identified critical and essential facilities and infrastructure and implement appropriate structural and non-structural mitigation strategies.	Public Works – Engineering	Planning	Long Term	✓		✓	✓	
FL #1	Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.	Planning	GIS, Public Works	Ongoing	✓	✓		✓	✓

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
FL #2	Implement Surface Water Master Plan capital improvement projects that can reduce flood threats.	Public Works	Planning	Ongoing	✓	✓	✓	✓	
FL #3	Address vulnerabilities of sewer pump stations to potential flood events.	Public Works	Planning	Ongoing	✓	✓	✓	✓	
FL #4	Acquire flood-prone and repetitive loss properties and preserve as open space.	Planning	Public Works, GIS	Long Term	✓	✓		✓	✓
SW #1	Reduce risk of erosion and soil destabilization by implementing the strategies outlined in the Surface Water Management Plan.	Public Works	Planning	Ongoing	✓	✓		✓	
SW #2	Maintain a tree hazard program for preventing future hazards, while improving long-term health and care of urban forest.	Parks and Recreation	Planning, Building, Public Works	Ongoing	✓	✓		✓	✓
WF #1	Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan.	TVF&R	Public Works, Parks and Recreation, Building, Planning	Ongoing	✓	✓	✓	✓	✓

Source: City of West Linn HMAC, 2018.

Note: Full text of the plan goals referenced in this table is located on page WL-2.

Risk Assessment

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

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

The local level rationale for the identified mitigation strategies (action items) is presented herein and within Volume I, Section 3 and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure WL-1. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure WL-1 Understanding Risk



Hazard Analysis

The West Linn HMA developed their hazard vulnerability assessment (HVA), using their previous HVA and the County’s HVA as a reference. Changes from their previous HVA and the County’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to West Linn, which are discussed throughout this addendum. For detailed information on the methodology see Volume I, Section 2.

Table WL-2 shows the HVA matrix for West Linn listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response and recovery. The method provides the jurisdiction with sense of hazard priorities but does not predict the occurrence of a hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake and Crustal earthquake) and one chronic hazard (windstorm) rank as the top hazard threats to the City (Top Tier). Winter storm, flood, and wildfire comprise the next highest ranked hazards (Middle Tier), while drought, extreme heat, volcanic event, and landslide hazards comprise the lowest ranked hazards (Bottom Tier).

Table WL-2 Hazard Analysis Matrix – West Linn

Hazard	Maximum				Total Threat Score	Hazard Rank	Hazard Tiers
	History	Vulnerability	Threat	Probability			
Earthquake - Cascadia	4	45	100	49	198	#1	Top Tier
Earthquake - Crustal	6	50	100	21	177	#2	
Windstorm	20	40	50	49	159	#3	
Winter Storm	10	20	70	49	149	#4	Middle Tier
Flood	14	35	30	49	128	#5	
Wildfire	2	35	70	14	121	#6	
Drought	10	10	50	28	98	#7	Bottom Tier
Extreme Heat	2	20	40	35	97	#8	
Volcanic Event	2	25	50	14	91	#9	
Landslide	2	25	20	21	68	#10	

Source: West Linn HMAc, 2018.

Table WL-3 categorizes the probability and vulnerability scores from the hazard analysis for the City and compares the results to the assessment completed by the Clackamas County HMAc. Variations between the City and County are noted in **bold** text within the city ratings.

Table WL-3 Probability and Vulnerability Comparison

Hazard	West Linn		Clackamas County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	Moderate	Low	High	Low
Earthquake - Cascadia	Moderate	High	Moderate	High
Earthquake - Crustal	Low	High	Low	High
Extreme Heat	Moderate	Moderate	Low	High
Flood	Moderate	Moderate	High	Moderate
Landslide	Low	Moderate	High	Low
Volcanic Event	Low	Moderate	Low	Moderate
Wildfire	Low	Moderate	High	Moderate
Windstorm	Moderate	High	Moderate	Low
Winter Storm	Moderate	Moderate	Moderate	Moderate

Source: West Linn and Clackamas County HMAc, 2018.

Community Characteristics

Table WL-4 and the following section provides information on City specific demographics and assets. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation.

Considering the City specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation. Between 2010 and 2016 the City grew by 465 people (2%);, as of 2018 the population was 25,830) and median household income decreased by about 3%.² Between 2018 and 2040 the population is forecast to grow by 8% to 27,861.³ New development has complied with the standards of the [Oregon Building Code](#) and the city's development code.

Transportation/Infrastructure

The City of West Linn is divided by two major regional transportation facilities — Interstate 205, a freeway running east-west through the southerly section of the City and State Highway 43 (Willamette Drive) that connects to I-205 near its southerly terminus and runs north- south through the northerly section of the City all the way to Portland.

Motor vehicles represent the dominant mode of travel through and within West Linn. West Linn contains two interchanges with I-205, the 10th Street interchange in the Willamette neighborhood and the Highway 43 (Willamette Drive) interchange in the Bolton neighborhood. The responsibility and authority, as well as the financial capability, to maintain an adequate level of service for the freeway I-205 rests with Metro and Oregon Department of Transportation (ODOT) authorities. Congestion on I-205, nonetheless, can result in the diversion of traffic onto City streets.

The City's public transit is provided by Portland's TriMet transit system which serves the majority of the commercially zoned areas. The availability and quality of pedestrian and bicycling facilities (sidewalks, bike lanes, and pathways) is inconsistent, generally newer neighborhoods have facilities. [Road and Base Maps](#) are found on the West Linn website.

Economy

The economy of West Linn is based primarily on service and retail-oriented commercial businesses and the City has more residents than employees. The City's single major industrial employer, the West Linn Paper Company closed in 2017. The site, located on the Willamette River, provided jobs to more than 300 workers is now the site of [West Linn's Waterfront Plan](#). The City, School District, and smaller employers (retail, offices and other professional services) provide for most of the City's employment.

The City of West Linn does not contain a major commercial district or downtown, but rather it possesses four distinct commercial districts. The Historic Willamette District was one of the first commercial and residential areas in West Linn. The commercial area still retains some of the turn-of-the-century architecture along Willamette Falls Drive and features on-street parking and residential units above retail establishments. Newer commercial and office buildings have been built to the north and east of the Historic District, including north of I-205.

² Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018 and Social Explorer, Table T57, U.S. Census Bureau, 2012-2016 and 2006-2010 American Community Survey Estimates.

³. Metro, 2040 Distributed Forecast (2016).

Table WL-4 Community Characteristics

Population Characteristics		
2010 Population	25,150	
2016 Population [2018 Population]	25,615	[25,830]
2040 Forecasted Population*	27,861	
Race (non-Hispanic) and Ethnicity (Hispanic)		
White	86%	
Black/ African American	1%	
American Indian and Alaska Native	< 1%	
Asian	5%	
Native Hawaiian and Other Pacific Islander	< 1%	
Some Other Race	0%	
Two or More Races	3%	
Hispanic or Latino	5%	
Limited or No English Spoken	3%	
Vulnerable Age Groups		
Less than 15 Years	4,827	18%
65 Years and Over	3,934	15%
Disability Status		
Total Population	2,308	9%
Children	208	3%
Seniors	1,091	28%
Income Characteristics		
Households by Income Category		
Less than \$15,000	496	5%
\$15,000-\$29,999	858	9%
\$30,000-\$44,999	970	10%
\$45,000-\$59,999	1,037	10%
\$60,000-\$74,999	863	9%
\$75,000-\$99,999	1,327	13%
\$100,000-\$199,999	2,996	30%
\$200,000 or more	1,467	15%
Median Household Income	\$89,806	
Poverty Rates		
Total Population	1,550	6%
Children	294	5%
Seniors	161	4%
Housing Cost Burden		
Owners with Mortgage	2,444	32%
Renters	1,154	49%

Source: U.S. Census Bureau, 2012-2016 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018. [Metro, 2040 Distributed Forecast](#). Note: * = Population forecast within Metro UGB

Housing Characteristics		
Housing Units		
Single-Family	8,596	84%
Multi-Family	1,613	16%
Mobile Homes	72	1%
Year Structure Built		
Pre-1970	1,970	19%
1970-1989	3,950	38%
1990 or later	4,361	42%
Housing Tenure and Vacancy		
Owner-occupied	7,677	75%
Renter-occupied	2,337	23%
Seasonal	94	1%
Vacant	173	2%

West Linn has grown substantially since its incorporation in 1913 and has an area today of about 8 square miles. The city is on Interstate 205 and within the southern bounds of the Portland metropolitan area (about 12 miles south of the City of Portland) and is bordered on the east by the Willamette River, and to the southwest by the Tualatin River, on the north by the City of Lake Oswego, and to the west by unincorporated Clackamas County. The City is within the Willamette River watershed.

Because of its location West Linn's climate is consistent with the Marine west coast climate zone, with warm summers and cool, wet winters. West Linn receives most of its rainfall between October and May, and averages 44 inches of rain, and less than one (1) inch of snow, per year.⁴

The easterly and southerly areas of the City that border the Willamette and Tualatin rivers are low-lying — 55 to 60 feet above sea level at Willamette Falls — while the central and northwesterly sections of the City contain a ridge that rises to as high as 650 feet above sea level.

⁴ ["Monthly Average for West Linn, OR"](#) The Weather Channel Interactive, Inc. Retrieved November 1, 2018.

Community Assets

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of West Linn. The community assets identified below were identified by the City of West Linn. The tables identify which hazards each asset may be exposed to, based upon both a GIS analysis as well as HMAAC member knowledge. Additional information is needed to fully understand the extent of risk to each asset. It is important to note that the facilities identified as “critical” and “essential” are characterized differently than the structural code that identifies buildings as “essential” and “non-essential.” The structural code uses different language and criteria and therefore have completely different meanings than the buildings identified in this addendum. For Community Asset location information see the [Atlas of West Linn](#).

Critical Facilities

These facilities are critical to government response, and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include: 911 Centers, Emergency Operations Centers, Police, and Fire Stations, Public Works facilities, sewer, and water facilities, hospitals, bridges, roads, shelters, and more.

Table WL-5 Critical Facilities in West Linn

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Facilities									
City Hall/EOC (built 2012, Level IV)									X
Public Works/Operations		X			X				
Library (backup EOC/ <i>historic building</i>)					X		X	X	X
Fire/Police Stations									
Fire Station #55 (Rosemont, ca. 2018)									
Fire Station #58 (Bolton, ca. 2010)									
Fire Station #59 (Willamette, ca. 2010)									
Police Department (ca. 2014)									

Critical Infrastructure:

Infrastructure that provides necessary services for emergency response include:

Table WL-6 Critical Infrastructure in West Linn

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Infrastructure									
Bridges									
Abernethy Bridge (I-205) (ODOT)		X		X	X			X	X
Arch Bridge (ODOT)		X		X					
Fields Bridge (County, Tualatin River, SW Borland Rd)		X							
Weiss Bridge (County, Tualatin River, SW Petes Mtn Rd)		X							
Overpasses									
I-205 (ODOT) (6)*		X			X		X	X	X
Pump Stations - Sewage									
Arbor		X			X		X	X	X
Bolton (Tri-City)		X		X	X		X	X	X
Calaroga		X			X		X	X	X
Cedaroak		X					X		
Johnson		X			X		X	X	X
Mapleton		X		X	X		X	X	X
Marylhurst							X		
River Heights		X		X	X		X	X	X
River Street (Tri-City)		X		X			X		
Willamette (Tri-City)		X		X					
Primary and Alternative Water Source									
South Fork Water		X					X		
I-205 Water Line		X		X	X			X	X
Lake Oswego Intertie Pump Station (alt.)									
Reservoirs/Pressure Zones									
Bland					X			X	X
Bolton (+ pump station)					X		X	X	X
Horton (+ pump station)					X			X	X
Rosemont								X	X
View Drive (Robinwood) (+ pump station)		X			X		X	X	X
Willamette (+ pump station)									

Note: * - ODOT overpasses include: Sunset Avenue, West A Street, Broadway Street, 10th Street, OR 43, and Blankenship Road. The Broadway Street overpass is to be removed as part of ODOT's I-205 widening project.

Essential Facilities

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public's ability to recover from the emergency. These facilities may include: City buildings such as the Public Services Building, the City Hall, and other public facilities such as schools.

Table WL-7 Essential Facilities in West Linn

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Essential Facilities									
Schools									
Bolton Primary (<i>historic building</i>)					X		X	X	X
Cedar oak Park Primary (<i>historic building</i>)		X					X		
Rosemont Ridge Middle (<i>historic building</i>)								X	X
Sunset Primary									
Trillium Creek Primary									
West Linn High (<i>historic building</i>)					X		X	X	X
Willamette Primary (<i>historic building</i>)		X			X			X	X
Other Essential Facilities									
Adult Community Center (backup EOC)								X	X
Sunset Fire Hall (Community Rooms)					X		X	X	X

Cultural and Historic Assets

The cultural and historic heritage of a community is more than just tourist charm. For families that have lived in the city for generations and new resident alike, it is the unique places, stories, and annual events that make West Linn an appealing place to live. The cultural and historic assets are both intangible benefits and obvious quality-of-life-enhancing amenities. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important. Please see the following maps for locations of cultural and historic assets: [Historic Railway Map](#), [Historic Resource Map](#), and [Willamette Falls Neighborhood Historic District Map](#).

Table WL-8 Cultural or Historic Assets in West Linn

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Cultural or Historic Assets									
Historic Landmarks (28)									
McLean House and Park		X		X	X			X	X
Willamette Falls Historic District									
Willamette Locks (decommissioned)		X		X	X		X	X	X

Vulnerable Populations:

Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, often experience the impacts of natural hazards and disasters more acutely. Populations that have special needs or require special consideration include:

Table WL-9 Vulnerable Populations in West Linn

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Vulnerable Populations									
Assisted Living Facilities									
Rose Linn Care Center								X	X
Tanner Spring Assisted Living								X	X
Childcare and Preschools									
Atlas Immersion Academy									
Beloved Montessori									
Cascade Montessori									
Kindercare Learning Center		X			X		X	X	X
La Petite Academy, Inc.					X		X	X	X
SunGarden Montessori					X			X	X
Schools									
<i>Schools listed in Essential Facilities</i>									
Youth Music Project		X							

Hazardous Materials:

Facilities that, if damaged, could cause serious secondary impacts may also be considered “critical.” A hazardous material facility is one example of this type of critical facility. Those sites that store, manufacture, or use potentially hazardous materials include:

Table WL-10 Hazardous Materials in West Linn

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Hazardous Materials									
Gas Stations (5)		X			X			X	X
Paper Mill		X		X	X		X	X	X
Public Works					X			X	X
Water Treatment Plant (Lake Oswego – Tigard)		X					X		

Economic Assets/Population Centers:

Economic assets include businesses that employ large numbers of people and provide an economic resource to the City. If damaged, the loss of these economic assets could significantly affect economic stability, and prosperity. Population Centers usually are aligned with economic centers and are a concern during evacuation/notification during a hazard event. See [West Linn Atlas](#) Places Index for a list of economic assets and population centers including: shopping and business, private pools, and multi-family housing.

Environmental Assets:

Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic, and functional ecosystem services for the community. See [West Linn Atlas](#) Place Index for a list of environmental assets including: points of interest, Willamette River Islands, Boat Ramps and Docks, and Parks and Open Spaces.

Hazard Characteristics

Drought

The HMAC determined that the City's probability for drought is **moderate** and that their vulnerability to drought is **low**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent and probability of a potential event. Due to the climate of Clackamas County, past and present weather conditions have shown an increasing potential for drought.

The City of West Linn currently obtains its potable water from the South Fork Water Board (SFWB, a wholesale water supplier that is equally owned by Oregon City and West Linn). The SFWB source of water is the Clackamas River that originates, like the Willamette, in the Cascade Range and flows west to its confluence with the Willamette River just east of the City. The SFWB operates a conventional water treatment plant located on the south side of the Clackamas River near its confluence with the Willamette. Its system includes intake facilities, a water treatment plant (located in Oregon City), and a transmission pipeline to a pump station located on Division Street in Oregon City. The water distribution system includes six service zones that are supplied by six storage facilities (reservoirs) and five pumping stations (see Table WL-6 for details). The [Water System Master Plan](#) was last updated in 2008 to provide long-term guidance for the development of the City's water system, which is a supporting document for the Comprehensive Plan. The City has a map of [Water Main Breaks \(2008-2012\)](#) and an Atlas of their Water System on their website.

Vulnerability Assessment

Due to insufficient data and resources, West Linn is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables WL-5 to WL-10.

Mitigation Activities

The City of West Linn has a water curtailment program that is activated by the City Council. The council's declaration includes the effective date, the reason for the declaration, and the level of prohibition. For more information see [Section 4.250](#) of the City's Municipal Code. Additional drought hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Earthquake (Cascadia Subduction Zone)

The HMAC determined that the City's probability for a Cascadia Subduction Zone (CSZ) earthquake is **moderate** and that their vulnerability to a CSZ earthquake is **high**. *The probability rating increased, and the vulnerability rating did not change, since the previous version of this NHMP addendum. Note: Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake and Crustal earthquake.*

Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent and probability of a potential event. Generally, an event that affects the County is likely to affect West Linn as well. The causes and characteristics of an earthquake event are appropriately described within the Volume I, Section 2 as well as the location and extent of potential hazards. Previous occurrences are well documented within Volume I, Section 2 and the community impacts described by the County would generally be the same for West Linn as well.

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Portland Hills Fault Zone, and Gales Creek-Newberg-Mt. Angel Structural Zone (discussed in the crustal earthquake section).

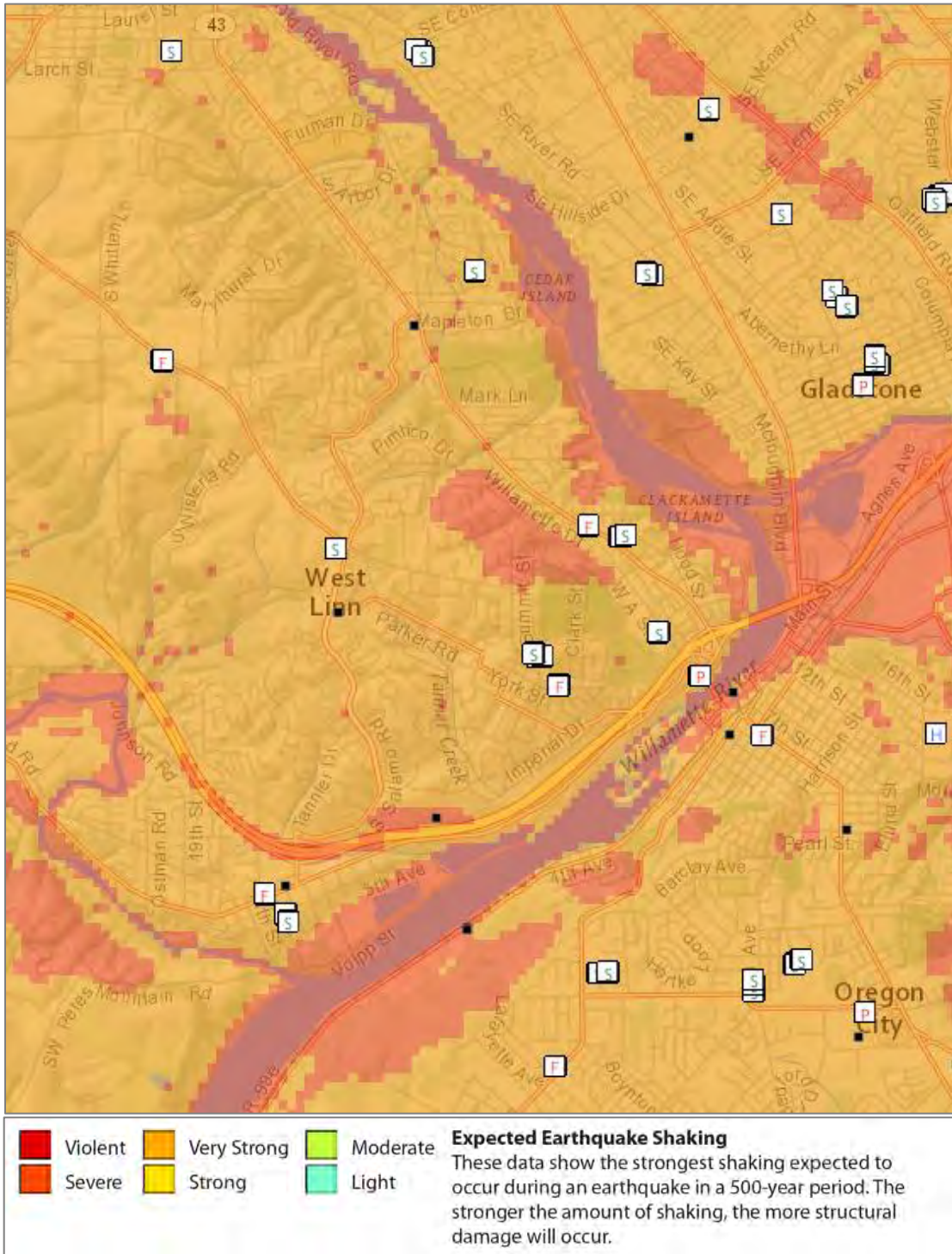
Figure WL-2 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the city is expected to experience very strong shaking (orange), while areas near rivers and streams will experience severe (light red) to violent (dark red) shaking in a CSZ event.

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year. Scientists have found evidence that 11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D.⁵

⁵ The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. <http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf>

Figure WL-2 Cascadia Subduction Zone Expected Shaking



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

Note: To view detail click the link above to access Oregon HazVu

The city's proximity to the Cascadia Subduction Zone, potential slope instability and the prevalence of certain soils subject to liquefaction and amplification combine to give the city a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places the city

predominately within the “Valley Zone” (Valley Zone, from the summit of the Coast Range to the summit of the Cascades). Within the Northwest Oregon region, damage and shaking is expected to be strong and widespread - an event will be disruptive to daily life and commerce and the main priority is expected to be restoring services to business and residents.

Earthquake (Crustal)

The HMAP determined that the City’s probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**. *These ratings did not change since the previous version of this NHMP addendum. Note: Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Crustal earthquake, and Cascadia Subduction Zone (CSZ) earthquake.*

Volume I, Section 2 describes the causes and characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect West Linn as well. Figure WL-3 shows a generalized geologic map of the West Linn area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows the areas of greatest concern within the City limits as red and orange.

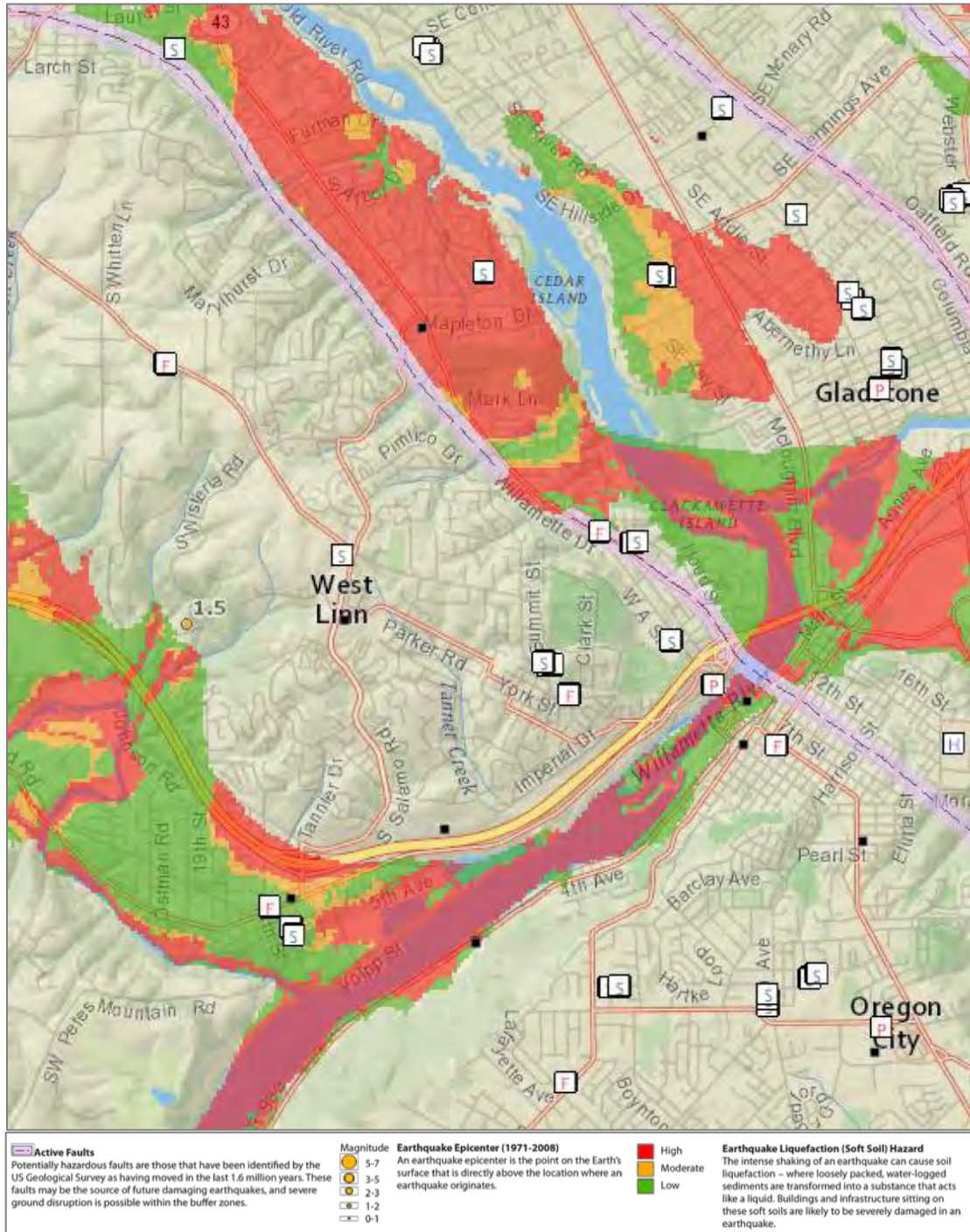
There are two potential crustal faults and/or zones near the City that can generate high-magnitude earthquakes. These include the Gales Creek-Mt. Angel Structural Zone and Portland Hills Fault Zone (discussed in greater detail below). Other faults include the Bolton fault (running through the city’s east edge roughly parallel to Willamette Drive/Highway 43) and Oatfield fault (just to the east of the city on the eastern side of the Willamette River), Canby-Molalla structural zones located west of the city, and the Mt. Hood Fault in eastern Clackamas County. Historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and lies about 11 miles northeast of West Linn.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

Figure WL-3 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



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

Note: To view detail click the link above to access Oregon HazVu

Vulnerability Assessment

Due to insufficient data and resources, West Linn is currently unable to perform a quantitative risk assessment for this hazard. However, the City completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified

hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected. Additionally, in 2018 the Department of Geology and Mineral Industries (DOGAMI) completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)), findings from that report are provided at the end of the crustal earthquakes hazard section.

Community assets located in the highest hazard zone for earthquakes include both major hazardous materials fixed sites in West Linn (West Linn Paper Company and Lake Oswego—Tigard Water Treatment Plant) as well as two gas stations. West Linn’s infrastructure is particularly vulnerable to earthquake damage. Of the city’s nine pump stations, eight are in the moderate to high hazard zones for earthquakes. While the I-205/Abernathy bridge has been seismically retrofitted, its footings lie in the highest hazard zone, as do those for the Oregon City-West Linn Bridge. During a major earthquake, emergency responders may have difficulty performing their duties because their buildings could be impacted by the event. The Bolton Fire Station, and the Police Department’s headquarters are in the moderate to high hazard zones. Areas near the Willamette and Tualatin Rivers are likely comprised of softer soils prone to liquefaction. This can be very destructive to underground utilities such as water and sewer lines. Buildings and water lines can sink into the liquefied ground while sewer pipes, manholes and pump stations (assets partially filled with air) may float to the surface. After the earthquake, the liquefied soil will re-solidify, locking tilted buildings and broken pipe connections into place. In 2018, TVF&R rebuilt Station #55 (Rosemont), and in 2010 they rebuilt Station #58 (Bolton) and Station #59 (Willamette). For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables WL-5 to WL-10.

Vulnerable populations such as children could be significantly impacted, as many schools lie in the highest two hazard zones. The data gathered from the statewide DOGAMI inventory should be used to prioritize school buildings in West Linn for seismic hazard retrofitting.

Seismic building codes were implemented in Oregon in the 1970s, however, stricter standards did not take effect until 1991 and early 2000s. As noted in the community profile, approximately 68% of residential buildings were built prior to 1990, which increases the City’s vulnerability to the earthquake hazard. Information on specific public buildings’ (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table WL-11; each “X” represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), none have a very high (100% chance) collapse potential, while four (4) have a high (greater than 10% chance) collapse potential. *Note: two fire stations and one school have been rebuilt.*

In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

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

areas. Restoration of utility services will require substantial mutual aid from utilities outside of the affected area.

Table WL-11 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Athey Creek Middle (2900 SW Borland Rd)	Clac_sch73	X			
Bolton Primary (5933 Holmes St)	Clac_sch82		X, X		
Cedaroak Park Primary (4515 S Cedaroak Dr)	Clac_sch85			X	
Rosemont Ridge (20001 Salamo Rd)	Clac_sch79	X			
Stafford Primary (19875 SW Stafford Rd)	Clac_sch93			X	
Sunset Primary (2351 Oxford St)	Clac_sch01	School rebuilt in 2017 per a 2014 bond.			
West Linn High (5464 W A St)	Clac_sch02	X			
Willamette Primary (1403 SE 12 th St)	Clac_sch72			X, X	
Public Safety					
TVF&R Fire Station #58 (Bolton) (6050 Failing St)	Clac_fir32	Facility rebuilt in 2010 via a 2006 bond.			
TVF&R Fire Station #59 (Willamette) (1860 Willamette Falls Drive)	Clac_fire33	Facility rebuilt in 2010 via a 2006 bond.			
Police Department (22825 Willamette Drive)	Clac_pol06	Facility rebuilt in 2014 on a different location via a 2011 bond			

Source: [DOGAMI 2007. Open File Report O-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#) “*” – Site ID is referenced on the [RVS Clackamas County Map](#)

Note 1: Bold indicates facilities that have been seismically retrofitted or rebuilt.

Note 2: Private schools were not assessed by DOGAMI as part of O-07-02.

Note 3: TVF&R Station #55 (Rosemont) was relocated/rebuilt in the City of West Linn (20790 Hidden Springs Road) in 2018.

Mitigation Activities

West Linn has taken mitigation steps to reduce the city’s vulnerability in earthquake events. The Police Station was built on a new site (1800 8th Avenue) in 2014 via a 2011 voter approved bond.⁶ Additional mitigation activities completed by the City of West Linn include:

- Seismic strengthening of supports for the West Linn primary water transmission line (24-inch) attached to the underside of the I-205 (Abernethy) Bridge over the

⁶ Malee, Patrick. Portland Tribune (August 7, 2014). “After three years, police station set for grand opening.” <https://pamplinmedia.com/wlt/95-news/229497-92676-after-three-years-police-station-set-for-grand-opening-> (Accessed December 7, 2018)

Willamette River between West Linn and Oregon City, as part of a general seismic upgrade of the bridge by the Oregon Department of Transportation, 2001-02

- Compliance with SB 13, enacted in 2001, requiring local governments to develop seismic preparation procedures, inform their employees about the procedures, and conduct earthquake drills.
- Conformance with seismic-related construction requirements in the Oregon Structural Specialty Code and Oregon One- and Two-Family Dwelling Specialty Code.
- Adoption of a policy to require undergrounding of power lines in new subdivisions.
- Development Code restrictions regarding construction on steep slopes.
- Adoption of Emergency Operations Plan (2017 update)

Additionally, in 2006 a \$77.5 million bond measure (34-133) was passed by southeast Portland metro-area voters to correct seismic safety deficiencies at Tualatin Valley Fire and Rescue Fire by rebuilding [Station 58](#) (Bolton) and [Station 59](#) (Willamette).⁷ In 2018, TVF&R completed construction on [Station 55](#) (Rosemont). In 2011, a local school district capital bond was approved to structurally reinforce Bolton Primary, Cedaroak Park Primary, and Stafford Primary schools. The historic Sunset Primary school was demolished⁸ and replaced in September 2017 with a new school per a 2014 school district capital bond.⁹

Earthquake Regional Impact Analysis

In 2018 DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)). Their study focused on damage to buildings, and the people that occupy them, and to two key infrastructure sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and night time (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damaged varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood structures that fare worse in an earthquake. The Portland Hills fault scenario created greater damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault

⁷ Tualatin Valley Fire & Rescue, "General Obligation Bond". <https://www.tvfr.com/100/General-Obligation-Bond> (Accessed December 5, 2018)

⁸ Kilstrom, Andrew. WestLinnTidings (June 29, 2017) "*Sunset: 127 years and counting*". <https://pamplinmedia.com/wlt/95-news/364495-244263-sunset-127-years-and-counting> (Accessed December 6, 2018)

⁹ West Linn-Wilsonville School District. "2014 Capital Bond Program". <https://www.wlww.k12.or.us/Bond> (Accessed December 6, 2018)

scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios, however, the impact is considerably less than it is to the transportation routes. Additional, capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts.

Table WL-12 shows the permanent resident population that are vulnerable to injury or death (casualty) and the buildings in the City that are susceptible to liquefaction and landslides, it does not predict that damage will occur in specific areas due to either liquefaction or landslide. More population and property are exposed to higher degrees of expected damage or casualty under the Portland Hills Fault “wet” scenario than in any other scenario.

Table WL-12 Expected damages and casualties for the CSZ fault and Portland Hills fault: earthquake, soil moisture, and event time scenarios

	Cascadia Subduction Zone (M9.0)		Portland Hills Fault (M6.8)	
	"Dry" Soil	"Wet" Saturated Soil	"Dry" Soil	"Wet" Saturated Soil
Number of Buildings	9,170	9,170	9,170	9,170
Building Value (\$ Million)	3,817	3,817	3,817	3,817
Building Repair Cost (\$ Million)	117	209	899	1,093
Building Loss Ratio	3%	5%	24%	29%
Debris (Thousands of Tons)	39	64	251	304
Long-Term Displaced Population	96	797	1,679	3,457
Total Casualties (Daytime)	68	99	493	566
Level 4 (Killed)	4	5	32	35
Total Casualties (Nighttime)	19	72	216	347
Level 4 (Killed)	0	2	6	9

Source: DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8, 12-9, 12-10, and 12-11.

Cascadia Subduction Zone Scenario

The City of West Linn is expected to have a 3% building loss ratio with a repair cost of \$117 million under the CSZ “dry” scenario, and an 5% building loss ratio with a repair cost of \$209 million under the CSZ “wet” scenario.¹⁰ The city is expected to have around 68 daytime or 19 nighttime casualties during the CSZ “dry” scenario and 99 daytime or 72 nighttime casualties during the CSZ “wet” scenario. It is expected that there will be a long-term displaced population of around 96 for the CSZ “dry” scenario and 797 for the CSZ “wet” scenario.¹¹

Portland Hills Fault Scenario

The City of West Linn is expected to have a 24% building loss ratio with a repair cost of \$899 million under the CSZ “dry” scenario, and a 29% building loss ratio with a repair cost of \$1.093 billion under the CSZ “wet” scenario.¹² The long-term displaced population and casualties are greatly increased for all the Portland Hills Fault scenarios. The city is expected to have around 493 daytime or 216 nighttime casualties during the Portland Hills Fault “dry” scenario and 566 daytime or 347 nighttime casualties during the Portland Hills Fault “wet”

¹⁰ DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8 and 12-9.

¹¹ Ibid, Tables 12-8 and 12-9.

¹² Ibid, Tables 12-10 and 12-11

scenario. It is expected that there will be a long-term displaced population of around 1,679 for the Portland Hills Fault “dry” scenario and 3,457 for the Portland Hills Fault “wet” scenario.¹³

Recommendations from the report included topics within Planning, Recovery, Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMPs mitigation strategies (Table WL-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and the recommendations see: *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, [O-18-02](#)).

Please review Volume I, Section 2 for additional information on this hazard.

Flood

The HMAC determined that the City’s probability for flood is **moderate** and that their vulnerability to flood is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent, and probability of a potential event. Figure WL-4 illustrates the flood hazard area for West Linn.

Portions of West Linn have areas of floodplain (special flood hazard areas, SFHA). These include the Tualatin, and Willamette Rivers. The Federal Emergency Management Agency (FEMA) regulatory floodplains for each of these rivers are depicted as relatively narrow areas on each side of the channels. On the Willamette River, the floodway is generally confined within high stream banks. On the Tualatin, the floodways cover a somewhat larger area.

Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage, and economic loss from business interruption. It is important for the City to be aware of flooding impacts and assess its level of risk.

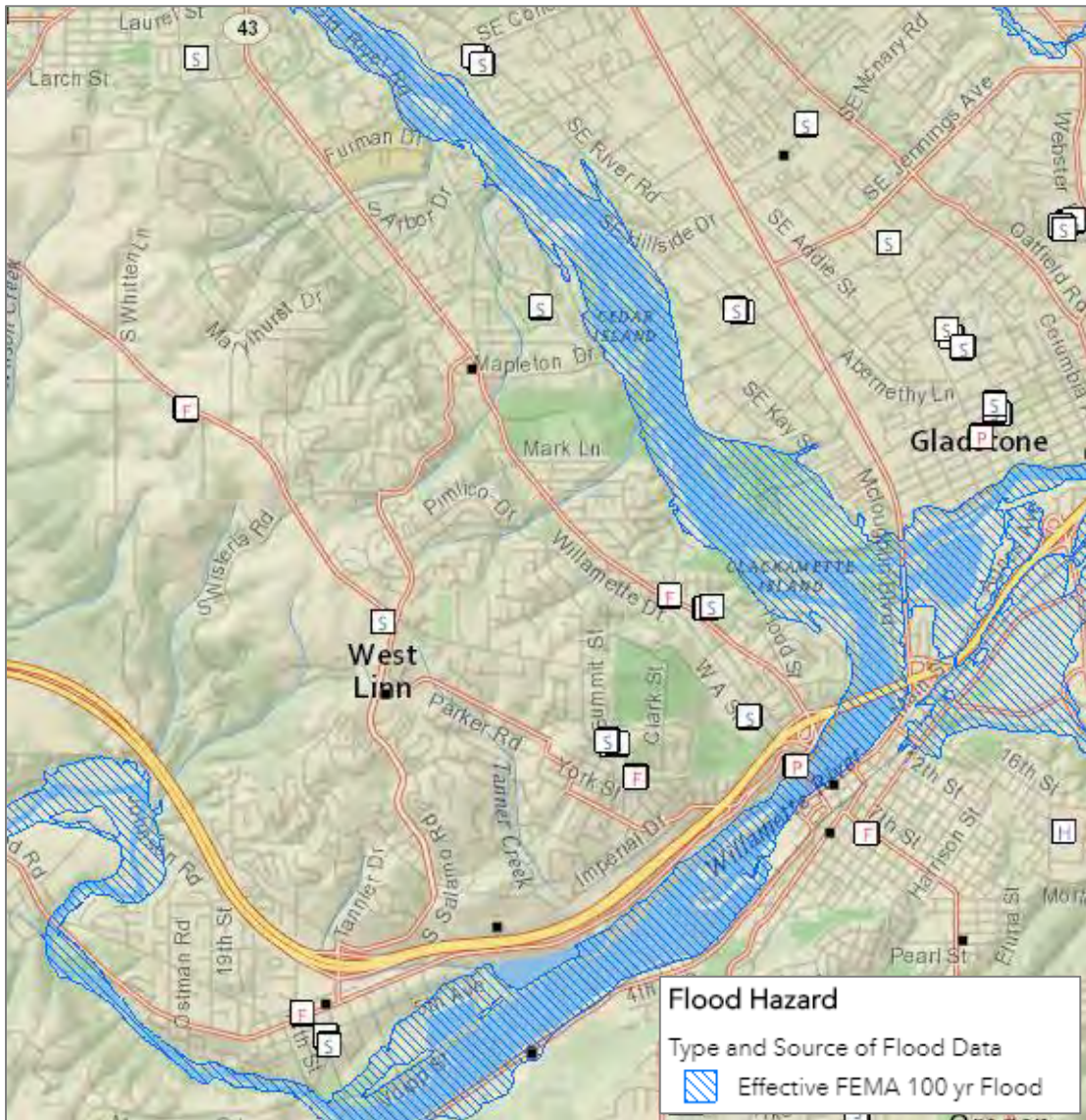
The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners, and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of West Linn outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage. City staff has identified sites where local drainage facilities are taxed during high flows, especially where open ditches enter culverts or go underground into storm sewers and

¹³ Ibid, Tables 12-10 and 12-11.

works to mitigate the stormwater flood risks in these areas (see the City's [Surface Water Management Plan](#) for more information).

Figure WL-4 Special Flood Hazard Area



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

Note: To view detail click the link above to access Oregon HazVu

The speed of onset, lack of warning, and depth of flooding make dam failures a potentially deadly, albeit unlikely, occurrence. There are four major dams upstream of West Linn on the Clackamas River: North Fork, Faraday, River Mill and Timothy. These are operated by Portland General Electric and are subject to the dam safety and warning requirements of the Federal Energy Regulatory Commission. According to the Clackamas County Emergency Operations Plan, areas of West Linn bordering on the Willamette in the vicinity of its confluence with the Clackamas would be inundated by a wall of water 60 - 80 feet high in approximately an hour and a half should the North Fork dam fail under a “probable maximum flood” (a worst-case scenario where all four dams fail). There are no major dams

on the Tualatin, and the Willamette River dams are far enough upstream and dispersed so that failures on these two rivers would not be much worse than a regular flood.

The largest flooding event to affect West Linn was the February 1996 flood. The high-water level meant tributaries could not drain into the Tualatin and Willamette River, which led to localized flooding on several backed-up creeks.

The extent of flooding hazards in West Linn primarily depends on climate and precipitation levels. Additionally, withdrawals for irrigation and drinking water, as well as stream and wetland modifications or vegetation removal can influence water flow.

Vulnerability Assessment

Due to insufficient data and resources, West Linn is currently unable to perform a quantitative risk assessment for this hazard. However, the City completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

Relatively few people (about 3% of the total population) live in the floodplain and thus are directly at risk from flooding. Dwelling units within or adjacent to the 100-year floodplain of the Tualatin those located on Swiftshore Avenue, Fields Bridge Park, and the Willamette Park. Residences along the Willamette that could be exposed to 100-year flooding events include those along River Street, Nixon Ave, Calaroga Ct., and Cedar Oak Park.

Several economic centers, zoned commercial and industrial, are located in the 100-year floodplain (including the site of the former West Linn Paper Company). Studies show that most businesses do not survive extended closure due to disasters, which can thus economically devastate local communities. It will be essential that the economic centers mapped in hazard areas be targeted for business continuity planning.

Additionally, a great deal of infrastructure (bridges, water lines, sewage pump stations, etc.) is in the floodplain. Infrastructure exposed to flooding includes, but is not limited to, Portland General Electric's Sullivan Hydroelectric Plant, Weiss Bridge, Fields Bridge, I-205 water line, Tri Cities sewage pump stations, and many more pieces of critical infrastructure that assist in supporting the essential needs of the community. Disruption to this infrastructure could result in transportation issues, power outages, sewage back-up, and affect overall community and environmental health.

A few historic sites, including the McLean House are also located in the floodplain. Many older buildings will have difficulty sustaining pressure from flooding events and should be targeted for floodplain retrofitting. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables WL-5 to WL-10.

National Flood Insurance Program (NFIP)

FEMA's Flood Insurance Study (FIS), and Flood Insurance Rate Maps (FIRMs) are effective as of June 17, 2008. Table WL-13 shows that as of July 2018, West Linn has 134 National Flood Insurance Program (NFIP) policies in force. Of those, 66 are for properties that were constructed before the initial FIRMs. The last Community Assistance Visit (CAV) for West

Linn was on August 28, 2003. West Linn does not participate in the Community Rating System (CRS).

The table shows that most flood insurance policies are for residential structures, primarily single-family homes. There has been a total of 44 paid claims for \$1,886,681. The City complies with the NFIP through enforcement of their flood damage prevention ordinance and their floodplain management program. The Community Repetitive Loss record for West Linn identifies one (1) Repetitive Loss (RL) Property¹⁴, which is not considered a Severe Repetitive Loss (SRL) Properties¹⁵. The RL property is a single-family residential, located in zone A21, and has had two claims for a total of \$23,270.99. For additional detail and a map of its general location see Volume I, Section 2 and Figure 2-13.

Table WL-13 Flood Insurance Detail

	Clackamas County	West Linn
Effective FIRM and FIS	6/17/2008	6/17/2008
Initial FIRM Date	-	3/15/1977
Total Policies	1,957	134
Pre-FIRM Policies	1,086	66
Policies by Building Type		
Single Family	1,761	131
2 to 4 Family	30	0
Other Residential	58	1
Non-Residential	9	0
Minus Rated A Zone	123	9
Insurance in Force	\$541,833,400	\$41,095,900
Total Paid Claims	590	44
Pre-FIRM Claims Paid	450	28
Substantial Damage Claims	83	9
Total Paid Amount	\$20,830,662	\$1,886,681
Repetitive Loss Structures	51	1
Severe Repetitive Loss Properties	4	0
CRS Class Rating	-	NP
Last Community Assistance Visit	-	8/28/2003

Source: Information compiled by Department of Land Conservation, and Development, July 2018.

Note: The portion of the cities of Portland and Tualatin that are within Clackamas County are not included in this table. NP = Not Participating

¹⁴ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

¹⁵ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP, and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000, and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

Mitigation Activities

West Linn employs several mitigation strategies to reduce the city's risk to flood events, including mapping flood-prone areas by address. The city development code includes policies and regulations for flood prone areas including, Flood Management Areas (Chapter 27), and Willamette and Tualatin River Protection (Chapter 28). West Linn regularly inspects and maintains the stormwater facilities. Catch basins are routinely cleaned and inspected using the vacator truck, and a regular street sweeping program reduces the amount of debris and contaminants entering the stormwater system. The City maintains a [Surface Water Management Plan](#).

Tualatin Valley Fire & Rescue (TVF&R) conducts public safety education on the dangers of moving water and coordinates mitigation and preparedness information with local emergency management and other response agencies, as part of the Clackamas County Water Rescue Consortium. TVF&R's Water Rescue Team is housed in the Willamette fire station.

Please review Volume I, Section 2 for additional information on this hazard.

Landslide

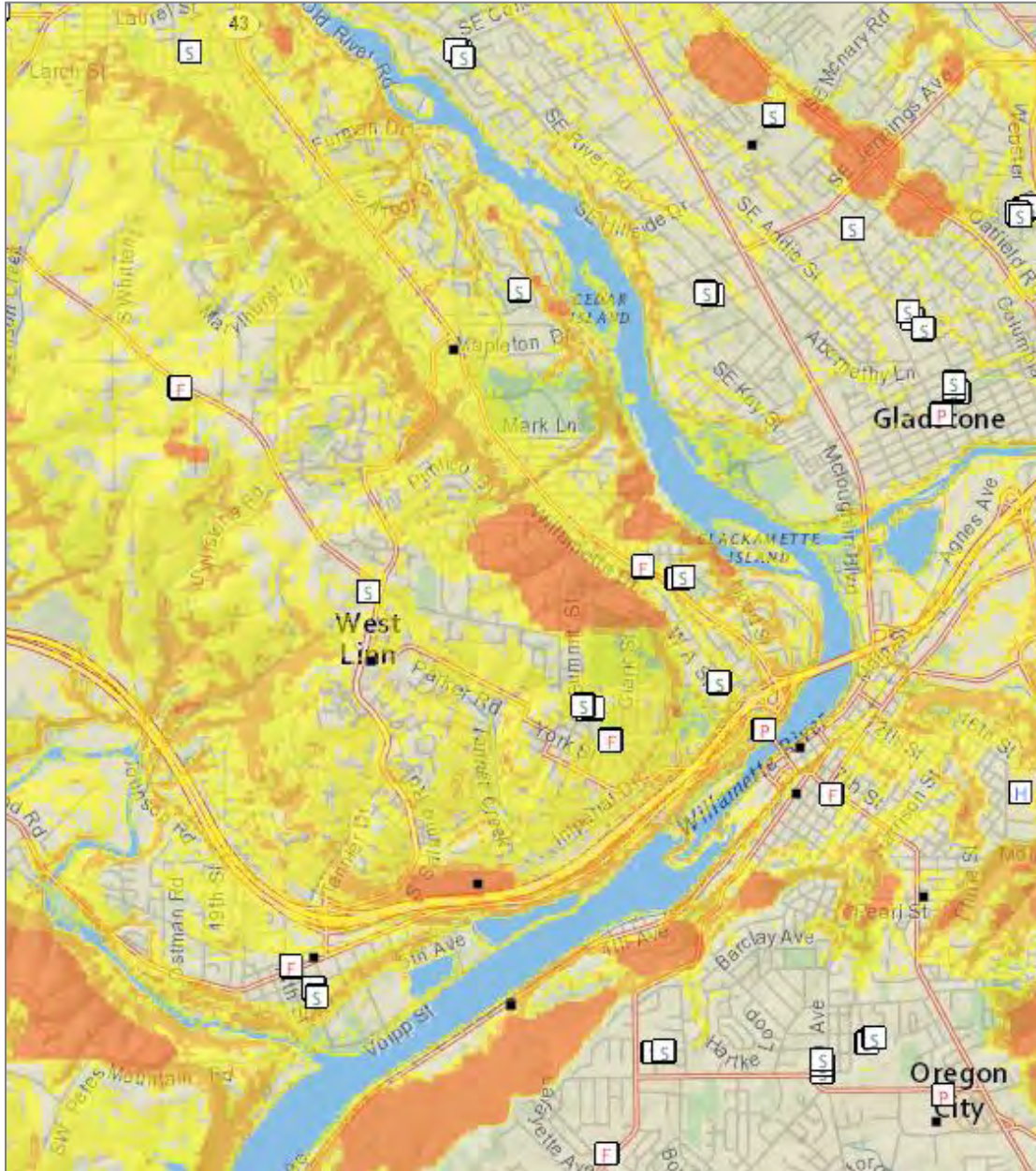
The HMAC determined that the City's probability for landslide is **low** and that their vulnerability to landslide is **moderate**. *The probability rating did not change, and the vulnerability rating decreased, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Although catastrophic landslides have not occurred in West Linn, steep slopes do exist along the banks of the Willamette River, and east of Willamette Drive coincident with the Bolton fault.

Landslide susceptibility exposure for West Linn is shown in Figure WL-5. Most of West Linn demonstrates a low to moderate landslide susceptibility exposure. Approximately 21% of West Linn has very high or high, and approximately 44% moderate, landslide susceptibility exposure.¹⁶ However, most of the areas that are identified to exhibit dangerous potential rapidly moving landslides are vacant and often preserved in wooded and dedicated open space. *Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard, and assets.*

¹⁶ DOGAMI. [Open-File Report, O-16-02](#), *Landslide Susceptibility Overview Map of Oregon* (2016)

Figure WL-5 Landslide Susceptibility Exposure



Low	Landsliding unlikely. Areas classified as Landslide Density = Low (less than 7%) and areas classified as Slopes Prone to Landsliding = Low.
Moderate	Landsliding possible. Areas classified as Landslide Density = Low to Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = Moderate OR areas classified as Landslide Density = Moderate (7%-17%) and areas classified as Slopes Prone to Landsliding = Low.
High	Landsliding likely. Areas classified as Landslide Density = High (greater than 17%) and areas classified as Slopes Prone to Landsliding = Low and Moderate OR areas classified as Landslide Density = Low and Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = High.
Very High	Existing landslides Landslide Density and Slopes Prone to Landsliding data were not considered in this category. Note: the quality of landslide inventory (existing landslides) mapping varies across the state.

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

Note: To view detail click the link above to access Oregon HazVu

Vulnerability Assessment

Due to insufficient data and resources, West Linn is currently unable to perform a quantitative risk assessment for this hazard. However, DOGAMI completed a statewide landslide susceptibility assessment in 2016 ([O-16-02](#)), general findings from that report are provided above and within Figure WL-5. Additionally, the City completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

About 50 percent of the City's population live in potential landside areas. Two critical facilities are exposed to the landslide hazard —Public Works Operations Building and Library (backup EOC). Three schools that are considered essential facilities are also exposed to the landslide hazard. In addition, critical infrastructure, economic centers, cultural or historic assets, environmental assets, and hazardous material sites are exposed to the landslide hazard. Hazardous materials sites would also suffer damage, resulting in threats to environmental and human health, while disrupting the availability of gasoline for vehicle transport and furthering economic loss because such sites are also sources of employment. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables WL-5 to WL-10.

This exposure means that large scale and simultaneous landslides triggered by an earthquake could substantially disrupt City operations buildings, fire stations and key pieces of infrastructure (bridges, sewage pump stations, water reservoirs) that would hinder the ability of the City to respond to emergency situations created by such an event.

As a result, it will be important for the City to pursue opportunities for retrofitting and mitigating important structures and infrastructure, such that said facilities can withstand and survive landslides, particularly simultaneous landslides generated by an earthquake. Business continuity planning shall also be an important factor, given the number of economic centers and employment facilities that are threatened by the landslide hazard.

Potential landslide-related impacts are adequately described within Volume I, Section 2, and include infrastructure damages, economic impacts (due to isolation, and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides, and debris flows can potentially occur during any winter, and thoroughfares beyond City limits are susceptible to obstruction as well.

The most common type of landslides are slides caused by erosion. Slides move in contact with the underlying surface, are generally slow moving, and can be deep. Rainfall-initiated landslides tend to be smaller; while earthquake induced landslides may be quite large. All soil types can be affected by natural landslide triggering conditions.

Mitigation Activities

West Linn works to mitigate future landslide hazards. The city development code includes several policies and regulations to protect slopes including the Water Resource Area Protection (Chapter 32), Stormwater Management (Chapter 33), and Building Height, Structures on Steep Slopes, Exceptions (Chapter 41).

Please review Volume I, Section 2 for additional information on this hazard.

Severe Weather

Severe weather can account for a variety of intense, and potentially damaging hazard events. These events include extreme heat, windstorms, and winter storms. The following section describes the unique probability, and vulnerability of each identified weather hazard.

Extreme Heat

The HMAC determined that the City's probability for extreme heat events is **moderate** and that their vulnerability is **moderate**. *The probability rating increased and the vulnerability rating did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the City as well.

A severe heat episode or "heat wave" occurs about every two to three years, and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days with temperatures greater than or equal to 90-degrees, or 100-degrees, Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit, and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The City of West Linn has not experienced any life-threatening consequences from the few historical extreme heat events, although changes in climate indicate that the area should expect to see more extreme heat events.

Please review Volume I, Section 2 for additional information on this hazard.

Windstorm

The HMAC determined that the City's probability for windstorm is **moderate** and that their vulnerability to windstorm is **high**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent, and probability of a potential event within the region. Because windstorms typically occur during winter months, they are sometimes accompanied by flooding and winter storms (ice, freezing rain, and very rarely, snow). Other severe weather events that may accompany windstorms, including thunderstorms, hail, lightning strikes, and tornadoes are generally negligible for West Linn.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation, and economic disruptions result as well.

Damage from high winds generally has resulted in downed utility lines, and trees usually limited to several localized areas. Electrical power can be out anywhere from a few hours to several days. Outdoor signs have also suffered damage. If the high winds are accompanied

by rain (which they often are), blowing leaves, and debris clog drainage-ways, which in turn may cause localized urban flooding.

Please review Volume I, Section 2 for additional information on this hazard.

Winter Storm (Snow/Ice)

The HMAC determined that the City's probability for winter storm is **moderate** and that their vulnerability to winter storm is **moderate**. *The probability rating did not change, and the vulnerability rating decreased, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent, and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the City typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

Most winter storms typically do not cause significant damage, they are frequent, and have the potential to impact economic activity. Road closures due to winter weather are an uncommon occurrence but can interrupt commuter and commercial traffic.

Vulnerability Assessment

Due to insufficient data and resources, West Linn is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. However, the City completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

The areas of the City that are often most at risk to severe storms are residential areas on steeper slopes, where roads may be icy and, thus, difficult to climb and descend. Road corridors leading to residential areas with fuller tree canopies are susceptible to downed tree limbs, and those areas that are above 500 feet in elevation are particularly vulnerable. However, some weather systems are characterized by a temperature inversion, where the valley floor is colder than the nearby hills. Consequently, severe storms affect the entire city. Several streets in areas of the City with steep grades are particularly hazardous during snow and ice events and are subject to closure during winter weather events including: Marylhurst Drive (from Hillcrest Drive to Lower Midhill Drive), Hidden Springs Road (from Bluegrass Way to Cottonwood Court), Pimlico Drive (from Palamino Way to Willamette Drive), Summit Street (from Rosemont Road to Skyline Drive), 12th Street (from Tualatin Avenue to Volpp Street), and Skye Parkway (from Troon Drive to Hillside Drive). The City's Snow and Ice Removal Plan is maintained by the Public Works Department and includes provisions to place equipment on designated principal routes throughout the City. For more information see the City's inclement weather information [webpage](#) and their [Winter Weather Route Map](#).

The major risk to property results from exposed utilities, especially power lines and water pipes that are damaged by wind, broken tree limbs and cold temperatures. Businesses also suffer economic losses when they must close as the result of the inclement weather and/or the loss of power, which, in turn, disrupts the local supply chain of goods and services. Periods of extended ice coverage hinder emergency response services and limit the mobility of residents, which could result in serious life safety issues.

Residents and businesses that are in areas that exhibit the severe storm hazard face some risk of damage from severe storms. Severe weather events are expected to impact nearly all City residents.

Two critical facilities are exposed to the severe weather hazards — City Hall and the library. Four schools and one adult community center that are considered essential facilities are also exposed to the severe weather hazards. In addition, critical infrastructure, economic centers, cultural or historic assets, environmental assets, and hazardous material sites are exposed to the severe weather hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Assets section and Tables WL-5 to WL-10.

The exposure of these facilities and infrastructure means that severe weather events could substantially disrupt the operations of City government buildings and fire stations, impairing key City functions, while hindering the ability of emergency response personnel to respond to emergency situations that are created by a severe storm event.

All these facilities depend upon utility lines, roads and bridges to operate and perform their respective important functions within the City. Exposed utility and power lines are particularly vulnerable to damage from severe winter storms by wind, ice and snow. More hardened infrastructure, like bridges and roads, can sustain a severe winter storm, but during the event, they are often hazardous to traverse because of icy, windy and snowy conditions.

Consequently, severe weather (wind or winter storm) could substantially disrupt numerous key resources and facilities within the City through impediments to the transportation system and damage to the power grid. Among other things, these transportation problems and power failures disrupt business operations and educational facilities, resulting in economic losses and halting educational opportunities.

Power to Hazardous material sites could also be disrupted. The sites themselves could be damaged or rendered inaccessible. In turn, these conditions could pose threats to the natural environment of the City and the health of its population, while disrupting the availability of gasoline for vehicle transport and furthering economic losses.

As a result, it will be important for the City to pursue opportunities for undergrounding utilities and retrofitting utility lines so that they may withstand cold weather conditions without freezing and bursting. Adhering to current building codes for weatherization of structures, as well as current engineering and fire codes that pertain to the steepness of new roads, are also key factors for the City to consider. Business continuity planning shall also be an important factor, given the number of economic centers and employment facilities that are threatened by the severe storm hazard.

Mitigation Activities

Mitigating severe weather can be difficult because storms affect all areas of the city, but West Linn has made progress to reduce the effects of storms. For over 25 years West Linn has been recognized as a Tree City USA. This distinction means West Linn has an active tree care ordinance and public education pieces, among others, which help to maintain a healthy urban forest. Most utilities are underground, and all new utilities are required to be undergrounded, but in case of power outages the city's critical facilities have back up power generation. West Linn also has a designated primary and secondary snow plow and sanding routes to help expedite snow removal.

Please review Volume I, Section 2 for additional information on this hazard.

Volcanic Event

The HMAC determined that the City's probability for a volcanic event is **low** and that their vulnerability to a volcanic event is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of volcanic hazards, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the western portion of the County is likely to affect West Linn as well. Several volcanoes are located near West Linn, the closest of which are Mount Hood, Mount Adams, Mount Saint Helens, Mount Rainier, and the Three Sisters.

Vulnerability Assessment

Due to insufficient data and resources, West Linn is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables WL-5 to WL-10.

Due to West Linn's relative distance from volcanoes, the city is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Depending on wind patterns and which volcano erupts, however, the city may experience ashfall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city could experience a heavier coating of ash.

Mitigation Activities

The existing volcano hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Wildfire

The HMAC determined that the City's probability for wildfire is **low**, and that their vulnerability to wildfire is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

The [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) was completed in May 2018. The CWPP is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard: <https://www.clackamas.us/dm/CWPP.html>. Information specific to West Linn is found in the following chapter: [Chapter 10.13: Tualatin Valley Fire and Rescue](#).

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions. Weather, and urbanization conditions are primarily at cause for the hazard level. West Linn has not experienced a catastrophic wildfire within City limits. However, wildfires have occurred, including a 20-acre three-alarm fire in 2006 along I-205 below the City's Willamette Reservoir and the Barrington Heights residential neighborhood.

Clackamas County has two major physiographic regions: the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern Clackamas County. The Willamette River Valley, which includes West Linn, is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range has a relatively small population and is characterized by heavily forested slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to its dense forest land. Human caused fires are responsible for most fires in Clackamas County.

The City is characterized by lush parks, neighborhoods surrounded by mature trees and under story vegetation and development intermingled with the natural landscape. Much of West Linn's undeveloped topography consists of wooded slopes 25 percent or steeper. These occluded woodlands range in size from 2 to 20 acres and make up a significant portion of the 373 acres of parks and open space managed by the City. Most of the woodlands are surrounded by urban development that are a concern in the case of a wildfire event. Figure WL-6 shows overall wildfire risk in West Linn. The forested hills within, and surrounding West Linn are interface areas including the following High Priority Communities at Risk (CARs): I-205 Corridor, Skyline Ridge, and Wilderness Park/Camassia Park; and the following Medium Priority CARs: Burnside Park and Maddax Woods, Hidden Springs, Mary S Young Park, White Oak Savannah, Wildwood Open Space, Wilson Creek Natural/Rosemont Area, and Wisteria.¹⁷

Most of the city has less severe (moderate or less) wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions.¹⁸ However, conditions vary widely and with local topography, fuels, and local weather (including wind)

¹⁷ Clackamas County Community Wildfire Protection Plan, *Tualatin Valley Fire and Rescue* (2018), Table 10.13-1.

¹⁸ [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts.

Figure WL-6 Overall Wildfire Risk



Source: [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

Vulnerability Assessment

Due to insufficient data and resources, West Linn is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. However, the City completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2018.

This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

Residences and businesses that border occluded woodlands with slopes greater than 25% are at the greatest risk of loss or damage from wildfires. A great deal of infrastructure is exposed to the wildfire hazard, including West Linn's primary water source. This could affect the efficiency of fire protection professionals during a large-scale wildfire. Vegetation along roadways is also highly dangerous, as negligent motorists provide ignition sources by tossing cigarette butts out car windows. Because schools are generally located near parks and scenic areas, they can be threatened by wildfires. Bolton Middle School, Cedaroak Park School, and West Linn High School and the Library (backup EOC) are particularly at risk. A variety of historic landmarks are also included in the high wildfire zones. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables WL-5 to WL-10.

The potential community impacts, and vulnerabilities described in Volume 1, Section 2 are generally accurate for the City as well. West Linn's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. The City will update the City's wildfire risk assessment if the fire plan presents better data during future updates (an action item is included to participate in future updates to the CWPP).

Property can be damaged or destroyed with one fire as structures, vegetation, and other flammables easily merge to become unpredictable, and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

Mitigation Activities

West Linn and Tualatin Valley Fire and Rescue (TVF&R) use several mitigation tools to reduce the city's risk to wildfires. TVF&R provides emergency fire suppression, medical response and rescue services to the City of West Linn under an intergovernmental agreement related to voter-approved annexation to the district. TVF&R staffs a four-person engine company at the Bolton fire station, a four-person engine company at the Rosemont fire station, and a three-person engine company at the Willamette fire station, 24 hours a day, seven days a week. Mutual aid agreements with neighboring jurisdictions are also in place. Water supply and storage capacity in West Linn conforms with recommended fire flow requirements.

The TVF&R provides outreach and education to the community on wildfire mitigation via news releases, posters, signage, website messages, safety exhibits at community events such as the West Linn Old Time Fair, and visits to schools, civic organizations and neighborhood associations.

Please review the [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) and Volume 1, Section 2 for additional information on this hazard.

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ATTACHMENT A: ACTION ITEM FORMS

ACTION ITEM FORMS

Multi-Hazard #1	48
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Severe Weather #2	59
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* - Priority Action Item

Note: The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity.

Summary of Action Changes

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

Previous NHMP Actions: Completed

Earthquake Action #3 (2012): “Update earthquake risk assessment using HAZUS and new mapping data” is considered complete. In 2018 the Department of Geology and Mineral Industries (DOGAMI) completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)),

Landslide Action #2 (2012): “Identify, prioritize and mitigate significant landslide threats to critical and essential facilities and infrastructure (e.g. reservoirs, pump stations) and neighborhoods” is considered complete. This was conducted by the City over the past five years. In 2016 the Department of Geology and Mineral Industries (DOGAMI) completed a landslide susceptibility analysis for the area. Information from that report has been incorporated into the City’s GIS capabilities ([O-16-02](#)).

Wildfire Action #2 (2012): “Review and assess adequacy of city’s water storage capacity for fighting wildfires, and develop strategy to address deficiencies, if any” is considered complete. The City performed the evaluation with TVF&R and found no issues. See WF #1 for ongoing activities related to this action.

See 2018 status identified in each action for activities that have been completed since the previous plan.

Previous NHMP Actions: Removed

Multi-Hazard Action #5 (2012): “Improve real-time hazard warning capability” was removed from the list since it was determined by the steering committee that there are no resources for this capability. Relevant components are integrated into MH #2.

Multi-Hazard Action #6 (2012): “Hire an Emergency Service Coordinator” was removed from the list since it was determined by the steering committee that there are no resources for this capability. Currently, the City of West Linn works contracts out to TVF&R to work with designated personnel who fill the Emergency Manager advisor role.

Earthquake Action #4 (2012): “Increase public awareness of earthquake threat and preparedness” was removed from the list of actions. This action is included within MH #2.

Earthquake Action #5 (2012): “Develop seismic analyses of key bridges that serve West Linn and develop strategies for retrofitting and replacement” was removed from the list of actions. This action was removed since vulnerable bridges are under ODOT or County control. ODOT has completed a seismic vulnerability assessment of key bridges. The County has an action to assess their bridges.

Note: Earthquake Action #1 was renamed as shown in this addendum, and the 2012 addendum did not include an Earthquake Action #2.

Flood Action #2 (2012): “Heighten public awareness of flood and storm water hazards and steps they can take to reduce flood threats” was removed from the list of actions. This action is included within MH #2.

Note: Flood Action #1 was renamed as shown in this addendum.

Landslide Action #1 (2012): “Increase public awareness of earthquake/landslide risks, development restrictions and mitigation measures” was removed from the list of actions. This action is included within MH #2.

Severe Weather Action #2 (2012): “Reduce risk of utility and communications outages” was removed from the list of actions. This action is considered a responsibility of the utility companies. The City requires undergrounding of utilities with most major developments and works with utilities to identify critical vulnerabilities.

Severe Weather Action #3 (2012): “Encourage public preparedness for winter storm events” was removed from the list of actions. This action is included within MH #2.

Wildfire Action #1 (2012): “Increase public awareness of wildfire threat and ways to reduce risk to life and property in the urban/woodland interface” was removed from the list of actions. This action is included within MH #2 and WF #1 (2019).

Wildfire Action #3 (2012): “Inventory alternative firefighting water sources and incorporate into Storm Water Master Plan” was removed from the list of actions. This action is a responsibility of TVF&R and is included within WF #1 (2019).

Wildfire Action #4 (2012): “Support and develop strategies to prohibit shake roofs on homes in WUI” was removed from the list of actions. This activity, while not prohibited by code, does not happen. See WF #1 for ongoing activities related to this action.

Wildfire Action #5 (2012): “Reduce fuel loading in woodland/urban interfaces, while balancing effects on wildlife and habitat” was removed from the list of actions. This activity is the responsibility of TVF&R and the parks department. Activities covered by this action occur as part of WF #1 (2019).

Note: 2012 Actions MH #1, MH #2, FL #3, FL #4, FL #5, and SW #4 were renumbered to 2019 Actions MH #3, MH #1, FL #2, FL #3, FL #4, and SW #2 respectively.

New NHMP Actions (2019):

- Multi-Hazard Action #5
- Wildfire Action #1

See action item forms below for detail.

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 NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the County, participating cities, and special districts. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. The City 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, the City 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 several 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 City 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.

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:	
Reduce threat to critical and essential public facilities.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
City Facilities Plan, Capital Improvement Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • <u>2018 Status</u>: Ongoing. City has updated city facilities plan. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Update Community Facilities Plan. • Update list of SDC-eligible projects to fund project to reduce threats from natural hazards to critical and essential public facilities. 			
Coordinating Organization:		Parks and Recreation	
Internal Partners:		External Partners:	
Public Works, Engineering			
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Parks SDC		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #2*

Proposed Action Item:		Alignment with Plan Goals:	
Enhance recognition of hazards, and appropriate mitigation and response activities through public education.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Conducting public outreach campaigns raises awareness about natural hazards and helps illustrate what residents and businesses can do to reduce the impact of a natural disaster on their properties, thereby reducing the impact of natural hazards on West Linn. • The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the county's actions to mitigate hazards. • 2018 Status: The City maintains a NHMP page: https://westlinnoregon.gov/planning/natural-hazards-mitigation-plan and provides outreach through the annual Emergency Management Fair; TVF&R has a page on preparedness: https://www.tvfr.com/182/Emergency-Preparedness 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Work with TVF&R, Clackamas County, West Linn/Wilsonville School District, and Community Planning Organizations and others (e.g., Red Cross) to create a steering committee for developing and distributing informational materials relating to natural hazards and on steps to reduce the threat of property damage and injury from hazards (including earthquakes) in the workplace and the home. • Enhance public understanding of natural hazards and appropriate mitigation/response activities through public education, including evacuation planning, provision of disaster supply kites, and dissemination of information via public service announcements on cable TV, the Internet and implementation of Code 4/telephone alert system. • Continue to host public safety fairs with an emphasis on hazard mitigation and preparedness. • Continue to present and emphasize the importance of the Map Your Neighborhood Program. 			
Coordinating Organization:		HMAC	
Internal Partners:		External Partners:	
Planning		Tualatin Valley Fire and Rescue, Public Safety Advisory Board	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High		

* - High Priority Action Item

Multi-Hazard #3

Proposed Action Item:		Alignment with Plan Goals:	
Identify, protect, and enhance natural resources in accordance with Goal 5.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • <u>2018 Status:</u> Ongoing. The NHMP has been used to help update the West Linn Comprehensive Plan. Goal 5 was adopted and in practice through the City's Development Code including the following chapters: <ul style="list-style-type: none"> • Chapter 24 (Planned Unit Development) and its density restrictions for areas with steep slopes; • Chapter 27 (Flood Management Areas) which uses the FEMA flood layers and the 1996 flood line; • Chapter 28 (Willamette and Tualatin River Protection) and its river habitat conservation area mapping; • Chapter 32 (Water Resource Area Protection) and its channel, creek, wetland, and significant riparian corridor inventories; and • Chapter 55 (Design Review) and its criterion related to not building in slumping or sliding areas. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Review inventory and recommendations to identify areas vulnerable to natural hazards that present opportunities for natural hazard mitigation activities, such as refining Comprehensive Plan maps, amending vegetation management policies, reducing fuel loading in occluded woodlands, etc. • Utilize inventory and recommendations to identify natural hazards in new development that can affect both existing and proposed development. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works, GIS		Clackamas County, METRO, Tualatin Valley Fire and Rescue	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #4

Proposed Action Item:		Alignment with Plan Goals:	
Maintain and incorporate available natural hazard data into City GIS databases and applications.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • <u>2018 Status</u>: Ongoing. The City maintains an enterprise GIS featuring multiple web mapping applications and distributed collaboration with external partners responsible for producing hazard data. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Develop strategies for acquiring the necessary staff, resources, software, etc. for undertaking the project of importing all GIS data into new GIS software. 			
Coordinating Organization:		Engineering - GIS	
Internal Partners:		External Partners:	
Public Works, Planning		DOGAMI, DLCD, FEMA	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #5

Proposed Action Item:		Alignment with Plan Goals:	
Integrate the goals and action items from the West Linn Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Development Code, Zoning Ordinance			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating natural hazards plans into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community. <u>2018 Status</u>: The City last amended their development code in 2018 (Ord. 1686). The City updated their comprehensive plan in July 2017 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Use the mitigation plan to help the City's Comprehensive Land Use Plan meet 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; Use zoning codes to regulate development in hazard-prone areas; Integrate the city's mitigation actions into the current emergency operations plan and capital improvement plans (where appropriate); Partner with other organizations and agencies with similar goals to promote building codes that are more disaster resistant at the state level; Use citizen input for the creation of appropriate ordinances; and Use the natural hazard mitigation planning to learn how to better integrate the NHMP into existing documents and programs. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works, City Council		Department of Land Conservation and Development, Department of Geology and Mineral Industries, Oregon Department of Transportation, Department of Environmental Quality	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, DLCD Technical Assistance Grant		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New action item		
Priority:	Medium		

Earthquake #1*

Proposed Action Item:		Alignment with Plan Goals:	
Conduct seismic evaluations on identified critical and essential facilities and infrastructure and implement appropriate structural and non-structural mitigation strategies.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Community Facilities Plan, Water Master Plan, Sanitary Sewer Master Plan, Surface Water Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for earthquakes to cause damage can assist a community in mitigating its overall risk to earthquakes. Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. Refer to risk assessment, and DOGAMI's rapid visual assessment scores <u>2018 Status:</u> Ongoing. A new police station has been built, Tualatin Valley Fire and Rescue (TVF&R) has completely rebuilt three fire stations in West Linn. Station 58 (Bolton) opened in August 2010; Station 59 (Willamette, which houses TVF&R's Water Rescue Team) opened in March 2010, and Station 55 (Rosemont) opened in August 2018. All stations were built to current seismic codes for critical facilities and incorporated additional measures such as extensive non-structural mitigation and larger emergency generators. Pump station and water facilities have been updated. Sunset Primary was rebuilt in 2017 per a 2014 bond. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Obtain funding to perform seismic evaluations; Conduct seismic evaluations on identified community assets (including shelters) for implementing appropriate structural and non-structural mitigation strategies; Prioritize seismic upgrades based on criticality of need and population served; Seismically retrofit critical government facilities to guarantee continuous operation during and after a natural disaster; Partner with appropriate organizations to implement seismic upgrades; and Create damage assessment procedures. 			
Coordinating Organization:		Public Works - Engineering	
Internal Partners:		External Partners:	
Planning		DOGAMI, School District, Tualatin Valley Fire and Rescue	
Potential Funding Sources:		Estimated cost:	Potential Funding Sources:
General Fund, Seismic Rehabilitation Grant Program, Hazard Mitigation Assistance Grants, Utility Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High		

* - High Priority Action Item

Flood #1

Proposed Action Item:		Alignment with Plan Goals:	
Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Flood Ordinance; Zoning Code, FEMA FIRMs, Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The National Flood Insurance Program provides communities with federally backed flood insurance to homeowners, renters, and business owners, if communities develop and enforce adequate floodplain management ordinances. The benefits of adopting NFIP standards for communities are a reduced level of flood damage in the community and stronger buildings that can withstand floods. The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will help reduce the level of flood damage to new and existing buildings in communities while providing homeowners, renters and business owners additional flood insurance protection. <u>2018 Status</u>: The city continues to comply with the NFIP via Chapter 27 of its Development Code. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Recommend revisions to requirements for development within the floodplain, where appropriate. Continue to develop strategies to improve the city's current rating in the National Flood Insurance Program's Community Rating System; Community Assistance Visits (CAV) are scheduled visits to communities participating in the NFIP for the purpose of: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. Actively participate with DLCD and FEMA during Community Assistance Visits. Assess the floodplain ordinances to ensure they reflect current flood hazards and situations and meet NFIP requirements. Mitigate areas that are prone to flooding and/or have the potential to flood. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
GIS, Public Works		Department of Land Conservation and Development; Association of State Floodplain Managers	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Flood #2*

Proposed Action Item:		Alignment with Plan Goals:	
Implement Surface Water Master Plan capital improvement projects that can reduce flood threats.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Surface Water Master Plan, Sanitary Sewer Master Plan, Flood Ordinance; Zoning Code, FEMA FIRMs, Comprehensive Plan, Capital Improvement Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The Surface Water Master Plan and Sewer Master Plan developed Capital Improvement Projects to address deficiencies in the stormwater and sewer systems; • The Surface Water Management Master Plan promotes proper watershed management; • Stormwater management is a key element in maintaining and enhancing a community's livability. There is a direct link between stormwater and a community's surface and ground waters. Protecting these waters is vital for a great number of uses, including fish and wildlife habitat, recreation, and drinking water. • <u>2018 Status:</u> This is an ongoing event, with the Public Works department working with both capital funding and materials and services funding to complete a variety of projects every year. Updated Surface Water Master Plan anticipated to be complete in 2019. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Revise SDC-eligible capital projects list and adopt new storm SDC as appropriate. • Initiate capital projects that can reduce flood threats. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Planning		Clackamas County Water Environment Services, METRO, Department of Environmental Quality, Department of Land Conservation and Development, Department of State Lands	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Environmental Fund		Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	High		

* - High Priority Action Item

Flood #3*

Proposed Action Item:		Alignment with Plan Goals:	
Address vulnerabilities of sewer pump stations to potential flood events.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Sanitary Sewer Master Plan, Flood Ordinance; Zoning Code, FEMA FIRMs, Comprehensive Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The Sewer Master Plan developed Capital Improvement Projects to address deficiencies in the stormwater and sewer systems; • The Sewer Master Plan promotes proper waste management; and • Sewer management is a key element in maintaining and enhancing a community's livability. There is a direct link between a sewer and a community's surface and ground waters. Protecting these waters is vital for a great number of uses, including fish and wildlife habitat, recreation, and drinking water. • <u>2018 Status:</u> This is an ongoing event. Updated Sanitary Sewer Master Plan anticipated to be complete in 2019. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Explore methods of flood-proofing key components of pump stations, elevating components that can be elevated, and elevating hazardous materials if present. • Develop strategies for pump stations to recover and resume operations as quickly as possible from flood event. • Complete pump station condition assessment. 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Planning		Clackamas County Water Environment Services, Department of Environmental Quality	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Environmental Fund, System Development Charge Funds		Moderate	<input checked="" type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	High		

* - High Priority Action Item

Flood #4

Proposed Action Item:		Alignment with Plan Goals:	
Acquire flood-prone and repetitive loss properties and preserve as open space.		Protect Life and Property; Enhance Natural Systems; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Flood Ordinance; Zoning Code, FEMA FIRMs, Comprehensive Plan, Parks and Recreation Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • There is currently one repetitive loss property within the City. • <u>2018 Status</u>: Ongoing. The county purchased the Mill Site. The West Linn Parks and Recreation Department purchased the Field Bridge and turned it into a park. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Identify funding sources, including bond revenue, grants and cooperative agreements with other agencies and organizations to acquire properties within the flood plain. • Implement mitigation strategies identified in the City's update of its Goal 5 analysis — a comprehensive inventory of natural, historic and cultural resources. • Explore strategies for acquisition of identified flood-prone properties along Tualatin River to complete Greenway program, keeping in mind that high-value riverfront properties can be difficult to acquire through FEMA grant programs. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works, GIS		Department of Land Conservation and Development; Association of State Floodplain Managers, Federal Emergency Management Agency, Oregon Military Department's Office of Emergency Management	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Capital Funds, FEMA HMA		Moderate to High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Severe Weather #1

Proposed Action Item:		Alignment with Plan Goals:	
Reduce risk of erosion and soil destabilization by implementing the strategies outlined in the Surface Water Management Plan.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure[201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to cause erosion can assist a community in mitigating its overall risk to wind and winter storms. <u>2018 Status</u>: Ongoing. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Review vegetation management policies and identify possible policy revisions to reduce likelihood of erosion and soil destabilization. Utilize updated Goal 5 analysis to identify, control and provide planning strategies for development of areas at risk to erosion and soil destabilization. Implement erosion control and soil destabilization strategies 			
Coordinating Organization:		Public Works	
Internal Partners:		External Partners:	
Planning		Clackamas County Water Environment Services, METRO, Department of Environmental Quality, Department of Land Conservation and Development, Department of State Lands	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Severe Weather #2

Proposed Action Item:		Alignment with Plan Goals:	
Maintain a tree hazard program for preventing future hazards, while improving long-term health and care of urban forest.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Tree Ordinance, Tree Technical Manual			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure[201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to cause power outages and other hazards can assist a community in mitigating its overall risk to wind and winter storms. <u>2018 Status</u>: Ongoing. The City uses an arborist for review of all major developments. West Linn has been a Tree City USA participating community for the past 25 years. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Re-evaluate tree preservation and tree-cutting ordinances to ensure consistency and effectiveness of programs. Assess pitfalls of selectively preserving older, taller individual trees that become threats once their surrounding forested environment is removed. Consider preserving younger trees. Consider obtaining services of professional arborist to assist in implementing hazard tree program and associated modifications to ordinances. When implementing tree removal program, exercise sensitivity toward public values of tree preservation and outcry over tree removal. 			
Coordinating Organization:		Parks and Recreation	
Internal Partners:		External Partners:	
Planning, Building, Public Works		PGE, private landowners	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds, General Fund		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

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; Enhance Natural Systems; Augment Emergency Services; 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:			
The wildfire mitigation action items provide direction on specific activities that organizations and residents in West Linn can take to reduce wildfire hazards. 2018 Status: Ongoing. CCWPP updated in 2018.			
Ideas for Implementation: CCWPP Identified Focus Areas and Priority Actions			
Wildfire Risk Assessment (Ch. 4):			
<ol style="list-style-type: none"> 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):			
<ol style="list-style-type: none"> 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):			
<ol style="list-style-type: none"> 1. Develop and FDB Communications Works Group. 2. Conduct a Conflagration Exercise. 			
Education and Community Outreach (Ch. 7):			
<ol style="list-style-type: none"> 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):			
<ul style="list-style-type: none"> • Identify a DTD representative for the WFEP. • Improve coordination with Rural Fire Agencies. • Integrate WU into Plan Map and include a public outreach strategy. 			
Coordinating Organization:		Tualatin Valley Fire and Rescue	
Internal Partners:		External Partners:	
Public Works, Parks and Recreation, Building, Planning		Clackamas Fire Defense Board, ODF, U.S. Forest Service, public land management agencies	
Potential Funding Sources:		Estimated cost:	Timeline:
ODF, operating budgets		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	High (CCWPP identified priority actions listed above)		

* - High Priority Action Item

ATTACHMENT B: PUBLIC INVOLVEMENT SUMMARY

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

To provide the public information regarding the draft NHMP addendum, and provide an opportunity for comment, an announcement (see text below) was announced on the city's [website](#) and an email contact was provided for public comment.

During the public review period there were no comments provided.

Press Release



The screenshot shows a web page with a light beige background. At the top left, there is a small vertical logo for 'West Linn'. The main heading is 'For Review and Public Comment - Natural Hazards Mitigation Plan'. Below the heading is a paragraph of text: 'The City's Natural Hazards Mitigation Plan is in the process of being updated. The plan is attached below and available for public comment until 5:00pm on March 8, 2019. Please submit all comments in writing to Amy Pepper, P.E. at apecper@westlinnoregon.gov'. A horizontal dotted line separates this text from a section titled 'Supporting Documents'. Under this section, there is a single document listed: 'West Linn Natural Hazards Mitigation Plan_update (2 MB)' with a small document icon to its left.

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City of Wilsonville Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan



March 2019

Volume II: Wilsonville Addendum



Prepared for:

City of Wilsonville

Prepared by:

**University of Oregon
Institute for Policy Research and Engagement
Oregon Partnership for Disaster Resilience**

Planning grant funding provided by:



FEMA

Federal Emergency Management Agency (FEMA)
Pre-Disaster Mitigation Program
Grant: EMS-2017-PC-0005
Sub-grant Application Reference: PDMC-PL-10-OR-2016-001, and

Additional Support Provided by:



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FEMA

August 6, 2019

The Honorable Jim Bernard
Chair, Clackamas County Commissioners
2020 Kaen Road Suite A
Oregon City, Oregon 97045

Dear Chairman Bernard:

On April 12, 2019, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan* as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance (HMA) grants through April 11, 2024, through your state.

Clackamas County	City of Estacada	City of Lake Oswego
City of West Linn	City of Wilsonville	

The updated list of approved jurisdictions includes the cities of West Linn and Wilsonville which recently adopted the *Clackamas County Multi-Jurisdictional Hazard Mitigation Plan*. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Joseph Murray, State Hazard Mitigation Planner with Oregon Military Department, Office of Emergency Management, at 503-378-3929, who coordinates and administers these efforts for local entities.

Sincerely,

Mark Carey, Director
Mitigation Division

Enclosure

JG:vl

RESOLUTION NO. 2755

A RESOLUTION OF THE CITY OF WILSONVILLE FOR ADOPTION OF THE CITY OF WILSONVILLE ADDENDUM TO THE CLACKAMAS COUNTY MULTI-JURISDICTIONAL NATURAL HAZARD MITIGATION PLAN.

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

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

WHEREAS, an adopted Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs and with approval of this NHMP the City will be eligible to apply for the Robert R. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through April 11, 2024; and

WHEREAS, the City of Wilsonville adopted the *City of Wilsonville addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan* to reflect new information contained therein through the creation of a new appendix (Appendix C) via Resolution 2418 on May 20, 2013; and

WHEREAS, Clackamas County has subsequently completed an update to the *Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan* of which the City of Wilsonville is party to; and

WHEREAS, the City of Wilsonville needs to update and replaced its addendum to the *Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan*; and

WHEREAS, This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation and Volume III (Appendices) which provide additional information; and

WHEREAS, the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials have approved the *Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan* and pre-approved the *City of Wilsonville Addendum to the Clackamas County Natural Hazard Mitigation Plan* on April 12, 2019; and

WHEREAS, final approval of the City's Addendum by FEMA is contingent upon this official adoption by the City.

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

1. The City adopts *City of Wilsonville Addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan, (2019 Update)*.
2. The City will submit this Adoption Resolution to the Oregon Office of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the *City of Wilsonville Addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan*.
3. This resolution is effective upon adoption.

ADOPTED by the Wilsonville City Council at a regular meeting there of this 17th day of June 2019, and filed with the Wilsonville City Recorder this date.


Tim Knapp, Mayor

ATTEST:


Kimberly Veliz, City Recorder

SUMMARY OF VOTES:

Mayor Knapp	Yes
Council President Akervall	Yes
Councilor Stevens	Yes
Councilor Lehan	Yes
Councilor West	Yes

Exhibit:

- A. City of Wilsonville Addendum to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan

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Purpose

This is an update of the Wilsonville addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation and Volume III (Appendices) which provide additional information. This addendum meets the following requirements:

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

Updates to Wilsonville's addendum are further discussed throughout the NHMP and within Volume III, Appendix B, which provides an overview of alterations to the document that took place during the update process.

Wilsonville adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on **June 17, 2019**. FEMA Region X approved the Clackamas County NHMP on **April 12, 2019** and the City's addendum on **August 6, 2019**. With approval of this NHMP the City is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **April 11, 2024**.

Mitigation Plan Mission

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

The City concurs with the mission statement developed during the Clackamas County planning process (Volume I, Section 3):

Promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

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

The City concurs with the goals developed during the Clackamas County planning process (Volume I, Section 3). All NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Below is a list of the NHMP goals:

GOAL #1: PROTECT LIFE AND PROPERTY

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

GOAL #2: ENHANCE NATURAL SYSTEMS

- Balance watershed planning, natural resource management, and land use planning with natural hazards mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

GOAL #3: AUGMENT EMERGENCY SERVICES

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, and business, and industry.
- Coordinate and integrate natural hazards mitigation activities, where appropriate, with emergency operations plans and procedures.

GOAL #4: ENCOURAGE PARTNERSHIPS FOR IMPLEMENTATION

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

GOAL #5: PROMOTE PUBLIC AWARENESS

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

NHMP Process, Participation and Adoption

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

Wilsonville first developed an addendum to Clackamas County's Natural Hazards Mitigation Plan in 2009. This plan was updated in 2013 and in 2018. The last update of the Wilsonville addendum to the Clackamas County NHMP was approved by FEMA on April 8, 2013.

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

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research, and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM), Clackamas County, and Wilsonville to update their NHMP. This project is funded through the Federal Emergency Management Agency's (FEMA) Fiscal-Year 2016 (FY16) Pre-Disaster Mitigation (PDM) Competitive Grant Program EMS-2017-PC-0005 (PDMC-PL-10-OR-2016-001). Members of the Wilsonville NHMP Hazard Mitigation Advisory Committee (HMAC) also participated in the County NHMP update process (Volume III, Appendix B).

The Clackamas County NHMP, and Wilsonville addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. The Wilsonville HMAC guided the process of developing the NHMP.

Convener

The Wilsonville Director of Public Works serves as the NHMP addendum convener. The convener of the NHMP will take the lead in implementing, maintaining and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the City of Wilsonville HMAC met formally and informally, to discuss updates to their addendum (Volume III, Appendix B). The HMAC reviewed and revised the City's addendum, with focus on the NHMP's risk assessment and mitigation strategy (action items).

This addendum reflects decisions made at the designated meetings and during subsequent work and communication with Clackamas County Resilience Coordinator, and the OPDR. The changes are highlighted with more detail throughout this document and within Volume III, Appendix B. Other documented changes include a revision of the City's risk assessment and hazard identification sections, NHMP mission and goals, action items, and community profile.

The Wilsonville HMAC was comprised of the following representatives:

- Convener, Delora Kerber, Director of Public Works
- Dan Carlson, Building Official

- Dan Pauly, Senior Planner
- Kerry Rappold, Natural Resource Program Manager
- Jeff Rubin, Tualatin Valley Fire & Rescue, Emergency Manager
- Dan Stark, GIS Manager
- Tim Woodley, West Linn-Wilsonville School District, Director of Operations

Public participation was achieved with the establishment of the HMAC, which was comprised of City officials representing different departments and sectors and members of the public. The HMAC served as the local review body for the NHMP's development. Community members were provided an opportunity for comment via the NHMP review process, and through a survey administered by Clackamas County (Volume III, Appendix G).

NHMP Implementation and Maintenance

The City Council will be responsible for adopting the Wilsonville addendum to the Clackamas County NHMP. This addendum designates a HMAC and a convener to oversee the development and implementation of action items. Because the City addendum is part of the County's multi-jurisdictional NHMP, the City will look for opportunities to partner with the County. The City's HMAC will convene after re-adoption of the Wilsonville NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The City's Director of Public Works will serve as the convener and will be responsible for assembling the HMAC. The HMAC will be responsible for:

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating and training new HMAC members on the NHMP and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement; and
- Documenting successes and lessons learned during the year.

The convener will also remain active in the County's implementation and maintenance process (Volume I, Section 4).

The City will utilize the same action item prioritization process as the County (Volume I, Section 4).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, and Building Codes, as well as the [Clackamas County NHMP](#), and the [State of Oregon NHMP](#).

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the city. Plans and policies already in existence have support from residents, businesses and policy makers. Where possible, Wilsonville will implement the NHMP's recommended actions through existing plans and policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Future development without proper planning may result in worsening problems associated with natural hazards. Metro, the regional government for Clackamas, Multnomah, and Washington counties, determines many land use laws for the tri-county region and sets the urban growth boundary. The entire Portland Metro area is subject to tremendous growth pressures due to its desirable location and the restrictions on urban sprawl placed by urban growth boundary requirements.

Wilsonville's acknowledged comprehensive plan is the City of Wilsonville Comprehensive Plan (2000, updated August 2013). The Oregon Land Conservation and Development Commission first acknowledged the plan in 1983. The City implements the plan through the Development Code.

Wilsonville currently has the following plans, regulations, and projects that relate to natural hazard mitigation. For a complete list visit the City's [website](#):

- [Comprehensive Plan](#)
- [Development Code](#)
 - [Section 4.139 The Significant Resource Overlay Zone \(SROZ\)](#)
 - [Section 4.171 Protection of Natural Features and Other Resources](#)
 - [Section 4.172 Floodplain Regulations](#)
 - [Section 4.176 Landscaping, Screening, and Buffering](#)
 - [Section 4.177 Street Improvement Standards](#)
 - [Section 4.320 Underground Utilities Requirements](#)
 - [Section 4.500 Willamette River Greenway](#)
 - [Section 4.600 Tree Preservation and Protection](#)
- [Capital Improvement Projects](#)
- [Coffee Creek Master Plan](#)
- [Development Process Guidelines](#)
 - [Natural Resources Process Guidelines](#)
- [Emergency Operations Plan](#)
- [Natural Resources Annexation Policy](#)
- [Transit System Master Plan](#)
- [Transportation Systems Plan](#)
 - [Portland Metro 2014 Regional Transportation Plan](#)
- [Stormwater Master Plan](#)
- [Water System Master Plan](#)

Other plans:

- [Clackamas County Community Wildfire Protection Plan](#)
 - [Tualatin Valley Fire and Rescue](#)

Government Structure

The City of Wilsonville has a council-manager form of government. The City Council consists of five members; a mayor and four councilors. The mayor presides over Council meetings. The mayor and City Council members are elected to four-year terms of office through a general election. The City Council is responsible for identifying problems and needs within the community and then addressing those problems through community goals and objectives.

Community Development is responsible for residential building and planning and monitoring future development. They make recommendations to City Council for changes to the Planning and Land Development Ordinance, Historic District Zones, the Comprehensive Plan and the Zoning Map.

The City of Wilsonville provides a variety of services to promote the safety and welfare of its residents. Public services that support the demands of a growing community include Community Development, Community Services, GIS, Public Safety, and Public Works.

Community Development: Includes Building, Planning, Engineering, Natural Resources, and Urban Renewal. The Department manages development projects within the city and produces the strategic vision of the city.

Community Services: Responsible for maintaining 12 public parks totaling 235 acres and the preservation of opens spaces, trees, creeks, wetlands, and habitat areas.

GIS: Provides mapping and data analysis services to City departments.

Public Safety: Consists of the Municipal Court, Wilsonville Police and Tualatin Valley Fire and Rescue who provide services to enhance the health and safety of Wilsonville residents.

Public Works: Responsible for maintaining streets, streetlights, water, sewer, and stormwater systems and manages the Willamette River Water Treatment and Wastewater Treatment Plants. Public works is also responsible for emergency management and response.

Continued Public Participation

An open public involvement process is essential to the development of an effective NHMP. To develop a comprehensive approach to reducing the effects of natural disasters, the planning process shall include opportunity for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the NHMP during review.¹ Keeping the public informed of the City's efforts to reduce its risk to future natural hazard events is important for successful NHMP implementation and maintenance. The City is committed to involving the public in the NHMP review and update process (Volume I, Section 4). The City posted the plan update for public comment before FEMA approval, and after approval will maintain the plan on the City's website: <https://www.ci.wilsonville.or.us/publicworks/page/emergency-management>.

¹ Code of Federal Regulations, Chapter 44. Section 201.6, subsection (b). 2015

NHMP Maintenance

The Clackamas County NHMP and City addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During the County NHMP update process, the City will also review and update its addendum (Volume I, Section 4). The convener will be responsible for convening the HMAC to address the questions outlined below.

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

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

Mitigation Strategy

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

The City's mitigation strategy (action items) were first developed during the 2009 NHMP planning process and revised during subsequent NHMP updates. During these processes, the HMAC assessed the City's risk, identified potential issues, and developed a mitigation strategy (action items).

During the 2018 update process the City re-evaluated their mitigation strategy (action items). During this process action items were updated, noting what accomplishments had been made and whether the actions were still relevant; any new action items were identified at this time (see Volume III, Appendix B for more information on changes to action items).

Priority Action Items

Table WA-1 presents a list of mitigation actions. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity. High priority actions are shown in **bold** text with grey highlight. The City will focus their attention, and resource availability, upon these achievable, high leverage, activities over the next five-years. Although this methodology provides a guide for the HMAC in terms of implementation, the HMAC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the

committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for detailed information for each action. Full text of the plan goals referenced in Table WA-1 is located on page WA-2.

Table WA-I Wilsonville Action Items

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
MH #1	Develop public education programs to inform the public about methods for mitigating the impacts of natural hazards.	Planning	Tualatin Valley Fire & Rescue, Hazard Mitigation Advisory Committee	Ongoing	✓		✓	✓	✓
MH #2	Integrate the goals and action items from the Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	Planning	Public Works, Building, Planning Commission, Natural Resources	Ongoing	✓	✓	✓	✓	✓
MH #3	Continue vegetation management throughout the city.	Natural Resources	Planning, Public Works, Parks	Ongoing			✓		✓
EQ #1	Conduct seismic evaluations of the Community Center and other critical and essential facilities and implement appropriate structural mitigation strategies.	Community Development, Public Works	Building, Engineering	Long Term	✓	✓	✓		
EQ #2	Perform non-structural mitigation on public facilities to improve life safety standards.	Human Resources	Building, Engineering	Ongoing	✓		✓		✓
EQ #3	Seismically retrofit Willamette Water Treatment Plant and Intake Facility	Engineering	Building	Long Term	✓		✓		

Natural Hazard Action ID	Action Item	Coordinating Organization (Lead)	Internal Partners	Timing	Plan Goals Addressed				
					Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
EQ #4	Complete the French Prairie Bridge, including accommodation of emergency vehicle passage.	Engineering	Building	Long Term	✓		✓	✓	
FL #1	Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.	Community Development	GIS, Planning	Ongoing	✓			✓	
FL #2	Coordinate with the Oregon Department of Transportation (ODOT) to increase the capacity of culverts.	Community Development	Engineering, Public Works	Ongoing	✓			✓	
FL #3	Implement the recommendations found in the Stormwater Master Plan.	Natural Resources	Planning, Public Works	Ongoing	✓	✓	✓	✓	
SW #1	Reduce negative effects from severe windstorm and severe winter storm events.	Community Development	Public Works	Ongoing	✓	✓	✓	✓	✓
WF #1	Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan.	TVF&R	Public Works, Parks and Recreation, Natural Resources	Ongoing	✓	✓	✓	✓	✓

Source: City of Wilsonville HMAc, 2018

Note: Full text of the plan goals referenced in this table is located on page WA-2.

Risk Assessment

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

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

The local level rationale for the identified mitigation strategies (action items) is presented herein and within Volume I, Section 3 and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure WA-1. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure WA-1 Understanding Risk



Hazard Analysis

The Wilsonville HMA developed their hazard vulnerability assessment (HVA), using their previous HVA and the County’s HVA as a reference. Changes from their previous HVA and the County’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Wilsonville, which are discussed throughout this addendum.

Table WA-2 shows the HVA matrix for Wilsonville listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response and recovery. The method provides the jurisdiction with a sense of hazard priorities but does not predict the occurrence of a hazard.

Two catastrophic hazards (Cascadia Subduction Zone earthquake and Crustal earthquake) and one chronic hazard (winter storm) rank as the top hazard threats to the City (Top Tier). Wildfire, extreme heat, drought, and windstorm comprise the next highest ranked hazards (Middle Tier), while flood, volcanic event, and landslide hazards comprise the lowest ranked hazards (Bottom Tier).

Table WA-2 Hazard Analysis Matrix – Wilsonville

Hazard	Maximum				Total Threat Score	Hazard Rank	Hazard Tiers
	History	Vulnerability	Threat	Probability			
Earthquake - Cascadia	4	45	100	28	177	#1	Top Tier
Earthquake - Crustal	6	50	100	21	177	#1	
Winter Storm	16	30	70	49	165	#3	
Wildfire	12	25	70	35	142	#4	Middle Tier
Extreme Heat	16	20	40	56	132	#5	
Drought	10	15	50	56	131	#6	
Windstorm	14	15	50	42	121	#7	
Flood	8	20	30	42	100	#8	Bottom Tier
Volcanic Event	2	15	50	14	81	#9	
Landslide	6	15	20	21	62	#10	

Source: Wilsonville HMAC, 2018.

Table WA-3 categorizes the probability and vulnerability scores from the hazard analysis for the City and compares the results to the assessment completed by the Clackamas County HMAC. Variations between the City and County are noted in **bold** text within the city ratings.

Table WA-3 Probability and Vulnerability Comparison

Hazard	Wilsonville		Clackamas County	
	Probability	Vulnerability	Probability	Vulnerability
Drought	High	Low	High	Low
Earthquake - Cascadia	Moderate	High	Moderate	High
Earthquake - Crustal	Low	High	Low	High
Extreme Heat	High	Moderate	Low	High
Flood	Moderate	Moderate	High	Moderate
Landslide	Low	Low	High	Low
Volcanic Event	Low	Low	Low	Moderate
Wildfire	Moderate	Moderate	High	Moderate
Windstorm	Moderate	Low	Moderate	Low
Winter Storm	Moderate	Moderate	Moderate	Moderate

Source: Wilsonville and Clackamas County HMAC, 2018.

Community Characteristics

Table WA-4 and the following section provides information on City specific demographics and assets. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation. Considering the City specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation. Between 2010 and 2016 the City grew by 4,215 people (22%; as of 2018 the population was 25,250) and median household income increased by about 2%.² Between 2018 and 2040 the population is forecast to grow by 7% to 27,046.³ In 2016, the city annexed 10.6 acres along SW Garden Acres Rd into the City. New development has complied with the standards of the [Oregon Building Code](#) and the city's development code.

Transportation/Infrastructure

Located on Interstate 5, transportation has played a major role in shaping Wilsonville's community and economy. Wilsonville's Commercial areas are located near primary routes and residential development are nearby. Interstate 5 has two exits in Wilsonville, one in the North where Boones Ferry Road becomes Ellingsen Road, and one in the South at Wilsonville Road. The Kinsman Road expansion project was completed in 2018 and included expansion of sewer and drinking water pipelines.

Motor vehicles represent the dominant mode of travel through and within Wilsonville. The City's public transit is provided by the South Metro Area Regional Transit (SMART) system, which operates seven routes within Wilsonville and connects with Portland's TriMet transit system at the Commerce Circle Station. SMART also connects with both Canby's and Salem's public transit systems. The City of Wilsonville also hosts freight rail services provided by the Portland and Western Railroad. There are no port services available where the Willamette River crosses through Wilsonville, but there is a recreational marina located across the river from Boones Ferry Park.

Economy

Wilsonville's proximity to major transportation routes and access to rail has made it a desirable place for commercial and industrial development. The city's residents work in a variety of industries, with "professional and related occupations" (24% of workforce) and "management, business, and financial operations occupations" (18%) accounting for the top two occupations.⁴

Wilsonville has an economic advantage due to its location at the north end of the Willamette Valley and its proximity to Portland. Wilsonville's industrial sites are made accessible through I-5 and I-205. High-tech companies in advanced imaging and design as well as distribution centers and manufacturers have located to Wilsonville. These companies included APCON, Inc., Coca-Cola Bottling of Oregon, Coherent, Crimson Trace Corp., FOODesign Machinery & Systems, Inc., FLIR Systems, InFocus, Kinetics, Mentor Graphics, OrePac, Rite Aid Distribution Center, Sysco Food Services, and Xerox Corporation.

² Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018 and Social Explorer, Table T57, U.S. Census Bureau, 2012-2016 and 2006-2010 American Community Survey Estimates.

³ Metro, 2040 Distributed Forecast (2016).

⁴ Social Explorer, Table 50, U.S. Census Bureau, 2012-2016 American Community Survey Estimates

Table WA-4 Community Characteristics

Population Characteristics		
2010 Population	19,525	
2016 Population [2018 Population]	23,740	[25,250]
2040 Forecasted Population*	27,046	
Race (non-Hispanic) and Ethnicity (Hispanic)		
White	75%	
Black/ African American	1%	
American Indian and Alaska Native	1%	
Asian	4%	
Native Hawaiian and Other Pacific Islander	1%	
Some Other Race	0%	
Two or More Races	4%	
Hispanic or Latino	14%	
Limited or No English Spoken	5%	
Vulnerable Age Groups		
Less than 15 Years	3,927	18%
65 Years and Over	3,092	14%
Disability Status		
Total Population	1,752	9%
Children	108	2%
Seniors	925	30%
Income Characteristics		
Households by Income Category		
Less than \$15,000	585	7%
\$15,000-\$29,999	1,009	12%
\$30,000-\$44,999	1,373	16%
\$45,000-\$59,999	1,153	13%
\$60,000-\$74,999	981	11%
\$75,000-\$99,999	1,002	12%
\$100,000-\$199,999	1,950	23%
\$200,000 or more	614	7%
Median Household Income	\$63,097	
Poverty Rates		
Total Population	2,032	10%
Children	588	13%
Seniors	217	7%
Housing Cost Burden		
Owners with Mortgage	1,169	31%
Renters	2,001	41%

Source: U.S. Census Bureau, 2012-2016 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2018. [Metro, 2040 Distributed Forecast](#). Note: * = Population forecast within Metro UGB

Housing Characteristics		
Housing Units		
Single-Family	4,284	47%
Multi-Family	4,635	51%
Mobile Homes	137	2%
Year Structure Built		
Pre-1970	255	3%
1970-1989	2,987	33%
1990 or later	5,825	64%
Housing Tenure and Vacancy		
Owner-occupied	3,777	42%
Renter-occupied	4,890	54%
Seasonal	0	0%
Vacant	400	4%

Wilsonville has grown substantially since its incorporation in 1969 and has an area today of 7.6 square miles. It is in the western region of Clackamas County, located about 26 miles south of the Washington border and southwest of the City of Portland. The City is within the Willamette River watershed.

The city is on Interstate 5 and about 26 miles south of the Washington border and at the northern end of the Willamette Valley at 154 feet above sea level. Because of its location Wilsonville’s climate is consistent with the Marine west coast climate zone, with warm summers and cool, wet winters. Wilsonville receives most of its rainfall between October and May, and averages 42 inches of rain, and less than one (1) inch of snow, per year.⁵

According to the [Comprehensive Plan](#), land has been designated for public, industrial, commercial, and residential use. The [Significant Resource Overlay Zone \(SROZ\) map](#) identifies areas where development is prohibited. The SROZ includes 780 acres of land and has a 25-foot buffer zone where building applications and city staff work together to decide on the ultimate “no build” boundary for individual sites.⁶

⁵ “[Monthly Average for Wilsonville, OR](#)” The Weather Channel Interactive, Inc. Retrieved November 1, 2018.

⁶ Wilsonville, Oregon. 2015 Development Code. § [4.139.00 thru 4.139.11](#)

Community Assets

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of Wilsonville. It is important to note that the facilities identified as “critical” and “essential” are characterized differently than the structural code that identifies buildings as “essential” and “non-essential.” The structural code uses different language and criteria and therefore have completely different meanings than the buildings identified in this addendum.

Critical Facilities

Facilities that are critical to government response, and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include: 911 Centers, Emergency Operations Centers, Police, and Fire Stations, Public Works facilities, sewer, and water facilities, hospitals, bridges, roads, shelters, and more.

Table WA-5 Critical Facilities in Wilsonville

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Facilities									
City Hall/EOC									
Fleet Services									
Public Works/Police Station/EOC #2		X							
Fire Stations									
Station 52 (Kinsman Road – west side)									
Station 56 (Elligsen Road – northeast)									
Potential Shelter Sites									
Lowrie Primary School (West side)									
Meridian Creek Middle School (East side)									
SpringRidge at Charbonneau (southeast)		X							

Hazardous Materials:

Facilities that, if damaged, could cause serious secondary impacts may also be considered “critical.” A hazardous material facility is one example of this type of critical facility. Those sites that store, manufacture, or use potentially hazardous materials include: Kinder Morgan Pipeline, Northwest Natural Pipeline, and Sysco.

Essential Facilities

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public's ability to recover from the emergency. These facilities may include: City buildings such as the Public Services Building, the City Hall, and other public facilities such as schools.

Table WA-6 Essential Facilities in Wilsonville

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Essential Facilities									
Schools									
Arts and Technology High (Art Tech High)									
Boeckman Creek Primary School					X				
Boones Ferry Primary School									
Clackamas Community College									
Inza R. Wood Middle School		X		X					
Learning Tree Pre-school (to 4th grade)									
Lowrie Primary School									
Mentor Child Development Center		X							
Meridian Creek Middle School									
Oregon Institute of Technology		X							
Wilsonville High School					X				
Food Providers									
Costco (+ pharmacy)									
Fred Meyer's (+ pharmacy)		X							
Safeway		X							
Sysco									
Target (+ pharmacy)									
Pharmacies									
McKesson HBOC distribution center									
Rite Aid									
Rite Aid distribution center									
Walgreens									
Other Essential Facilities									
Coffee Creek Correctional Facility									
Community Center									
Library									
Parks and Recreation Facility									
Providence Medical Facility									

Critical Infrastructure:

Infrastructure that provides necessary services for emergency response include:

Table WA-7 Critical Infrastructure in Wilsonville

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Infrastructure									
Arterials									
*designates road maintained by others									
I-5*							X		X
95th Ave									
Barber Street									
Boberg Road									
Boeckman Road				X					
Boones Ferry Road									
Brown Road									
Canyon Creek Road									
Coffee Lake Drive									
Day Road*									
Elligsen Road							X		
French Prairie Drive									
Grahams Ferry Road*									
Kinsman Road									
Miley Road*									
Parkway Avenue									
Parkway Center Drive									
Ridder Road									
Stafford Road*									
SW Touchman									
Town Center Loop									
Wilsonville Road									
Bridges									
Arrowhead Creek Lane Bridge									
Barber Street Bridge									
Boeckman Road Bridge									
Boone's Bridge (I-5/Willamette River)		X							
Creek Lane Bridge									
I-5/Wilsonville Road, Boeckman Road and Elligsen Road overpasses									
Wilsonville Road/Boeckman Creek Bridge									
Other Critical Infrastructure									
Charbonneau Reservoir									

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Critical Infrastructure									
City wells									
Communication Tower - Elligsen									
Communication Tower - Pioneer Court		X							
Communication Tower - Villebois									
Communication Tower – 1 st Street									
Electric substations									
Freight tracks									
First Student Fleet & Dispatch									
Kinder Morgan Gas Line									
Level B Reservoir									
Level C Reservoir									
Northwest Natural Gas Line									
Power lines									
Pump stations		X		X					
Republic Waste Services									
SMART Transit Facility (WES Commuter Rail Site)									
Waste Water Treatment Plant – 1 st Street									
Water Treatment Plant – Arrowhead									

Cultural and Historic Assets

The cultural and historic heritage of a community is more than just tourist charm. For families that have lived in the city for generations and new resident alike, it is the unique places, stories, and annual events that make Wilsonville an appealing place to live. The cultural and historic assets are both intangible benefits and obvious quality-of-life-enhancing amenities. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important. Cultural and historic assets include: CREST Environmental Learning Center, Fir Point Farm, Murase Plaza, Old Town (Historic), Oregon Korean War Museum, and Tauchman House in Boones Ferry Farm. Due to their historic nature many of these facilities are vulnerable to the earthquake hazard.

Economic Assets/Population Centers:

Economic assets include businesses that employ large numbers of people and provide an economic resource to the city of Wilsonville. If damaged, the loss of these economic assets could significantly affect economic stability, and prosperity. Population Centers usually are aligned with economic centers, and are a concern during evacuation/notification during a hazard event include:

Table WA-8 Economic Assets/Population Centers in Wilsonville

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Economic Assets / Population Centers									
APCON, Inc									
Argyle Square									
Charbonneau Village Town Center									
Coherent									
Crimson Trace Corporation									
DW Fitz									
FLIR Systems		X							
FOODesign Machinery and Systems, Inc		X							
Georgia Pacific									
Kinetics									
Mentor Graphics									
Old Town Square									
OrePac									
Pacific Foods Distribution Center									
Pacific Pride		X							
Prologic									
Republic Waste Management									
Rite Aid Distribution Center									
Rockwell Collins									
Southern Wine & Spirits									
Swire Coca-Cola of Oregon									
Sysco Food Services of Portland, Inc									
Tarr fueling									
Wilsonville Chamber of Commerce		X							
Wilsonville Concrete									
Xerox Corporation									

Environmental Assets:

Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic, and functional ecosystem services for the community include:

Table WA-9 Environmental Assets in Wilsonville

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Environmental Assets									
Arrowhead Creek									
Basalt Creek				X					
Boeckman Creek							X		
Boeckman Creek Crossing Trail							X		
Boones Ferry Park (cultural/historic asset)									
Canyon Creek									
Canyon Creek Park									
Charbonneau Golf Course		X							
Coffee Creek									
Coffee Lake Wetlands				X					
Community Garden									
Courtside Park									
Graham Oaks Nature Park and Trailhead (cultural/historic asset)		X							
Hathaway Park									
Memorial Park (cultural/historic asset)									
Meridian Creek									
Merryfield Park									
Palermo Park									
River Fox Park									
Sofia Park									
Town Center Park (cultural/historic asset)		X							
Tranquil Park									
Villebois park system									
Willamette River				X					
Willamette River Water Treatment Plant Park									
Willow Creek Landover Park									

Vulnerable Populations:

Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, often experience the impacts of natural hazards and disasters more acutely. Populations that have special needs or require special consideration include:

Table WA-10 Vulnerable Populations in Wilsonville

Facility	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm
Vulnerable Populations									
Coffee Creek Correctional Facility			X				X	X	
Day care facilities		X	X					X	X
Schools (see list under essential facilities)									
Senior Care Facilities									
Avalon Adult Center		X	X					X	
Brookdale		X	X					X	
Marquis Care at Wilsonville		X	X					X	
Springridge Court at Charbonneau		X	X					X	
The Wilsonville		X	X					X	
Other Facilities									
Charleston at Villebois			X						
Creekside Woods		X	X					X	
Rainwater Gardens at Villebois			X						
Renaissance at Villebois			X						

Hazard Characteristics

Drought

The HMAC determined that the City's probability for drought is **high** and that their vulnerability to drought is **low**. *The probability rating increased, and the vulnerability rating did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent and probability of a potential event. Due to the climate of Clackamas County, past and present weather conditions have shown an increasing potential for drought.

The City of Wilsonville Public Works Department manages Wilsonville's water supply. Wilsonville houses one large water intake facility and water treatment plant, which provides water to both the City of Wilsonville and the City of Sherwood. The City draws its water supply from the Willamette River, the City of Wilsonville and Tualatin Valley Water District (TVWD) have plans to develop additional facilities at Wilsonville to expand its water supply by 2026. This expanded infrastructure will also supply water to Beaverton and Hillsboro

residents. In addition to the Willamette water supply, Wilsonville also has eight local emergency wells available for use in the event of a drought.

Vulnerability Assessment

Due to insufficient data and resources, Wilsonville is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables WA-5 through WA-10.

Mitigation Activities

The existing drought hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Earthquake (Cascadia Subduction Zone)

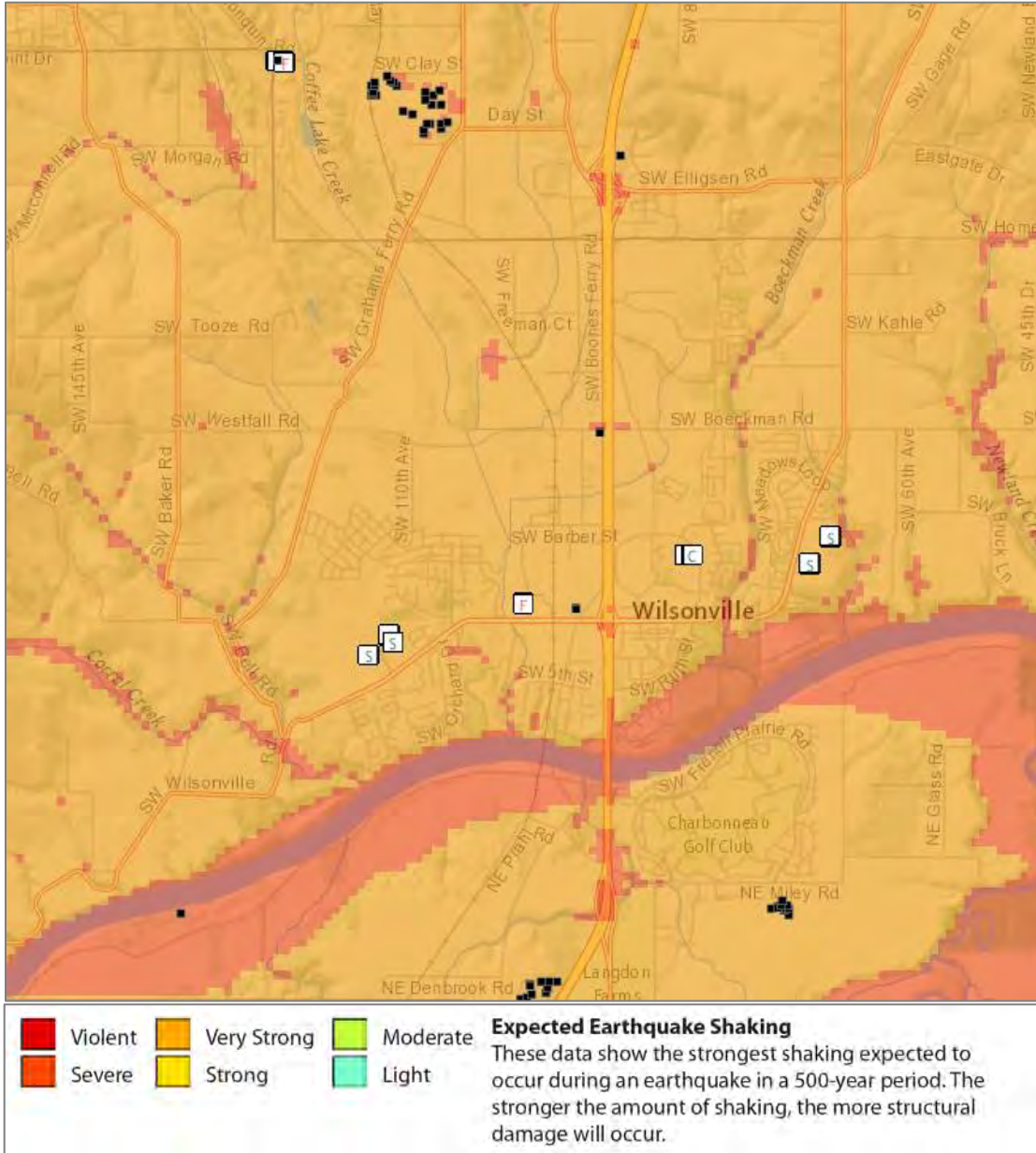
The HMAC determined that the City's probability for a Cascadia Subduction Zone (CSZ) earthquake is **moderate** and that their vulnerability to a CSZ earthquake is **high**. *The probability rating increased, and the vulnerability rating did not change, since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Cascadia Subduction Zone (CSZ) earthquake and Crustal earthquake.*

Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent and probability of a potential event. Generally, an event that affects the County is likely to affect Wilsonville as well. The causes and characteristics of an earthquake event are appropriately described within the Volume I, Section 2 as well as the location and extent of potential hazards. Previous occurrences are well documented within Volume I, Section 2 and the community impacts described by the County would generally be the same for Wilsonville as well.

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Portland Hills Fault Zone, and Gales Creek-Newberg-Mt. Angel Structural Zone (discussed in the crustal earthquake section).

Figure WA-2 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the city is expected to experience very strong shaking (orange), while areas near rivers and streams will experience severe (light red) to violent (dark red) shaking in a CSZ event.

Figure WA-2 Cascadia Subduction Zone Expected Shaking



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

Note: To view detail click the link above to access Oregon HazVu.

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year. Scientists have found evidence that 11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average

occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D.⁷

The city's proximity to the Cascadia Subduction Zone, potential slope instability and the prevalence of certain soils subject to liquefaction and amplification combine to give the city a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places the city predominately within the "Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades). Within the Northwest Oregon region, damage and shaking is expected to be strong and widespread - an event will be disruptive to daily life and commerce and the main priority is expected to be restoring services to business and residents.

Community assets located in the center of the city include Flir Systems, FOODesign Machinery & Systems, Inc., Pacific Pride, WES commuter rail station, Mentor Graphics Child Development Center, and a pump/lift station. Another high impact area is located within Charbonneau and includes the Charbonneau Village Town Center. If a large earthquake were to occur the biggest vulnerability would be reaching the Charbonneau neighborhood because it is located across the Willamette River from the rest of the city. The Boone Bridge that provides access to Charbonneau has had seismic retrofit work done, but this does not guarantee use in a large event. Additionally, Wood Middle School is in a high impact area.

Earthquake (Crustal)

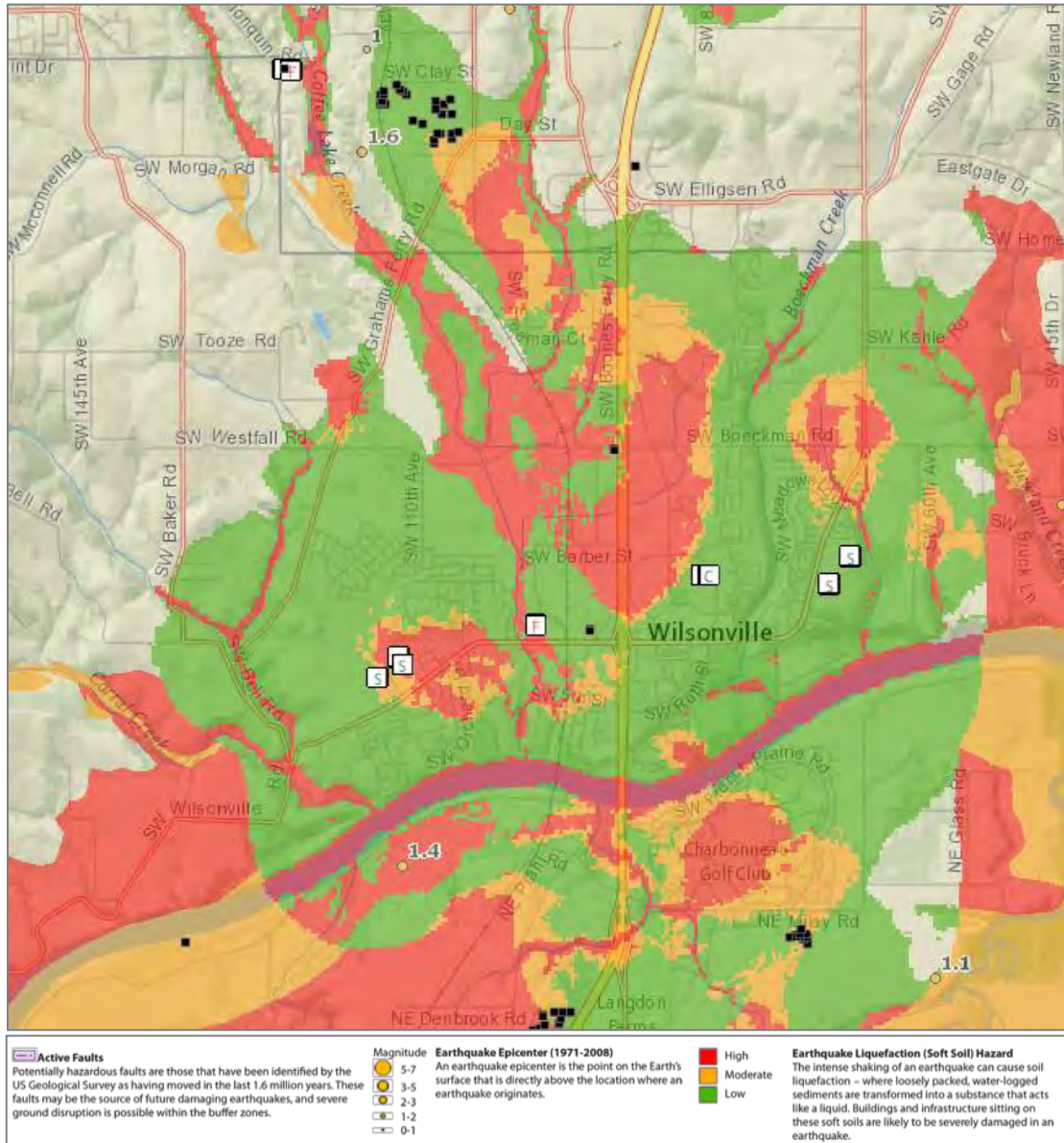
The HMAC determined that the City's probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**. *These ratings did not change since the previous version of this NHMP addendum. Previously, the earthquake hazard profile was a single risk assessment, which is now divided into two separate earthquake hazards: Crustal earthquake, and Cascadia Subduction Zone (CSZ) earthquake.*

Volume I, Section 2 describes the causes and characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Wilsonville as well. Figure WA-3 shows a generalized geologic map of the Wilsonville area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows the areas of greatest concern within the City limits as red and orange.

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

⁷ The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. <http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf>

Figure WA-3 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



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

Note: To view detail click the link above to access Oregon HazVu

There are two potential crustal faults and/or zones near the City that can generate high-magnitude earthquakes. These include the Gales Creek-Mt. Angel Structural Zone and Portland Hills Fault Zone (discussed in greater detail below). Other nearby faults include the Bolton fault and Oatfield faults which run through the city west and east side respectively, Canby-Molalla structural zones located west of the city, and the Mt. Hood Fault in eastern Clackamas County. Historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and lies about 11 miles northeast of Wilsonville.

Vulnerability Assessment

Due to insufficient data and resources, Wilsonville is currently unable to perform a quantitative risk assessment for this hazard. However, in 2018 the Department of Geology and Mineral Industries (DOGAMI) completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)), findings from that report are provided at the end of the crustal earthquakes hazard section.

Seismic building codes were implemented in Oregon in the 1970s, however, stricter standards did not take effect until 1991 and early 2000s. As noted in the community profile, approximately 36% of residential buildings were built prior to 1990, which increases the City's vulnerability to the earthquake hazard. Information on specific public buildings' (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in

Table WA-11; each "X" represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), one (1) has a very high (100% chance) collapse potential and two (2) have a high (greater than 10% chance) collapse potential. *Note: two fire stations and the police station have been, or are scheduled to be, seismically retrofitted or rebuilt.*

For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables WA-5 through WA-10. In addition to building damages, utility (electric power, water, wastewater, natural gas) and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

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

Mitigation Activities

Wilsonville has taken mitigation steps to reduce the city's vulnerability in earthquake events. City Hall and the water treatment plant are up to the newest building codes, meaning these buildings can be occupied even after large earthquake events. Seismic retrofit grant awards per the [Seismic Rehabilitation Grant Program](#)⁸ have been funded to retrofit Public

⁸ The Seismic Rehabilitation Grant Program (SRGP) is a state of Oregon competitive grant program that provides funding for the seismic rehabilitation of critical public buildings, particularly public schools and emergency services facilities.

Works/Police Station (Phase Two of 2015-2017 grant award, \$251,685). A \$77.5 million bond measure (34-133) was passed in 2006 by southeast Portland metro-area voters to correct seismic safety deficiencies at Tualatin Valley Fire and Rescue Fire Station 52 and to replace Fire Station 56. ODOT has seismically upgraded Boone Bridge, but specifics on this project are not known.

Table WA-II Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Arts & Technology High (29796 SW Town Center Loop E)	N/A	X			
Boeckman Creek Primary (6700 SW Wilsonville Rd)	Clac_sch71	X			
Boones Ferry Primary (11495 SW Wilsonville Rd)	Clac_sch84	X			
CCC Wilsonville Campus (29353 Town Center Loop E)	Clac_Coc08				X
Inza R. Wood Middle (11055 SW Wilsonville Rd.)	Clac_sch92			X, X	
Wilsonville High (6800 SW Wilsonville Rd)	Clac_sch77	X			
Learning Tree Day School (29880 Town Center Loop W)	N/A	<i>2007 RVS report did not include structural appendix for this facility</i>			
Lowrie Primary School (28995 SW Brown Rd)	N/A	<i>2007 RVS report did not include structural appendix for this facility</i>			
Meridian Creek Middle School (6300 SW Hazel St)	N/A	<i>2007 RVS report did not include structural appendix for this facility</i>			
Public Safety					
Fire Station 52 (TVF&R) (29875 Kinsman Rd)	Clac_fir34	Seismic retrofit of entire building via 2006 bond.			
Fire Station 56 & South Operating Center (TVF&R) (8445 Elligsen Rd)	Clac_fir54	Facility rebuilt via 2006 bond.			
Public Works/Police Station (30000 Town Center Loop E)	N/A	Mitigated per 2015-2017 SRGP grant.			
Hospital					
Providence Medical Plaza (29345 SW Town Center Loop)	N/A	2007 RVS report did not include structural appendix for this facility			

Source: [DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.](#) "*" – Site ID is referenced on the [RVS Clackamas County Map](#)

Note: Bold indicates facilities that have been seismically retrofitted or rebuilt.

Earthquake Regional Impact Analysis

In 2018 DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults ([O-18-02](#)). Their study focused on damage to buildings, and the people that occupy them, and to two key infrastructure

sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and night time (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damaged varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood structures that fare worse in an earthquake. The Portland Hills fault scenario created greater damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios, however, the impact is considerably less than it is to the transportation routes. Additional, capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts.

Table WA-12 shows the permanent resident population that are vulnerable to injury or death (casualty) and the buildings in the City that are susceptible to liquefaction and landslides, it does not predict that damage will occur in specific areas due to either liquefaction or landslide. More population and property are exposed to higher degrees of expected damage or casualty under the Portland Hills Fault “wet” scenario than in any other scenario.

Table WA-12 Expected damages and casualties for the CSZ fault and Portland Hills fault: earthquake, soil moisture, and event time scenarios

	Cascadia Subduction Zone (M9.0)		Portland Hills Fault (M6.8)	
	"Dry" Soil	"Wet" Saturated Soil	"Dry" Soil	"Wet" Saturated Soil
Number of Buildings	5,492	5,492	5,492	5,492
Building Value (\$ Million)	4,410	4,410	4,410	4,410
Building Repair Cost (\$ Million)	291	423	406	681
Building Loss Ratio	7%	10%	9%	15%
Debris (Thousands of Tons)	155	196	196	283
Long-Term Displaced Population	147	894	181	1,616
Total Casualties (Daytime)	199	315	255	505
Level 4 (Killed)	7	14	9	24
Total Casualties (Nighttime)	38	100	50	173
Level 4 (Killed)	1	3	1	6

Source: DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8, 12-9, 12-10, and 12-11.

Cascadia Subduction Zone Scenario

The City of Wilsonville is expected to have a 7% building loss ratio with a repair cost of \$291 million under the CSZ “dry” scenario, and an 10% building loss ratio with a repair cost of \$423 million under the CSZ “wet” scenario.⁹ The city is expected to have around 199 daytime or 38 nighttime casualties during the CSZ “dry” scenario and 315 daytime or 100 nighttime casualties during the CSZ “wet” scenario. It is expected that there will be a long-term displaced population of around 147 for the CSZ “dry” scenario and 894 for the CSZ “wet” scenario.¹⁰

Portland Hills Fault Scenario

The City of Wilsonville is expected to have a 9% building loss ratio with a repair cost of \$406 million under the CSZ “dry” scenario, and a 15% building loss ratio with a repair cost of \$681 million under the CSZ “wet” scenario.¹¹ The long-term displaced population and casualties are greatly increased for all the Portland Hills Fault scenarios. The city is expected to have around 255 daytime or 50 nighttime casualties during the Portland Hills Fault “dry” scenario and 505 daytime or 173 nighttime casualties during the Portland Hills Fault “wet” scenario. It is expected that there will be a long-term displaced population of around 181 for the Portland Hills Fault “dry” scenario and 1,616 for the Portland Hills Fault “wet” scenario.¹²

Recommendations from the report included topics within Planning, Recovery, Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMPs mitigation strategies (Table WA-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and the recommendations see: *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, [O-18-02](#)).

Please review Volume I, Section 2 for additional information on this hazard.

Flood

The HMAC determined that the City’s probability for flood is **moderate** and that their vulnerability to flood is **moderate**. *The probability rating decreased, and the vulnerability rating increased, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent, and probability of a potential event. Figure WA-4 illustrates the flood hazard area for Wilsonville, which covers 390 acres including open water.

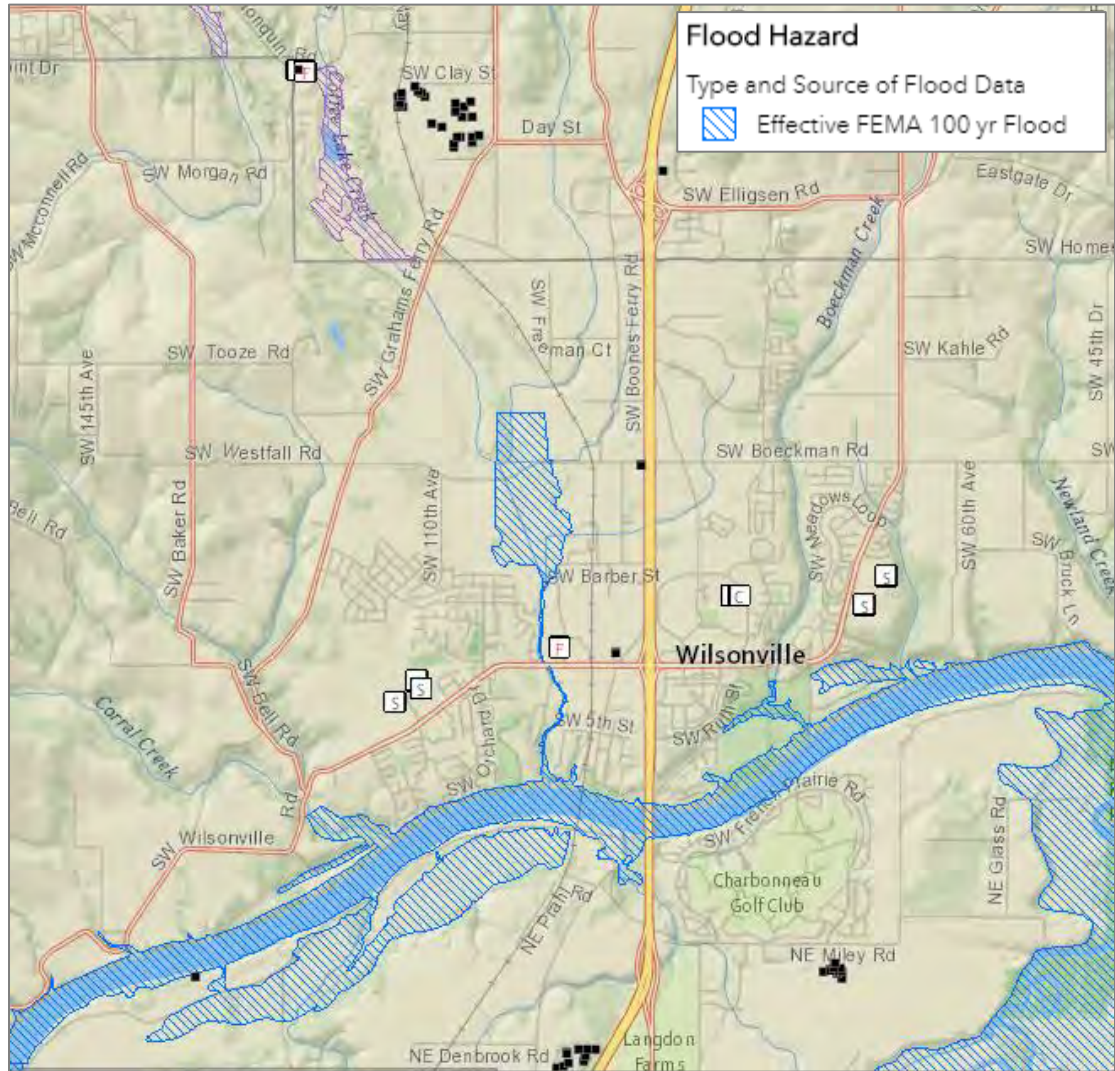
⁹ DOGAMI, *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon* (2018, O-18-02), Tables 12-8 and 12-9.

¹⁰ Ibid, Tables 12-8 and 12-9.

¹¹ Ibid, Tables 12-10 and 12-11

¹² Ibid, Tables 12-10 and 12-11.

Figure WA-4 Special Flood Hazard Area



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

Note: To view detail click the link above to access Oregon HazVu

Portions of Wilsonville have areas of floodplain (special flood hazard areas, SFHA). These include the Willamette River, Coffee Creek, Basalt Creek, Boeckman Creek, Meridian Creek, Arrowhead Creek, Corral Creek, and South Tributary. The geographic location of the flooding hazard was determined using the designated FEMA 100-year floodplain data, as well as the inundation line for the 1996 flood. The flood hazard includes portions of Boeckman Road, a large area along Seely Ditch between the confluence of Basalt Creek, Coffee Creek, and South Tributary. Impacted community assets include one pump station, and fewer than five homes.

Vulnerability Assessment

Due to insufficient data and resources, Wilsonville is currently unable to perform a quantitative risk assessment for this hazard. Fortunately, most of the flood hazard is included in the Significant Resource Overlay Zone (SROZ), where development is prohibited. The SROZ includes 780 acres of land and has a 25-foot buffer zone where building applications and city staff work together to decide on the ultimate “no build” boundary for

the site. The SROZ map includes a few areas where the 1996 flood extended beyond the FEMA 100-year flood boundaries. These areas include portions of Corral Creek, spots in Memorial Park, and an area just west of Memorial Park.

Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage, and economic loss from business interruption. It is important for the City to be aware of flooding impacts and assess its level of risk.

The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners, and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of Wilsonville outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage.

The largest flooding event to affect Wilsonville was the February 1996 flood. The high-water level meant tributaries could not drain into the Willamette River, which led to localized flooding on several backed-up creeks. Flooding also occurred at culverts and drainage choke points near Sun Place, Commerce Circle, and a pathway near Inza R. Wood Middle School. The La Quinta Hotel on Sun Place experienced a few inches of flooding to the first floor. The culverts that frequently cause flooding are owned and maintained by the Oregon Department of Transportation. The worst flooding occurred along the Willamette River. Portions of Memorial Park flooded but the sewer lift station was unaffected because Public Works sandbagged the facility and pumped out water for days. Three homes on Montgomery Way and Rose Lane were flooded; two homes had flooding in their living spaces and one home had storage space flooding.

The extent of flooding hazards in Wilsonville primarily depends on climate and precipitation levels. Additionally, withdrawals for irrigation and drinking water, as well as stream and wetland modifications or vegetation removal can influence water flow. In the past flooding has occurred along the Willamette River, in Coffee Creek Wetlands, and at choke points that can back up during heavy precipitation events. These problem areas include the backside of SW Commerce Circle, Sun Place (where a La Quinta hotel is located), a pathway at Inza R. Wood Middle School (which has resulted in the parking lot being flooded in the past), and Rose Lane, where the river can back up and come onto the road, causing traffic problems. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables WA-5 through WA-10.

National Flood Insurance Program (NFIP)

FEMA's Flood Insurance Study (FIS), and Flood Insurance Rate Maps (FIRMs) are effective as of June 17, 2008. Table WA-13 shows that as of July 2018, Wilsonville has 35 National Flood Insurance Program (NFIP) policies in force. Of those, 12 are for properties that were constructed before the initial FIRMs. The last Community Assistance Visit (CAV) for Wilsonville was on January 14, 2009. Wilsonville does not participate in the Community Rating System (CRS). The table shows that the majority of flood insurance policies are for residential structures, primarily single-family homes. There has been a total of three (3) paid

claims for \$73,826. The City complies with the NFIP through enforcement of their flood damage prevention ordinance and their floodplain management program.

The Community Repetitive Loss record for Wilsonville identifies no Repetitive Loss Properties¹³ or Severe Repetitive Loss Properties¹⁴.

Table WA-13 Flood Insurance Detail

	Clackamas County	Wilsonville
Effective FIRM and FIS	6/17/2008	6/17/2008
Initial FIRM Date	-	1/6/1982
Total Policies	1,957	35
Pre-FIRM Policies	1,086	12
Policies by Building Type		
Single Family	1,761	34
2 to 4 Family	30	1
Other Residential	58	0
Non-Residential	9	0
Minus Rated A Zone	123	0
Insurance in Force	\$541,833,400	\$10,902,000
Total Paid Claims	590	3
Pre-FIRM Claims Paid	450	2
Substantial Damage Claims	83	0
Total Paid Amount	\$20,830,662	\$73,826
Repetitive Loss Structures	51	0
Severe Repetitive Loss Properties	4	0
CRS Class Rating	-	NP
Last Community Assistance Visit	-	1/14/2009

Source: Information compiled by Department of Land Conservation, and Development, July 2018.

Note: The portion of the cities of Portland and Tualatin that are within Clackamas County are not included in this table.

NP = Not Participating

Mitigation Activities

Wilsonville employs several mitigation strategies to reduce the city's risk to flood events. The city development code includes policies and regulations for flood prone areas including the Significant Resource Overlay Zone, Floodplain Regulations, Protection of Natural Features and Other Resources, and Willamette River Greenway. Development review practices and conditions of development require developers to account for 100% of

¹³ A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

¹⁴ A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP, and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000, and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

stormwater management onsite to reduce the risks of urban flooding in the future. Wilsonville regularly inspects and maintains the stormwater facilities. Enclosed pipe sections and catch basins are routinely cleaned and inspected using the combination truck, and a regular street sweeping program reduces the amount of debris and contaminants entering the stormwater system. The Stormwater Master Plan is currently being updated and several projects are underway to improve drainage. The Villebois development is creating a diversion to fix the flooding problem at Inza R. Wood Middle School. The sewer lift station in Memorial Park was relocated to avoid future flooding.

Please review Volume I, Section 2 for additional information on this hazard.

Landslide

The HMAC determined that the City's probability for landslide is **low** and that their vulnerability to landslide is **low**. *These ratings did not change since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Wilsonville does not have a history of landslides. This is due to a primary and secondary open space ordinance in effect during the late 1970s. In the primary zone development was diverted from slopes greater than 20%, and in the secondary zone development was limited on slopes between 12% and 20%. This decades old ordinance has since been replaced by the Significant Resource Overlay Zone. Because of Wilsonville's progressive actions very little development has occurred on steep slopes.

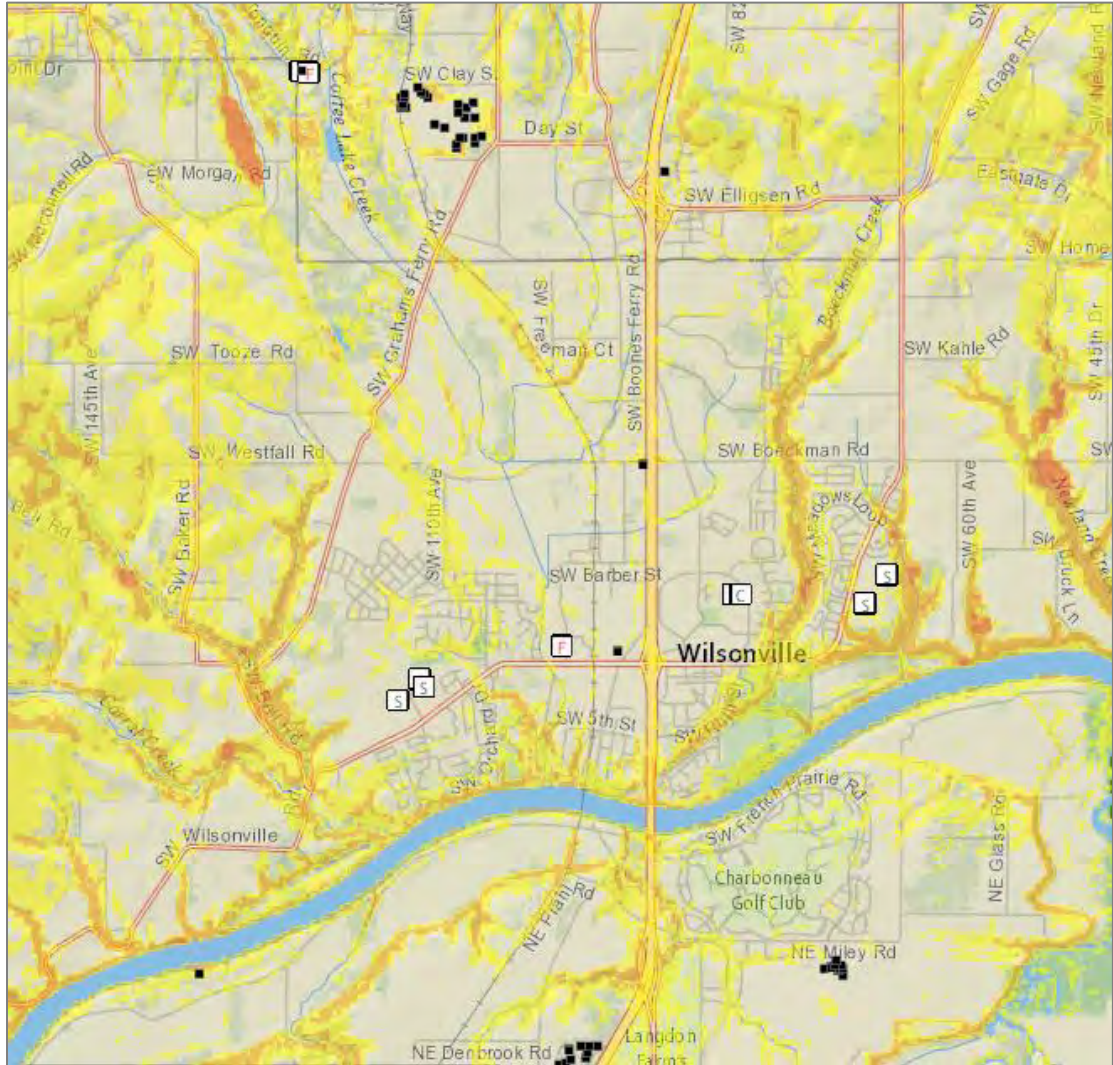
Although landslides have not occurred in Wilsonville, steep slopes do exist along the banks of the Willamette River. Four neighborhoods have been built near these slopes including Day Dream Ranch, Cedar Point, Edgewater, and Charbonneau. Canyon Creek Apartments are built on a moderate hill near the creek.

Landslide susceptibility exposure for Wilsonville is shown in Figure WA-5. Most of Wilsonville demonstrates a low to moderate landslide susceptibility exposure. Approximately 6% of Wilsonville has very high or high, and approximately 21% moderate, landslide susceptibility exposure.¹⁵

Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard, and assets.

¹⁵ DOGAMI. [Open-File Report, O-16-02](#), *Landslide Susceptibility Overview Map of Oregon* (2016)

Figure WA-5 Landslide Susceptibility Exposure



Low	Landsliding unlikely. Areas classified as Landslide Density = Low (less than 7%) and areas classified as Slopes Prone to Landsliding = Low.
Moderate	Landsliding possible. Areas classified as Landslide Density = Low to Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = Moderate OR areas classified as Landslide Density = Moderate (7%-17%) and areas classified as Slopes Prone to Landsliding = Low.
High	Landsliding likely. Areas classified as Landslide Density = High (greater than 17%) and areas classified as Slopes Prone to Landsliding = Low and Moderate OR areas classified as Landslide Density = Low and Moderate (less than 17%) and areas classified as Slopes Prone to Landsliding = High.
Very High	Existing landslides Landslide Density and Slopes Prone to Landsliding data were not considered in this category. Note: the quality of landslide inventory (existing landslides) mapping varies across the state.

Source: [Oregon HazVu: Statewide Geohazards Viewer \(DOGAMI\)](https://www.oregon.gov/oha/ohahp/Geomatics/Pages/Statewide-Geohazards-Viewer-(DOGAMI).aspx)

Note: To view detail click the link above to access Oregon HazVu

Vulnerability Assessment

Due to insufficient data and resources, Wilsonville is currently unable to perform a quantitative risk assessment for this hazard. However, DOGAMI completed a statewide landslide susceptibility assessment in 2016 ([O-16-02](#)), general findings from that report are provided above and within Figure WA-5.

Potential landslide-related impacts are adequately described within Volume I, Section 2, and include infrastructure damages, economic impacts (due to isolation, and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides, and debris flows can potentially occur during any winter, and thoroughfares beyond City limits are susceptible to obstruction as well. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables WA-5 through WA-10.

The most common type of landslides are slides caused by erosion. Slides move in contact with the underlying surface, are generally slow moving, and can be deep. Rainfall-initiated landslides tend to be smaller; while earthquake induced landslides may be quite large. All soil types can be affected by natural landslide triggering conditions.

Mitigation Activities

Wilsonville works to mitigate future landslide hazards. The city development code includes several policies and regulations to protect slopes including the Significant Resource Overlay Zone, Protection of Natural Features and Other Resources, Landscaping, Screening and Buffering, and Willamette River Greenway. A tree detention program prohibits cutting down trees over 6" in diameter at breast height, which helps to stabilize soils. The city has a maintenance plan to ensure the storm water drains are regularly cleaned in the Cedar Ridge and Daydream Ranch neighborhoods. This plan was enacted after a home in the Portland West Hills (outside Wilsonville) slid in October 2008 because of improper drainage.

Wilsonville completed the Rivergreen Stormwater Outfall project which addressed runoff and groundwater seepage that caused significant erosion on the Willamette River bank. The city constructed a bioswale, rerouted stormwater discharges, and completed bank stabilization projects to prevent further erosion and stabilize areas of the bank that had been impacted by erosion.

Please review Volume I, Section 2 for additional information on this hazard.

Severe Weather

Severe weather can account for a variety of intense, and potentially damaging hazard events. These events include extreme heat, windstorms, and winter storms. The following section describes the unique probability, and vulnerability of each identified weather hazard.

Extreme Heat

The HMAC determined that the City's probability for extreme heat events is **high** and that their vulnerability is **moderate**. *The probability rating increased, and the vulnerability rating did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the City as well.

A severe heat episode or "heat wave" occurs about every two to three years, and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days with temperatures greater than or equal to 90-degrees, or 100-degrees, Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit, and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The City of Wilsonville has not experienced any life-threatening consequences from the few historical extreme heat events, although changes in climate indicate that the area should expect to see more extreme heat events.

Please review Volume I, Section 2 for additional information on this hazard.

Windstorm

The HMAC determined that the City's probability for windstorm is **moderate** and that their vulnerability to windstorm is **low**. *The probability rating decreased, and the vulnerability rating did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent, and probability of a potential event within the region. Because windstorms typically occur during winter months, they are sometimes accompanied by flooding and winter storms (ice, freezing rain, and very rarely, snow). Other severe weather events that may accompany windstorms, including thunderstorms, hail, lightning strikes, and tornadoes are generally negligible for Wilsonville.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation, and economic disruptions result as well.

Damage from high winds generally has resulted in downed utility lines, and trees usually limited to several localized areas. Electrical power can be out anywhere from a few hours to several days. Outdoor signs have also suffered damage. If the high winds are accompanied by rain (which they often are), blowing leaves, and debris clog drainage-ways, which in turn may cause localized urban flooding.

Please review Volume I, Section 2 for additional information on this hazard.

Winter Storm (Snow/Ice)

The HMAC determined that the City's probability for winter storm is **moderate** and that their vulnerability to winter storm is **moderate**. *The probability rating decreased, and the vulnerability rating did not change, since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent, and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They

originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the City typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

The biggest impact of winter storms is congestion on roadways. Interstate 5 bisects Wilsonville into east and west sections. When I-5 backs up many of Wilsonville's transportation networks become congested. This is especially true if snow on I-5 is not plowed. Wilsonville has minimal construction on steep slopes but the Canyon Creek Apartment Complex has steep driveways which may be difficult to traverse in freezing weather.

Most winter storms typically do not cause significant damage, they are frequent, and have the potential to impact economic activity. Road, and rail closures due to winter weather are an uncommon occurrence but can interrupt commuter, and commercial traffic as noted above.

Vulnerability Assessment

Due to insufficient data and resources, Wilsonville is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Assets section and Tables WA-5 through WA-10.

Mitigation Activities

Mitigating severe weather can be difficult because storms affect all areas of the city, but Wilsonville has made progress to reduce the effects of storms. For over a decade Wilsonville has been recognized as a Tree City USA, and the city received a Tree City USA Growth Award for demonstrating progress in its community forestry program. These distinctions mean Wilsonville has an active tree care ordinance and public education pieces, among others, which help to maintain a healthy urban forest. Most utilities are underground and all new utilities are required to be undergrounded, but in case of power outages the city's critical facilities have back up power generation. Wilsonville also has a designated snow plow and sanding route to help expedite snow removal.

Please review Volume I, Section 2 for additional information on this hazard.

Volcanic Event

The HMAC determined that the City's probability for a volcanic event is **low** and that their vulnerability to a volcanic event is **low**. *The probability rating did not change, while the vulnerability decreased since the previous version of this NHMP addendum.*

Volume I, Section 2 describes the characteristics of volcanic hazards, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the western portion of the County is likely to affect Wilsonville as well. Several volcanoes are located near Wilsonville, the closest of which are Mount Hood, Mount Adams, Mount Saint Helens, Mount Rainier, and the Three Sisters.

Vulnerability Assessment

Due to insufficient data and resources, Wilsonville is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables WA-5 through WA-10.

Due to Wilsonville's relative distance from volcanoes, the city is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Depending on wind patterns and which volcano erupts, however, the city may experience ashfall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city could experience a heavier coating of ash.

Mitigation Activities

The existing volcano hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County NHMP.

Please review Volume I, Section 2 for additional information on this hazard.

Wildfire

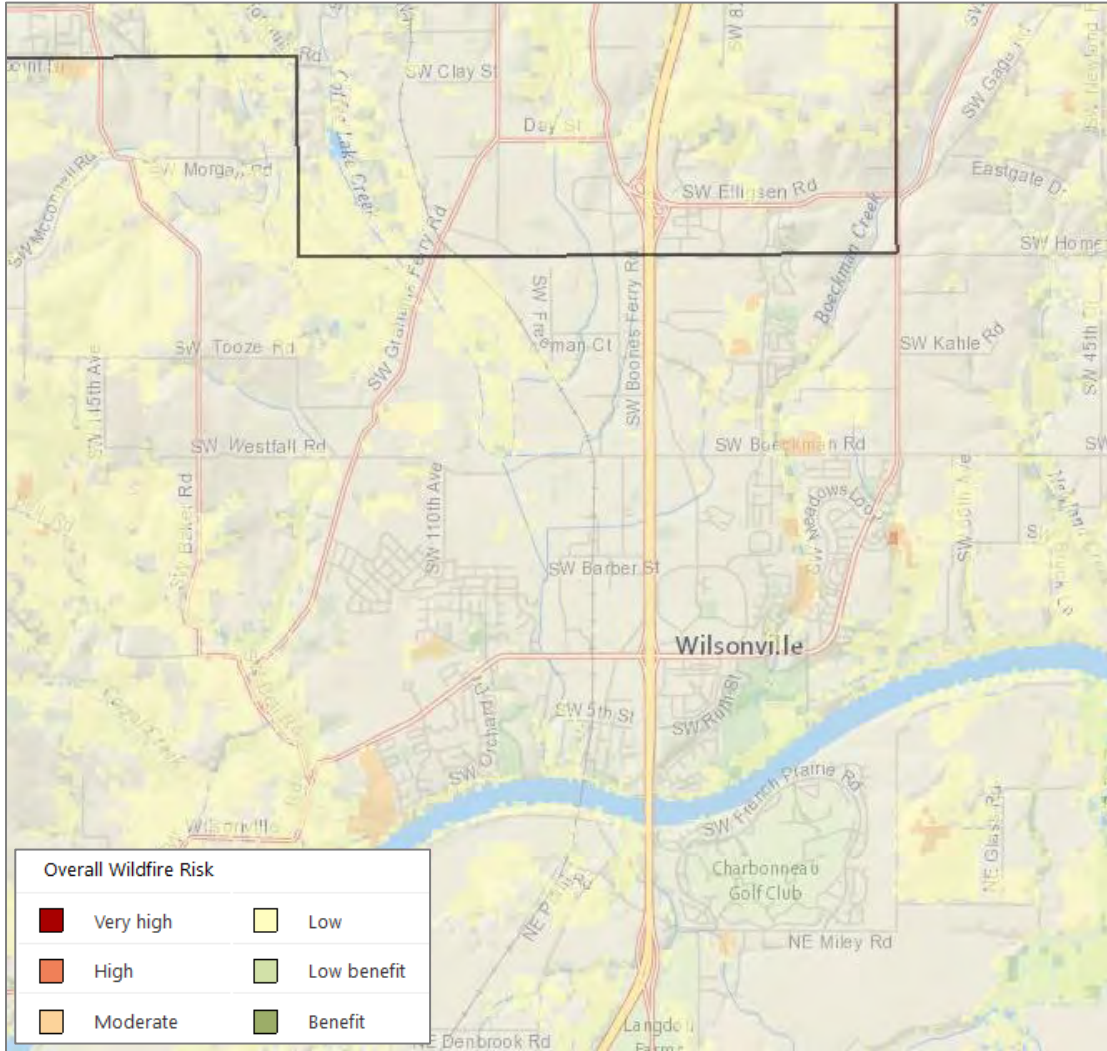
The HMAC determined that the City's probability for wildfire is **moderate**, and that their vulnerability to wildfire is **moderate**. *These ratings did not change since the previous version of this NHMP addendum.*

The [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) was completed in May 2018. The CWPP is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard: <https://www.clackamas.us/dm/CWPP.html>. Information specific to Wilsonville is found in the following chapter: [Chapter 10.13: Tualatin Valley Fire and Rescue](#).

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions. Weather, and urbanization conditions are primarily at cause for the hazard level. Wilsonville has not experienced a wildfire within City limits, but the city has abundant wooded areas that are a concern in the case of a wildfire event. Figure WA-6 shows overall wildfire risk in Wilsonville.

Clackamas County has two major physiographic regions: the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern Clackamas County. The Willamette River Valley, which includes Wilsonville, is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range has a relatively small population and is characterized by heavily forested slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to its dense forest land. Human caused fires are responsible for most fires in Clackamas County. In Wilsonville most instances of fire have been started by the railroads and I-5 but the fires have been small enough to contain quickly and easily.

Figure WA-6 Overall Wildfire Risk



Source: [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

The forested hills within, and surrounding Wilsonville are interface areas including the Beckman Creek Corridor, Xerox Woods, Burnerts Orchard, the Living Enrichment Center (LEC), Metro Graham Oaks Nature Park, the area north of Elligsen Road near fire station 56, and the area east of Wilsonville High School, where access would be a problem. High and Medium Priority Communities at Risk (CARs) within the City include: Graham Oaks Nature Park (part of Ladd Hill CAR) and Boeckman Creek.¹⁶

Most of the city has less severe (moderate or less) wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions.¹⁷ However, conditions vary widely and with local topography, fuels, and local weather (including wind) conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire

¹⁶ Clackamas County Community Wildfire Protection Plan, *Wilsonville Fire Department* (2018), Table 10.13-1.

¹⁷ [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts.

Vulnerability Assessment

Due to insufficient data and resources, Wilsonville is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets section and Tables WA-5 through WA-10.

The potential community impacts, and vulnerabilities described in Volume I, Section 2 are generally accurate for the City as well. Wilsonville's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. The City will update the City's wildfire risk assessment if the fire plan presents better data during future updates (an action item is included to participate in future updates to the CWPP).

Property can be damaged or destroyed with one fire as structures, vegetation, and other flammables easily merge to become unpredictable, and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

Mitigation Activities

Wilsonville uses several mitigation tools to reduce the city's risk to wildfires. The city enforces open lots to cut grasses before July 4th. If the property owner does not cut the grass the city will do it. The Significant Resources Overlay Zone has prohibited development in many of the densely forested areas. Tualatin Valley Fire & Rescue adopted a district-wide wildland map that governs new construction, and an active public education program for high risk-wildfire areas.

Please review the [2017 Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) and Volume I, Section 2 for additional information on this hazard.

ATTACHMENT A: ACTION ITEM FORMS

ACTION ITEM FORMS

Multi-Hazard #1*	45
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Flood #2	53
Flood #3*	54
Severe Weather #1	55
Wildfire #1*	56

* - Priority Action Item

Note: The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity.

Summary of Action Changes

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

Previous NHMP Actions: Completed

Earthquake Action #2 (2012): “Seismically retrofit Elligsen Road Fire Station and associated structures” is considered complete. A \$77.5 million bond measure (34-133) was passed in 2006 by southeast Portland metro-area voters to correct seismic safety deficiencies at Tualatin Valley Fire and Rescue Fire Station 52 and to replace Fire Station 56. In addition, Earthquake Action #1 (2012) was updated in this version of the addendum to reflect the completion of seismic work to City Hall and water treatment plant; the public works/police station is funded for retrofit through the Oregon Seismic Rehabilitation Grant Program (see EQ #1 for more information).

See 2018 status identified in each action for activities that have been completed since the previous plan.

Previous NHMP Actions: Removed

Multi-Hazard Action #3 (2012): “Identify and pursue funding opportunities to develop and implement hazard mitigation activities” was removed from the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Multi-Hazard Action #4 (2012): “Continue to update and improve hazard assessments in the Natural Hazards Mitigation Plan as new information becomes available” was removed from

the list since it was determined by the steering committee that this is a function of their Implementation and Maintenance Plan and did not need to be included as an action.

Note: 2012 Actions MH #5 and EQ #3 were renumbered to 2019 Actions MH #3 and EQ #2 respectively.

New NHMP Actions (2019):

- Earthquake Action #3
- Earthquake Action #4
- Wildfire Action #1

See action item forms below for detail.

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 NHMP includes a range of action items that, when implemented, will reduce loss from hazard events in the County, participating cities, and special districts. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. The City 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, the City 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 several 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 HMAP but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and/or resources toward completion of the action items.

Internal partner organizations are departments within the City 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.

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:	
Develop public education programs to inform the public about methods for mitigating the impacts of natural hazards.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • Conducting public outreach campaigns raises awareness about natural hazards and helps illustrate what residents and businesses can do to reduce the impact of a natural disaster on their properties, thereby significantly reducing the impact of natural hazards on the City of Wilsonville. • The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the county's actions to mitigate hazards. • <u>2018 Status:</u> The City utilizes the city's website to provide information on natural hazards: https://www.ci.wilsonville.or.us/publicworks/page/emergency-management 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Conduct public education as hazard seasons approach. These include earthquake awareness month in April, wildfire prevention in summer, and flood and severe storm information in winter; • Identify property owners in flood, landslide, and wildfire hazard zones, and conduct a target mailing to disseminate information on all hazards; • Partner with Clackamas County and other jurisdictions to develop public education flyers for all hazards; • Include insurance information in public outreach and education materials and promote purchase of appropriate insurance coverage; • Include hazard information on the city website and link to the Tualatin Valley Fire & Rescue safety tips website; and • Utilize the city newsletter, The Boones Ferry Messenger, to disseminate hazard information 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Tualatin Valley Fire & Rescue, Hazard Mitigation Advisory Committee		Neighborhood Associations, Wilsonville Chamber of Commerce, Clackamas County, Oregon Partnership for Disaster Resilience	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	High		

* - High Priority Action Item

Multi-Hazard #2

Proposed Action Item:		Alignment with Plan Goals:	
Integrate the goals and action items from the Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
Comprehensive Plan, Zoning Ordinance			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating natural hazards plans into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community. <u>2018 Status:</u> The City updated their development code in 2015. The floodplain ordinance was last updated in 2010 (Ordinance 686, 11/1/10). The City updated their comprehensive plan in July 2013. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Use the mitigation plan to help the City's Comprehensive Land Use Plan meet 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 city's mitigation actions into the current capital improvement plans to ensure development does not encroach on known hazard areas; Incorporate the Natural Hazards Mitigation Plan into City Code where appropriate; and Use the natural hazard mitigation planning resources provided by the Oregon Partnership for Disaster Resilience to learn how to better integrate the NHMP into existing documents and programs. 			
Coordinating Organization:		Planning	
Internal Partners:		External Partners:	
Public Works, Building, Planning Commission, Natural Resources		Department of Land Conservation and Development, Department of Geology and Mineral Industries, Oregon Department of Transportation, Department of Environmental Quality	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, DLCDC Technical Assistance Grant		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Multi-Hazard #3

Proposed Action Item:		Alignment with Plan Goals:	
Continue vegetation management throughout the city.		Augment Emergency Services; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> Landscaping and vegetation make a difference in mitigating the impacts of natural hazards. Trees break the force of the wind and stabilize the soil. Wetlands absorb much of the overflow from stream channels. Fire-resistant vegetation can retard the spread of wildfires toward vulnerable buildings. Limiting or regulating the amount of vegetation cleared off a hillside lot reduces the risk of increasing the number of landslide-prone areas in a community. Planting vegetation or maintaining slope terraces can also reduce slope-runoff. Planners can use landscaping requirements to preserve or enhance the protection such natural features afford. These requirements may be part of site plan reviews or a separate set of zoning regulations and environmental performance standards. <u>2018 Status:</u> Ongoing activity of city. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Partner with Clackamas County, Oregon Department of Transportation (ODOT), railroad companies, Oregon Department of Forestry (ODF), US Forestry Service (USFS), and citizens to control vegetation along transportation corridors; Identify appropriate practices for eliminating invasive species such as blackberry and English Ivy; Maintain healthy urban canopy and remove excess understory; Maintain vegetation coverage for slope stability; Identify hazardous trees for remediation or removal; Review and update existing ordinances to incorporate and improve vegetation management on private property; Develop mechanism to review vegetation on a case by case basis; Provide education to the public about justifications for, and benefits of vegetation mitigation practices; and Encourage fuels reduction on private property by providing education for pruning, safe tree removal and native vegetation use; Continue to update the Significant Resource Overlay Zone (SROZ); and Continue to enforce the noxious vegetation code. 			
Coordinating Organization:		Natural Resources	
Internal Partners:		External Partners:	
Planning, Public Works, Parks		Clackamas County, railroad companies, ODOT, ODF, PGE, USFS	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Earthquake #1

Proposed Action Item:		Alignment with Plan Goals:	
Conduct seismic evaluations of the Community Center and other critical and essential facilities and implement appropriate structural mitigation strategies.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The Wastewater Treatment Plant, Community Center, and Public Works/Police Building are not up to seismic standards; • 2018/2019 Public Works/Police Building is undergoing seismic rehabilitation; and • Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. • <u>2018 Status</u>: Seismic study on the Charbonneau reservoir was completed in April 2012. Other critical facilities are built to life safety standards (but not to operational standards). Wastewater Treatment Plant was updated in 2014. Public Works/Police Station is currently being seismically retrofitted (per Phase Two of the 2015-2017 Seismic Rehabilitation Grant Program). 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Obtain funding to perform evaluations; • Prioritize seismic upgrades based on criticality of need and population served; • Partner with appropriate organizations to implement seismic upgrades; and • Seismically retrofit these facilities to guarantee continuous operation during and after a natural disaster. 			
Coordinating Organization:		Community Development and Public Works	
Internal Partners:		External Partners:	
Building, Engineering		Wilsonville Police, DOGAMI	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Seismic Rehabilitation Grant Program, Hazard Mitigation Assistance Grants		Moderate to High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Earthquake #2

Proposed Action Item:		Alignment with Plan Goals:	
Perform non-structural mitigation on public facilities to improve life safety standards.		Protect Life and Property; Augment Emergency Services; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(ii)]. Implementing non-structural mitigation programs will reduce the potential for life loss in public buildings and assist a community in reducing its overall earthquake risk. <u>2018 Status</u>: The City provides non-structural mitigation public outreach and education regularly, including drills and training. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> 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; and Encourage facility managers, business owners, and teachers to refer to FEMA's practical guidebook: Reducing the Risks of Nonstructural Earthquake Damage; 			
Coordinating Organization:		Human Resources	
Internal Partners:		External Partners:	
Building, Engineering		TVF&R, Oregon Occupational Safety and Health Administration	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Seismic Rehabilitation Grant Program		Low to Moderate	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing action item		
Priority:	Medium		

Earthquake #3*

Proposed Action Item		Alignment with Plan Goals:	
Seismically retrofit Willamette Water Treatment Plant and Intake Facility		Protect Life and Property; Augment Emergency Services	
Alignment with Existing Plans/Policies:			
Willamette River Water Treatment Plant 2017 Master Plan Update			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The Water Treatment Plant was built in 2002, but is not built to current seismic standards; • Changes in the seismic design criteria since the WRWTP was constructed in 2002. Given the changes in the USGS data between 2002 and 2008, projected ground accelerations in the region have increased up to 28percent, significantly adding to the structural design requirements; • The preliminary structural analysis identified both structural and non-structural vulnerabilities that may affect plant performance in a regional catastrophic seismic event. This 2017 MPU recommends including seismic retrofits to minimize infrastructure downtime and ensure plant performance after a catastrophic event; • The preliminary life-safety analysis identified issues about building code compliance and structural improvements. This 2017 MPU recommends modifications to support worker safety after a catastrophic seismic event; and • Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> • Gain funding to retrofit/replace Willamette Water Treatment Plant and Intake Facility; and • Partner with appropriate organizations to implement seismic upgrades; and • Seismically retrofit this facility to guarantee continuous operation during and after a natural disaster. 			
Coordinating Organization:		Engineering	
Internal Partners:		External Partners:	
Building		Infrastructure Finance Authority	
Potential Funding Sources:		Estimated cost:	Timeline:
Rate Payers, SRGP, HMA (PDM, HMGP), General Fund		High (\$1,160,000)	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	New Action Item (2018)		
Priority:	High		

* - High Priority Action Item

Earthquake #4

Proposed Action Item:		Alignment with Plan Goals:	
Construct the French Prairie Bridge, including accommodation of emergency vehicle passage.		Protect Life and Property; Augment Emergency Services; Encourage Partnerships for Implementation;	
Alignment with Existing Plans/Policies:			
Bike Ped Master Plan, Parks and Rec Master Plan, Transportation System Plan, Ice Age Tonquin Trail Master Plan, Wilsonville Tourism Development Strategy			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The French Prairie Bridge would fill a critical gap in local and regional multi-modal transportation infrastructure, connecting the Portland metro area and the northern portion of the Willamette Valley, known as the French Prairie region; Provide an alternate, seismically resilient route; to access either side of the Willamette River when I-5 is impeded post-earthquake, hazardous spill, traffic accident, etc.); and Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption <u>2018 Status:</u> In the process of planning and developing preliminary designs for a proposed bicycle/pedestrian/emergency-access bridge across the Willamette River. A new bridge would be built near the historic Boones Ferry location, between the I-5 Boone Bridge and the railroad bridge to the west. http://frenchprairiebridgeproject.org/ 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Gain funding to retrofit/replace French Prairie Bridge; and Partner with appropriate organizations to implement seismic upgrades; and Seismically retrofit this facility to guarantee continuous operation during and after a natural disaster. 			
Coordinating Organization:		Engineering	
Internal Partners:		External Partners:	
Building		ODOT, Metro, Clackamas County	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, Seismic Rehabilitation Grant Program, Hazard Mitigation Assistance Grants		High	<input type="checkbox"/> Short Term (0-2 years) <input checked="" type="checkbox"/> Long Term (2-4+ years) <input type="checkbox"/> Ongoing
Form Submitted by:	New action item		
Priority:	Medium		

Flood #1

Proposed Action Item:		Alignment with Plan Goals:	
Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.		Protect Life and Property; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Flood Ordinance; Zoning Code			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The National Flood Insurance Program provides communities with federally backed flood insurance to homeowners, renters, and business owners, if communities develop and enforce adequate floodplain management ordinances. The benefits of adopting NFIP standards for communities are a reduced level of flood damage in the community and stronger buildings that can withstand floods. According to the NFIP, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance. The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will help reduce the level of flood damage to new and existing buildings in communities while providing homeowners, renters and business owners additional flood insurance protection. <u>2018 Status:</u> Ongoing activity of city. Flood ordinance is current. See Flood section for more information. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Community Assistance Visits (CAV) are scheduled visits to communities participating in the NFIP for the purpose of: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. Actively participate with DLCD and FEMA during Community Assistance Visits. Assess the floodplain ordinances to ensure they reflect current flood hazards and situations and meet NFIP requirements. Coordinate with the county to ensure that floodplain ordinances and NFIP regulations are maintained and enforced. Mitigate areas that are prone to flooding and/or have the potential to flood. These areas include SW Commerce Circle, Sun Place, Rose Lane, and the pathway/parking lot at Inza R. Wood Middle School, Montgomery Way, and Memorial Park. 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
Planning, GIS		Department of Land Conservation and Development; Association of State Floodplain Managers	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund		Low	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Flood #2

Proposed Action Item:		Alignment with Plan Goals:	
Coordinate with the Oregon Department of Transportation (ODOT) to increase the capacity of culverts.		Protect Life and Property; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> In 2008, flooding occurred at culverts and drainage choke points near Sun Place, Commerce Circle, and a pathway near Inza R. Wood Middle School. In the past flooding has occurred along the Willamette River, in Coffee Creek Wetlands, and at choke points that can back up during heavy precipitation events. These problem areas include the backside of SW Commerce Circle, Sun Place (where a La Quinta hotel is located), a pathway at Inza R. Wood Middle School (which has resulted in the parking lot being flooded in the past), and Rose Lane, where the river can back up and come onto the road, causing traffic problems. <u>2018 Status</u>: culvert projects occur annually. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Develop an Intergovernmental Agreement with ODOT Identify undersized culverts and propose mitigation action; Work with business owners to discuss flooding problems; Prioritize construction projects based on criticality of need; and Coordinate with ODOT for funding opportunities. 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
Engineering, Public Works		ODOT, Business community, METRO, Clackamas County, Washington County	
Potential Funding Sources:		Estimated cost:	Timeline:
General Fund, ODOT resources		Medium to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

Flood #3*

Proposed Action Item:		Alignment with Plan Goals:	
Implement the recommendations found in the Stormwater Master Plan.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships for Implementation	
Alignment with Existing Plans/Policies:			
Stormwater Master Plan			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> • The stormwater master plan developed Capital Improvement Projects to address deficiencies in the stormwater system; • The stormwater master plan promotes proper watershed management; and • Stormwater management is a key element in maintaining and enhancing a community's livability. There is a direct link between stormwater and a community's surface and ground waters. Protecting these waters is vital for a great number of uses, including fish and wildlife habitat, recreation, and drinking water. • <u>2018 Status:</u> Stormwater Master Plan was updated in 2012. Capital improvement projects occur annually. 			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
<ul style="list-style-type: none"> • Identify funding sources to implement recommendations. 			
Coordinating Organization:		Natural Resources	
Internal Partners:		External Partners:	
Planning, Public Works		Clackamas County Water Environment Services, METRO, Department of Environmental Quality, Department of Land Conservation and Development, Department of State Lands	
Potential Funding Sources:		Estimated cost:	Timeline:
ODF, operating budgets		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	High		

Severe Weather #1

Proposed Action Item:		Alignment with Plan Goals:	
Reduce negative effects from severe windstorm and severe winter storm events.		Protect Life and Property; Enhance Natural Systems; Augment Emergency Services; Encourage Partnerships & Implementation; Promote Public Awareness	
Alignment with Existing Plans/Policies:			
2018 Status/Rationale for Proposed Action Item:			
<ul style="list-style-type: none"> The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to cause power outages can assist a community in mitigating its overall risk to wind and winter storms. <u>2018 Status</u>: Ongoing activity of city. 			
Ideas for Implementation:			
<ul style="list-style-type: none"> Encourage burial of power lines for existing development; Ensure that there are back up underground lines to major businesses & employers; Develop partnerships to implement programs to keep trees from threatening lives, property, and public infrastructure; and Continue regular tree trimming practices (City focus in right-of-way; private property owners and utility companies take care of trees on their property). 			
Coordinating Organization:		Community Development	
Internal Partners:		External Partners:	
Public Works		PGE, Bonneville Power Administration, private landowners	
Potential Funding Sources:		Estimated cost:	Timeline:
Capital Funds		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	Existing Action Item		
Priority:	Medium		

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; Enhance Natural Systems; Augment Emergency Services; 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:			
The wildfire mitigation action items provide direction on specific activities that organizations and residents in Wilsonville can take to reduce wildfire hazards.			
Ideas for Implementation: CWPP Identified Focus Areas and Priority Actions			
<u>Wildfire Risk Assessment (Ch. 4):</u>			
<ol style="list-style-type: none"> Maintain and update the Fuels Reduction (FR) and Communities at Risk (CAR) maps and databases. Continue to track structure vulnerability data throughout the County through structural triage assessments. Update the Overall Wildfire Risk Assessment as new data becomes available. 			
<u>Hazardous Fuels Reduction and Biomass Utilization (Ch. 5):</u>			
<ol style="list-style-type: none"> Develop and maintain an inventory of potential and successful FR projects by meeting with parks and natural lands managers quarterly. Continue securing funding to implement projects/hire seasonal ODF staff. 			
<u>Emergency Operations (Ch. 6):</u>			
<ol style="list-style-type: none"> Develop and FDB Communications Works Group. Conduct a Conflagration Exercise. 			
<u>Education and Community Outreach (Ch. 7):</u>			
<ol style="list-style-type: none"> Develop Firewise toolkit for CAR's. Create incentives for fuels reduction. Update and distribute the Burn Permitting and Fire Restrictions Brochure. Continue to improve address signage throughout the County. 			
<u>Structural Ignitability Policies and Programs (Ch. 8):</u>			
<ol style="list-style-type: none"> Identify a DTD representative for the WFEP. Improve coordination with Rural Fire Agencies. Integrate WU into Plan Map and include a public outreach strategy. 			
Coordinating Organization:		TVF&R	
Internal Partners:		External Partners:	
Public Works, Parks and Recreation, Natural Resources		Clackamas Fire Defense Board, Oregon Department of Forestry, U.S. Forest Service, U.S. Bureau of Land Management, public land management agencies	
Potential Funding Sources:		Estimated cost:	Timeline:
ODF, operating budgets		Low to High	<input type="checkbox"/> Short Term (0-2 years) <input type="checkbox"/> Long Term (2-4+ years) <input checked="" type="checkbox"/> Ongoing
Form Submitted by:	New Action Item		
Priority:	High (CWPP identified priority actions listed above)		

ATTACHMENT B: PUBLIC INVOLVEMENT SUMMARY

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

To provide the public information regarding the draft NHMP addendum, and provide an opportunity for comment, an announcement (see text below) was announced on the city's [website](#) (including the draft plan and an opportunity to comment) and via social media (NextDoor, Facebook, Twitter). In addition, the City conducted an interview with the local newspaper (Wilsonville Spokesman) but a story was not published. The opportunity to review the draft plan and to comment was left open from December 27, 2018 through January 15, 2019.

During the public review period there were no formal comments provided; however, the draft plan received at least 50 clicks.

City Website Announcement

The screenshot shows the Wilsonville Oregon website. At the top, there is a navigation bar with the city logo, phone number (503-682-1011), contact and subscribe links, a search bar, and social media icons. Below the navigation bar are dropdown menus for RESIDENTS, GOVERNMENT, BUSINESS, and RESOURCES. The main content area features a sidebar on the left with a menu of public works categories: PUBLIC WORKS, WHAT PUBLIC WORKS DOES, ADOPT-A-ROAD, BACKFLOW, BULK WATER METERS, EMERGENCY MANAGEMENT, INDUSTRIAL PRETREATMENT, WASTE WATER TREATMENT PLANT, WATER TREATMENT PLANT, and DOCUMENTS - PUBLIC WORKS. The central content area is titled "Natural Hazards Mitigation Plan Comments" and contains the following text: "In accordance with state and federal law, The City of Wilsonville is required to have a Natural Hazards Mitigation Plan (NHMP) that articulates the City's short- and long-term plans to mitigate potential natural hazards that could occur within our region. These natural hazards include earthquakes, floods, wildfires and severe winter storms. The City's NHMP was developed in concert with the Clackamas County Department of Disaster Management's recent countywide update, and includes input from the City's Engineering, Public Works, Planning and Community Development divisions. This draft plan can be accessed below under "Supporting Documents." The plan is subject to public review and comment before adoption as an addendum to the Clackamas County NHMP. The plan is effective for a five-year period following adoption. For more information, or to submit feedback on this plan before January 15, contact Martin Montalvo, Public Works Operations Manager, at 503-570-1560; montalvo@ci.wilsonville.or.us." Below this text is a "Supporting Documents" section with a link to "Wilsonville National Hazards Mitigation Plan (NHMP) DRAFT (4 MB)". At the bottom of the central area are input fields for "Name", "E-mail Address", and a "Provide Comment by Jan. 15" text area. The right sidebar is titled "Contact" and lists "PUBLIC WORKS" contact information: Phone: 503-682-4092, Fax: 503-682-8816, Emergency/After Hours Phone: 1-866-252-3614, Water Feature Hotline Phone: 503-685-6356, Site Address: 30000 SW Town Center Loop E, Wilsonville, OR 97070, and Mailing Address: 29799 SW Town Center Loop E, Wilsonville, OR 97070. It also lists hours: Monday - Friday 7:30am - 4:30pm and a "View Staff Directory" link.

Social Media Announcements

Natural Hazards Mitigation Plan (NHMP)

In accordance with state and federal law, The City of Wilsonville is required to have a Natural Hazards Mitigation Plan (NHMP) that articulates the City's short- and long-term plans to mitigate potential natural hazards that could occur within our region. This draft NHMP plan is subject to public review and comment before adoption. To See more...



New 16h ago · Subscribers of City of Wilsonville

Reply

Elaine M., Wilsonville · 12h ago **New**
I sure hope we never see a flood like that 😊



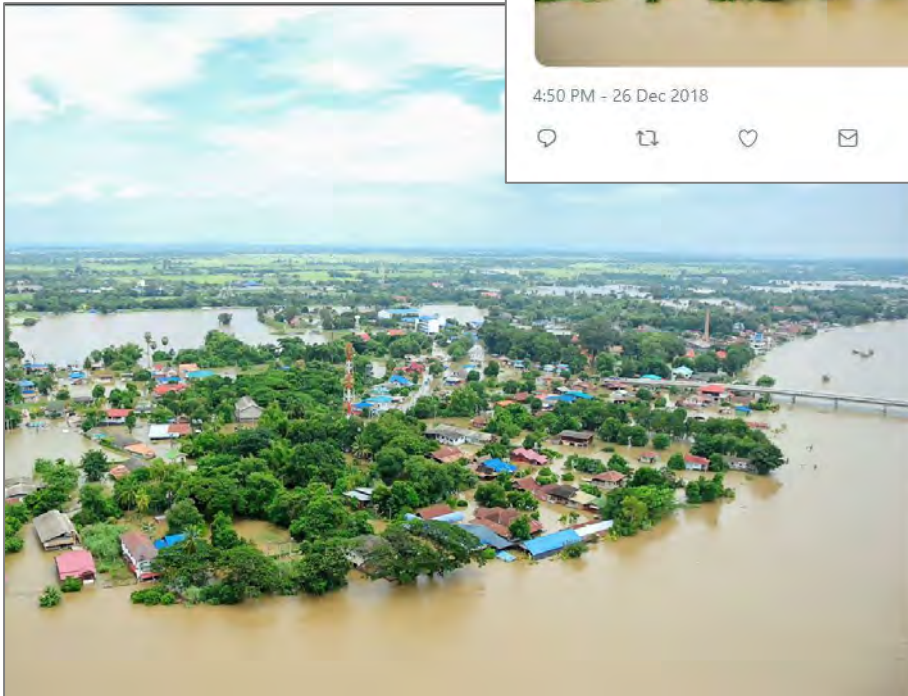
City of Wilsonville
@WilsonvilleOR

Following

The City is required to have a Natural Hazards Mitigation Plan (NHMP) that articulates the City's plans to mitigate potential natural hazards. This draft plan is subject to public review and comment before adoption. To review or comment, visit bit.ly/2EKMinb



4:50 PM - 26 Dec 2018



comment before adoption. To review, comment (by Jan. 15) or learn more about the plan, visit <http://bit.ly/2EKMinb>

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4 1 Comment 1 Share

Like Comment Share

Most Relevant

Karen Dase Let the residents know before a testing! Is there a schedule for tests?

Like Reply Message 11h

Wilsonville - Local Government
No tests. Just sharing a plan that guides preventative measures the City would develop to minimize loss of life and property damage should an event occur.

Like Reply Commented on by William Evans 1h

Write a comment