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

Photo Credit: City of Wilsonville

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Prepared for
The City of Wilsonville

WILSONVILLE
OREGON

Updated:

June 17, 2019 (Resolution # 2755)
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This Natural Hazard Mitigation Plan was prepared by:

CLACKAMAS COUNTY

UNIVERSITY OF OREGON | School of Planning, Public Policy and Management | Institute for Policy Research and Engagement

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Table of Content

List of Tables

List of Figures

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 **[DATE TBD, 2024].** FEMA Region X approved the Clackamas County NHMP on **[DATE TBD, 2024]** and the City's addendum on **[DATE TBD, 2024].** 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 **[DATE TBD-1, 2024].**

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.*

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.

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 Public Works Director, Delora Kerber 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 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 Wilsonville HMAC was comprised of the following representatives:

- Convener, Delora Kerber, Public Works Director
- Martin Montolvo, Public Works Operations Manager
- Kerry Rappold, Natural Resources Manager
- Planning Division Staff

The HMAC served as the local review body for the NHMP update.

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 convener will serve as the conveners 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;
- Evaluating effectiveness of the NHMP at achieving its purpose and goals (use Table 26, Volume I, Section 4, as one tool to help measure effectiveness); and
- Documenting successes and lessons learned during the year.

The HMAC will be responsible for the following activities described in detail in Volume I, Section 4:

The jurisdiction will utilize the same implementation and maintenance process identified in Volume I, Section 4.

The jurisdiction will provide continued public participation during the plan maintenance process through periodic presentations to elected officials, public meetings, postings on social media, and/or through interactive content on the jurisdiction's website (for more information see Volume I, Section 4).

The jurisdiction will utilize the same action item prioritization process as the County (for more information see Volume I, Section 4 and Volume III, Appendix E).

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.

Capability Assessment

The Capability Assessment identifies and describes the ability of the City of Wilsonville to implement the mitigation strategy and associated action items. Capabilities can be evaluated through an examination of broad categories, including: existing authorities, policies, programs, funding, and resources.

Existing Authorities

Hazard mitigation can be executed at a local scale through three (3) methods: integrating hazard mitigation actions into other local planning documents (i.e., plan integration), adopting building codes that account for best practices in structural hardening, and codifying land use regulations and zoning designations that prescribe mitigation into development requirements. The extent to which a municipality or multi-jurisdictional effort leverages these approaches is an indicator of that community's capabilities.

Comprehensive Plan

Oregon's Statewide Planning Goal 7 requires comprehensive planning within every jurisdiction that is designed to reduce risks to people and property from natural hazards.

The Wilsonville Comprehensive Plan is an official statement of the goals, policies, implementation measures, and physical plan for the development of the city. The plan documents the city's approach to the allocation of available resources for meeting current and anticipated future needs. It was revised in its entirety in 2000 and updated in June 2020 (October 2018 version).

The Comprehensive Plan includes implementation measures related to flooding (implementing the NFIP and Title 3 of Metro's Urban Growth Boundary Functional Plan), storm drainage, water provision and water conservation, fire protection, etc. Policy 4.1.5 includes implementation measures to protect people and property from natural hazards.

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.[1]

Planned updates to the jurisdiction's Goal 7 element or its broader comprehensive plan will reflect the data and findings within this NHMP and integrate analyses of future climate and natural hazard impacts into the community's long-range plans.

Land Use Regulations

Existing land use policies that define zoning and address hazardous conditions provide another source of mitigation capability.

Title 3 of the Metro Urban Growth Management Functional Plan

This policy requires the city to balance any fill in the floodplain with a corresponding cut that excavates an equal amount of material. In addition, Title 3 requires the city to regulate the area of inundation from the 1996 flood in addition to the area with a 1% chance of flooding as identified on National Flood Insurance Program (NFIP) maps.

Municipal Development Codes

The Community Development Department includes divisions responsible for planning, building, engineering, natural resources, economic development, and urban renewal. The Community Development Department implements the policies and master plans of the Wilsonville Comprehensive Plan to guide growth and ensure that appropriate infrastructure (roads, utility capacity, parks, public facilities, etc.) is available for predicted city expansion needs. They work closely with the County and neighboring jurisdictions to ensure plans are aligned.

The Wilsonville Planning and Land Development Ordinance, otherwise known as the Development Code, is Chapter 4 of the Wilsonville Municipal Code.

Section 4.172 Flood Plain Regulations These regulations were last updated in 2018. They regulate the 100-year flood plain identified by the Federal Insurance Administration (FIA) in the "Flood Insurance Study for Clackamas County and Incorporated Areas dated effective June 17, 2008, and displayed on FIA Floodway and Flood Insurance Rate Maps dated effective June 17, 2008. They ensure the City and its residents and businesses, continued eligibility in the National Flood Insurance Program by complying with the requirements of the National Flood Insurance Act of l968 and the Flood Disaster Protection Act of l973. Their flood prevention code section is based on the Oregon Model Flood Hazard Prevention code, which includes provisions addressing substantial improvement/substantial damage.

Wilsonville Code Chapter 8 - Environment This section of the City code details City Stormwater regulations as they apply to system users, spills, sediment and erosion control, and other pertinent information.

Structural Building Codes

The Oregon Legislature recently adopted updated building codes for both residential (2023 adoption) and commercial structures (2022) since the last update of this Plan. These building codes are based on the 2021 version of the International Building Code, International Fire Code, and International Existing Building Code.

The Wilsonville Community Development Department administers and enforces the 2022 Oregon Fire Code, the 2022 Oregon Structural Specialty Code, Mechanical Specialty Code, Plumbing Specialty Code,

[1] Wilsonville, Oregon. 2015 Development Code. § 4.139.00 thru 4.139.11

Electrical Specialty Code, and Residential. Specialty Code As a result, both new residential and commercial structures will be required to build according to the latest seismic and wind hardening standards in addition to requiring fire resistant building materials for those structures constructed in proximity or within the WUI.

Public Works

The City of Wilsonville Public Works Department is composed of the divisions responsible for maintaining the City's stormwater system, wastewater system, water system, streets, and facilities. Much of their work is associated with the reduction of hazards to the community and the implementation of resilience measures.

City Administration

The City Council of Wilsonville has the responsibility of developing and adopting the annual city budget. Integrating hazard mitigation goals and projects into the annual budget is key to implementing the plan. The City Council tries to broadly address resilience planning needs while it determines city and departmental priorities and looks for multiple-impact projects wherever possible. They also work with staff to apply for federal and state grant funding to pursue larger projects that are outside of general fund capacity.

Policies and Programs

This Plan directs Wilsonville and Clackamas County to explore integration into other planning documents and processes. Wilsonville has made significant progress in integrating the NHMP into its portfolio of planning processes and programs over the last five years.

Wastewater Treatment Plant Master Plan, 2023

The Wastewater Treatment Plant Master Plan identifies improvements required through the planning period (through 2045) to comply with requirements of the plant's National Pollutant Discharge Elimination System (NPDES) permit and potential future regulatory requirements, while accommodating growth identified in the 2018 City of Wilsonville Comprehensive Plan. Proposed improvements are recommended to three buildings within the Wastewater Treatment Plant to address seismic issues identified in this study.

Total Maximum Daily Loads (TMDLs) Implementation Plan, 2020

Total Maximum Daily Loads define the amount of pollutants that can be present in a water body without causing water quality criteria to be exceeded. Extensive water quality monitoring and modeling (for temperature, bacteria, and mercury) has been completed to establish Total Maximum Daily Loads for the Willamette River. The City's first Willamette River TMDL Implementation Plan was approved by the Oregon Department of Environmental Quality (DEQ) in 2008. The City submitted its updated TMDL Implementation Plan to the DEQ in 2020.

NPDES MS-4 Permit

The Stormwater division must ensure that the work is done in compliance with the National Pollutant Discharge Elimination System (NPDES) Permit. This Division is committed to an ongoing education program for its employees and the community to keep up with the evolving changing technology, rules, and regulations.

Community Wildfire Protection Plan

The Clackamas County Community Wildfire Protection Plan (CWPP) will be incorporated into this Plan as a functioning annex. The NHMP will also be integrated into the City's Capital Improvement Plan, to be adopted by early 2024.

National Flood Insurance Program

Wilsonville participates in the National Flood Insurance Program. The Engineering (administration) and Building (enforcement) Departments are responsible for administering the day-to-day activities of the city's floodplain program.

Specifically, the floodplain manager:

- maintains and administers Wilsonville's floodplain regulations;
- reviews and issues floodplain development permits;
- maintains elevation certificates for all new and substantially improved structures (and maintains an extensive database of historic elevation certificates);
- ensures that encroachments do not occur within the regulated floodway;
- implements measures to ensure that new and substantially improved structures are protected from flood losses;
- maintains floodplain studies and maps and makes this information available to the public;
- maintains a flood information website with digital flood insurance rate map (DFIRM) data;
- conducts site visits to assess conditions and provide technical assistance to the public;
- maintains a library of historical flood related information;
- informs the public of flood insurance requirements; and
- conducts outreach and training about flood hazards and development within the floodplain.

Personnel

The following Wilsonville personnel have assignments related to natural hazard mitigation planning and implementation:

Emergency Management: Public Works Director, Delora Kerber

Public Information Officer: Communications and Marketing Director, Bill Evans

Floodplain Manager: Community Development Director (Chris Neamtzu)

Capital improvement planning: City Engineer (Zach Weigel)

Capital improvement execution: City Engineer (Zach Weigel)

Wilsonville does not have any employees solely designated to Emergency Management or Mitigation. These personnel integrate hazards and resilience planning into their greater work programs to the best of their abilities. However, there is limited capacity to expand upon their capabilities or workloads.

Capital Projects

Wilsonville has implemented recommendations from the last NHMP into its capital improvement projects, including:

The following mitigation-related or resilience projects have been completed:

- 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. O
- DOT has seismically upgraded Boone Bridge, but specifics on this project are not known.
- The Villebois development created 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.
- The Rivergreen Stormwater Outfall project addressed runoff and groundwater seepage that caused significant erosion on the Willamette Riverbank. 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.

Ongoing projects that enhance the City's resilience include:

- Stormwater Master Plan (to be complete in 2024)
- City of Wilsonville Public Works Complex – includes EOC, two seismically resilient buildings
- French Prairie Bridge Project – not constructed, concept only
- Water Treatment Plant Expansion
- Water Intake Facility – hardened banks of Willamette and seismic
- West Side Level B Reservoir and Off-Site Improvements – design (30%), construction in summer/Fall 2024.
- 5th Street/Kinsman Extension
- Meridian Middle School
- Boeckman Road Corridor Project – bridge over Boeckman Creek (landslide area).
- Boeckman Canyon Sanitary Sewer project -- currently under construction
- Primary School in Frog Pond – Frog Pond Elementary School (under construction open AY24-25)

Capital Resources

Wilsonville maintains several capital resources that have important roles to play in the implementation of the natural hazard mitigation plan.

Communication Towers: Clackamas County cellular tower C-800 (emergency communications only) on reservoir site.

Critical facilities with power generators for use during emergency blackouts include: City Hall, Public Works, Police Department, Transit Department, Water Plan, Wastewater Plant. All facilities have e-power (emergency generator power). All but library and community center.

Food pantries include: Wilsonville Community Sharing – tenant in existing building and will become one in another building (part of Oregon Food Bank)

Fueling storage: SMART Fleet Complex

Findings

Several important findings from this capability assessment informed the design of the Plan's mitigation strategy and aided in prioritizing action items.

Staffing Limitations and Capacity

Wilsonville staff are assigned hazard mitigation responsibilities as a (small) part of their larger job responsibilities. Restricted capacity reduces the breadth of the programming the community can undertake in any year. The city relies upon its relationships with the County and other cities within its region to expand its operations.

Reliance upon outside funding streams and local match requirements

Wilsonville operates on a limited budget with many conflicting priorities. This leaves few opportunities for using local financial resources to implement hazard mitigation work. They lean heavily upon state and federal grant funds as the primary means for securing mitigation funding. Hazard mitigation grants such as HMGP and BRIC require 10-25% local funding match, as well as extra staff capacity and expertise to navigate the application process and manage the funding.

Leveraging Partnerships with Public and Nonprofit Entities

Regional planning displayed in Community Wildfire Protection Planning process demonstrates the City's ability to effectively share information and identify priority needs.

Mitigation Plan Mission

The 2024 HMAC reviewed the previous NHMP Mission and Goals in comparison to the State NHMP Goals and determined that they would make necessary updates to include references to community lifelines and to advance equity and inclusion in hazard mitigation.

The NHMP mission states the purpose and defines the primary functions of 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 mission of the NHMP is to:

Enhance county resiliency and capacity to address natural hazards by promoting sound public policy and effective mitigation strategies designed to equitably reduce risk and impacts on community members, community lifelines, historic and cultural resources property, and ecological systems.

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 residents and public and private partners can take while working to reduce the 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.

Meetings with the HMAC, previous hazard event reports, and the previous NHMPs served as methods to obtain input and identify priorities in developing goals for reducing risk and preventing loss from natural hazards.

All the 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.

Goal 1: Protect Life and Property

- Develop and implement mitigation and climate adaptation projects and policies that aid in protecting lives by making homes, businesses, community lifelines, and other property more resilient to natural hazards and impacts from climate change.
- Establish mitigation projects and policies that minimize losses and repetitive damages from recurring disasters while promoting insurance coverage for severe hazards
- Improve hazard identification and risk assessment information to inform and provide recommendations for enhanced resilience in new development decisions, and promote preventative measures for existing development in areas vulnerable to natural hazards.

Goal 2: Enhance Natural Systems

- Incorporate natural hazard mitigation planning and activities into watershed planning, natural resource management, natural systems enhancement, and land use planning to protect life, property, and ecological system.

Goal 3: Augment Emergency Services

- Strengthen emergency operations by enhancing communication, collaboration, and coordination of natural hazard mitigation activities and policies across agencies at all levels and regions of government, sovereign tribal nations, and the private sector.

Goal 4: Encourage Partnerships for Implementation

- Improve communication, coordination, and participation among and with public agencies, community members, community lifelines, and private sector organizations to prioritize and implement hazard mitigation activities and policies.
- Enhance efforts toward identifying and optimizing opportunities across state agencies, surrounding communities, and private entities for resource sharing, mutual aid, and funding sources/support.

Goal 5: Promote Public Awareness

- Build community resilience and awareness and reduce the effects of natural hazards and climate change through community-wide engagement, collaboration, resource-sharing, learning, leadership-building, and identifying mitigation project-related funding opportunities.

Goal 6: Advance Equity and Inclusion

- Mitigate the inequitable impacts of natural hazards by prioritizing the directing of resources and efforts to build resilience and engagement in the most vulnerable communities least able to prepare, respond, and recover.
- Strengthen efforts aimed at increasing engagement, outreach, and collaboration with community and cultural organizations and agencies that are dedicated to providing services and support to vulnerable and underserved communities.

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) was 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 2023 update process, the City re-evaluated their mitigation strategy (action items). During this process action items were updated, noting if the action is complete, not complete and whether the actions were still relevant; any new action items were identified at this time (see Attachment B for more information on changes to action items).

Mitigation Successes

The community has several examples of mitigation success including the following projects funded through FEMA Hazard Mitigation Assistance and the Oregon Infrastructure Finance Authority's Seismic Rehabilitation Grant Program[2].

FEMA Funded Mitigation Successes

- None identified.

Seismic Rehabilitation Grant Program Mitigation Successes

- None identified.

Other Mitigation Successes

- 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.
- DOT has seismically upgraded Boone Bridge, but specifics on this project are not known.

Action Items

Table WA-1 documents the title of each action along with, the lead organization, partners, timeline, cost, and potential funding resources. 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 with orange 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 changes to actions since the previous NHMP.

[2] 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 WA-1 Action Items

		Impacted Hazard									Implementation and Maintenance			
Action Item #	Statement	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm	Lead/ Partners	Timeline	Potential Funding Source	Estimated Cost
1	Develop public education programs to inform the public about methods for mitigating the impacts of natural hazards.	X	X	X	X	X	X	X	X	X	Planning/ TVF&R, HMAC	Ongoing	Local Resources. DLCD TA, FEMA HMA	Low
2	Continue vegetation management throughout the city.							X	X	X	Natural Resources/ Planning, Public Works, Parks	Ongoing	Local Resources. DLCD TA, FEMA HMA	Medium
3	Conduct seismic evaluations of the Community Center and other critical and essential facilities and implement appropriate structural mitigation strategies.		X								Community Development, Public Works/ Building, Engineering	Long	Local Resources. DLCD TA, FEMA HMA	Medium
4	Perform non-structural mitigation on public facilities to improve life safety standards.		X								Human Resources/ Building, Engineering	Ongoing	Local, State, Federal Grants and BRIC	Low to High
5	Seismically retrofit Willamette Water Treatment Plant and Intake Facility		X								Engineering/ Building, Willamette Intake Facility Commission	Short	Local, State and Federal Grants and BRIC	High
6	Complete the French Prairie Bridge, including accommodation of emergency vehicle passage.		X								Engineering/ Building	Long	Local and State	High

		Impacted Hazard									Implementation and Maintenance			
Action Item #	Statement	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm	Lead/ Partners	Timeline	Potential Funding Source	Estimated Cost
7	Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.				X						Community Development/ GIS, Planning	Ongoing	Local Resources. DLCD TA, FEMA HMA (FMA)	Low
8	Implement the recommendations found in the Stormwater Master Plan Update. Including, but not limited to: 1. Memorial Park Lift Station Relocation Project 2. Regional Park 7 and 8 Level Spreader 3. Charbonneau Stormwater Improvements, 4. Meridian Creek Culvert Replacement				X						Natural Resources/ Planning, Public Works	Ongoing	Local, State, Federal Grants and BRIC	Medium to High
9	Reduce negative effects from severe windstorm and severe winter storm events.								X	X	Community Development/ Public Works	Ongoing	Local Resources, FEMA HMA (FMA)	Low to High
10	Remove hazardous trees identified in the systemwide hazardous tree evaluation.							X	X	X	Community Development/ Public Works	Short	Local Resources, FEMA TA, FEMA HMA	Medium
11	Coordinate wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan.							X			TVF&R/ Public Works, Parks and Recreation, Natural Resources	Ongoing	Local Resources, FEMA HMA, CWDG	Low to High

Source: Wilsonville NHMP HMAC, updated 2023
Cost: Low (less than $50,000), Medium ($50,000-$100,000), High (more than $100,000)
Timing: Ongoing (continuous), Short (1-2 years), Medium (3-5 years), Long (5 or more years)
Priority Actions: Identified with orange highlight

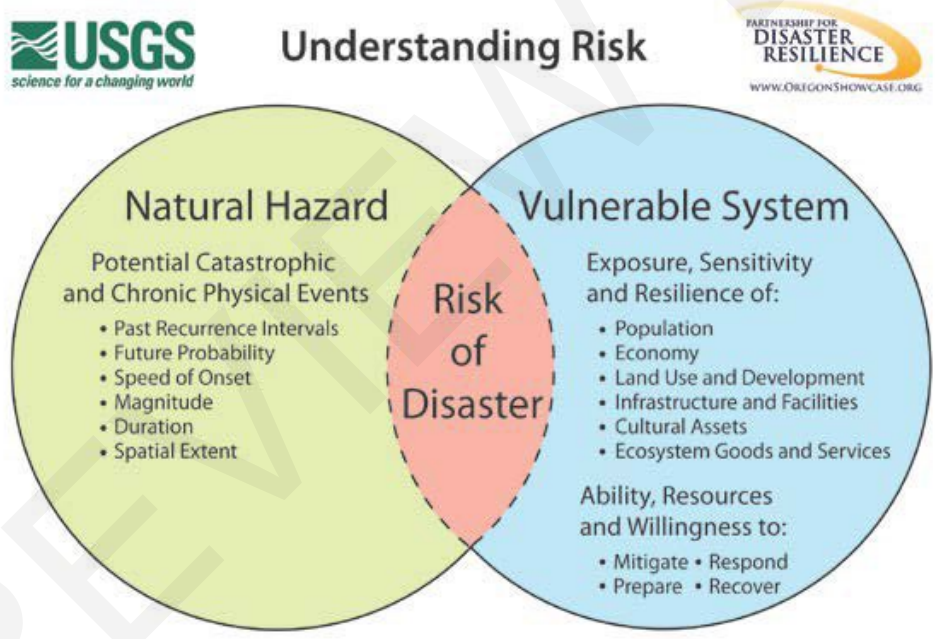
Risk Assessment

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



Source: USGS- Oregon Partnership for Disaster Resilience Research Collaboration, 2006

Hazard Analysis

The Wilsonville 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 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 (extreme heat) rank as the top hazard threats to the City (Top Tier). Winter storm, wildfire, drought, and windstorm, comprise the next highest ranked hazards (Middle Tier), while flood, volcanic event, and landslide comprise the lowest ranked hazards (Bottom Tier).

Table WA-2 Hazard Analysis Matrix

Hazard	History	Vulnerability	Maximum Threat	Probability	Total Threat Score	Hazard Rank	Hazard Tiers
Earthquake - Cascadia	2	45	100	35	182	1	*Top Tier*
Earthquake - Crustal	6	50	100	21	177	2	
Extreme Heat Event	16	35	70	56	177	3	
Winter Storm	16	30	70	49	165	4	*Middle Tier*
Wildfire	12	25	70	35	142	5	
Drought	10	15	50	56	131	6	
Windstorm	14	15	50	42	121	7	
Flood	8	15	30	42	95	8	*Bottom Tier*
Volcanic Event	2	15	50	7	74	9	
Landslide	6	15	20	21	62	10	

Source: Wilsonville HMAC, 2023.

Community Characteristics

Table WA-3 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.

The city is on Interstate 5 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.[3]

Population, Housing, and Income

Wilsonville has grown substantially since its incorporation in 1969 and has an area today of 7.5 square miles. It is in the western region of Clackamas County, located approximately 26 miles south of the Washington border and southwest of the City of Portland. The City is within the Willamette River watershed.

Between 2016 and 2022 the City grew by 3,574 people (15%; as of 2022 the population is 27,414). Between 2022 and 2045 the population is forecast to grow by 11% to 30,566.

Most of the population is White/Caucasian (73%) and about 18% of the population is Hispanic or Latino. The poverty rate is 9% (10% of children under 18, 10% for people 65 and older), 6% do not have health insurance, and 51% of renters pay more than 30% of their household income on rent (36% for owners). About 46% of the population has a bachelor's degree or higher (5% do not have a high school degree). Approximately 10% of the population lives with a disability (35% of population 65 and older), and 39% are either below 15 (22%) or over 65 (17%) years of age. About 13% of the population are 65 or older and living alone and 7% are single parents.

The City includes a diversity of land uses but is zoned primarily residential. About 53% of housing units are single-family, 45% are multifamily, and 2% are mobile homes. Less than five percent of homes (3%) were built before 1970; 69% were built after 1990. Newer homes are more likely to be built to current seismic, flood, wildfire, and other hazard standards. Almost two-thirds (48%) of housing units are owner occupied, 47% are renter occupied, less than 1% are seasonal homes, and 4% are vacant.

Transportation and 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. Thirteen percent (13%) of renters and 1% of owners do not have a vehicle. Most workers drive alone to work (72%); 12% carpool, 2% use public transit, 2% either walk or use a bicycle, and 10% work at home. 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

[3] "Monthly Average for Wilsonville, OR" The Weather Channel Interactive, Inc. Retrieved November 1, 2018.

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 on Willamette River where it 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. About 49% of the resident population 16 and over is in the labor force (12,714 people) and are employed in a variety of occupations including professional (29%), management, business, and financial (19%), sales (12%), office and administrative (12%), and construction, extraction, and maintenance (7%) occupations.

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.

Most workers residing in the city (85%, 10,114 people) travel outside of the city for work primarily to Portland and surrounding areas.[4] A significant population of people travel to the city for work, (92% of the workforce, 19,832 people) primarily from Portland and surrounding areas.[5]

[4] U.S. Census Bureau. LEHD Origin-Destination Employment Statistics (2002-2021). Longitudinal-Employer Household Dynamics Program, accessed on January 8, 20243 at https://onthemap.ces.census.gov.

[5] Ibid.

Table WA-3 Community Characteristics

Population Characteristics		Population Growth
2016 Population Estimate	23,740	
2022 Population Estimate	27,414	15%
2045 Population Forecast*	30,566	11%
Race		
American Indian and Alaska Native		1%
Asian		4%
Black/ African American		2%
Native Hawaiian and Other Pacific Islander		1%
White		73%
Some Other Race		< 1%
Two or More Races		5%
Hispanic or Latino/a (of any race)		18%
Limited or No English Spoken	1,085	4%
Vulnerable Age Groups		
Less than 5 Years	1,367	5%
Less than 15 Years	4,490	17%
65 Years and Older	3,820	15%
85 Years and Older	616	2%
Age Dependency Ratio		0.47
Disability Status (Percent age cohort)		
Total Disabled Population	2,564	10%
Children (Under 18)	102	2%
Working Age (18 to 64)	1,171	8%
Seniors (65 and older)	1,291	35%

Household Characteristics		
Housing Units		
Single-Family (includes duplexes)	5,681	53%
Multi-Family	4,863	45%
Mobile Homes (includes RV, Van, etc.)	163	2%
Household Type		
Family Household	6,327	62%
Married couple (w/ children)	2,092	20%
Single (w/ children)	754	7%
Living Alone 65+	1,364	13%
Year Structure Built		
Pre-1970	357	3%
1970-1989	2,968	28%
1990-2009	5,078	47%
2010 or later	2,304	22%
Housing Tenure and Vacancy		
Owner-occupied	5,188	48%
Renter-occupied	5,073	47%
Seasonal	52	< 1%
Vacant	394	4%
Vehicles Available (Occupied Units)		
No Vehicle (owner occupied)	55	1%
Two+ vehicles (owner occupied)	3,775	73%
No Vehicle (renter occupied)	638	13%
Two+ vehicles (renter occupied)	2,275	45%

Income Characteristics		
Households by Income Category		
Less than $15,000	887	9%
$15,000-$29,999	788	8%
$30,000-$44,999	1,089	11%
$45,000-$59,999	957	9%
$60,000-$74,999	1,136	11%
$75,000-$99,999	1,046	10%
$100,000-$199,999	3,206	31%
$200,000 or more	1,152	11%
Median Household Income		$78,508
Gini Index of Income Inequality		0.43
Poverty Rates (Percent age cohort)		
Total Population	2,303	9%
Children (Under 18)	476	10%
Working Age (18 to 64)	1,474	10%
Seniors (65 and older)	353	10%
Housing Cost Burden (Cost > 30% of household income)		
Owners with a Mortgage	1,315	36%
Owners without a Mortgage	367	24%
Renters	2,597	51%

Employment Characteristics		
Labor Force (Population 16+)		
In labor Force (% Total Population)	12,714	49%
Unemployed (% Labor Force)	764	6%
Occupation (Top 5) (Employed 16+)		
Professional & Related	3,652	29%
Management, Business, & Financial	2,405	19%
Sales & Related	1,546	12%
Office & Administrative	1,532	12%
Construction, Extraction, & Maint.	848	7%
Health Insurance		
No Health Insurance	1,437	6%
Public Health Insurance	6,690	27%
Private Health Insurance	19,468	80%
Transportation to Work (Workers 16+)		
Drove Alone	9,034	72%
Carpooled	1,535	12%
Public Transit	236	2%
Motorcycle	23	< 1%
Bicycle/Walk	301	2%
Work at Home	1,306	10%

Source: U.S. Census Bureau, 2016-2021 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", METRO 2040 Population Distributed Forecast (2021, Exhibit A to Ordinance 21-1457).
Note: ACS 5-year estimates represent average characteristics from 2012-2016 or 2017-2021. Sampling error may result in low reliability of data. This information or data is provided with the understanding that conclusions drawn from such information are the responsibility of the user. Refer to the original source documentation to better understand the data sources, results, methodologies, and limitations of each dataset presented.

Community Lifelines

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of the city. Community Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function. Mitigating these facilities will increase the community's resilience.

The community lifelines identified below were identified by the City of Wilsonville. This integrated network of assets, services, and capabilities are used day-to-day to support the recurring needs of the community and enable all other aspects of society to function. Decisive intervention (e.g., rapid re-establishment or employment of contingency response solutions) is required to maintain/reestablish these facilities and services following a hazard incident.

Critical Facilities

Facilities that are critical and essential 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-4 includes critical facilities identified in the DOGAMI Risk Report (2024) and assumed impact from individual hazards. Facilities listed in yellow to be updated by DOGAMI in March, 2024.

Table WA-4 Critical Facilities in Wilsonville

Critical Facilities by Community	Flood 1% Annual Chance	CSZ 9.0 Earthquake Moderate to Complete Damage	Canby-Molalla Fault Mw-6.8 Moderate to Complete Damage	Landslide High and Very High Susceptibility	Wildfire High or Moderate Risk
	Exposed	>50% Prob.	>50% Prob.	Exposed	Exposed
Boeckman Creek Primary School	-	X	X	-	-
Boones Ferry Primary School	-	-	-	-	-
Geneva Health Center and Urgent Care	-	-	X	-	-
Inza R. Wood Middle School	-	X	X	-	-
Lowrie Primary	-	-	-	-	-
Meridian Creek Middle	-	-	-	-	-
Tualatin Valley Fire and Rescue - Station 52	-	-	X	-	-
Tualatin Valley Fire and Rescue - Station 54					
Tualatin Valley Fire and Rescue - Station 56	-	-	X	-	-
Victory Academy	-	X	X	-	-
Wilsonville High School	-	X	X	-	-
Wilsonville Public Works Complex (EOC #1)	-	-	X	-	-
City Hall (EOC #2)	-	X	X	-	-
Willamette River Water Treatment Plant	-	X	X	-	-
Wilsonville Sewage Treatment	-	X	X	-	-

Source: DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (O-24-XX, September 2023 Draft), Table A-24.

Additional Critical Facilities not included in the DOGAMI Risk Report:

- Fleet Services
- Police Station
- Spring Ridge at Charbonneau (southeast shelter

Critical Infrastructure

Infrastructure that provides necessary services for emergency response include:

Arterial Roads:

- I-5
- 95th Avenue
- Barber Street
- Boberg Road
- Boeckman Road
- Boones Ferry Road
- Brown Road
- Canyon Creek Road
- Coffee Lake Drive
- Day Road
- Elligsen Road
- 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)
- Creek Lane Bridge
- I-5/Wilsonville Road, Boeckman Road, and Elligsen Road overpasses
- Wilsonville Road/Boeckman Creek Bridge

Other critical infrastructure:

- Charbonneau Reservoir
- City wells
- Communication Tower
- Communication Tower – Pioneer Court
- Communication Tower -- Villebois
- Communication Tower
- Electric substation
- Freight tracks
- First Student Fleet & Dispatch
- Kinder Morgan Gas Line
- Level B Reservoir
- Level C Reservoir
- Northwest Natural Gas Line
- Power lines
- Pump stations
- Republic Waste Services
- SMART Transit Facility
- Wastewater Treatment Plant
- Water Treatment Plant – Arrowhead Creek Lane

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: community gathering places, commercial centers, and other public facilities such as school fields.

Schools

- Arts and Technology High
- Boeckman Creek Primary School
- Boones Ferry Primary School
- Clackamas Community College

- Frog Pond Elementary
- Inza R. Wood Middle School
- Learning Tree Pre-school (to 4th grade)
- Lowrie Primary School
- Mentor Child Development Center
- Meridian Creek Middle School
- Oregon Institute of Technology
- Wilsonville High School

Pharmacies

- McKesson HBOC distribution center
- Rite Aid
- Rite Aid distribution center
- Walgreens

Food Providers

- Costco (+ pharmacy)
- Fred Meyer's (+ pharmacy)
- Safeway
- Sysco
- Target (+ pharmacy)

Other Essential Facilities

- Coffee Creek Correctional Facility
- Community Center
- Library
- Parks and Recreation Facility
- Providence Medical Facility

Environmental Facilities

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

- Arrowhead Creek
- Basalt Creek
- Boeckman Creek
- Boeckman Creek Crossing Trail
- Boones Ferry Park (cultural/historic asset)
- Canyon Creek
- Canyon Creek Park
- Charbonneau Golf Course
- Coffee Creek
- Coffee Creek Wetlands
- Community Garden
- Courtside Park
- Graham Oaks Nature Park and Trailhead (cultural/historic asset)
- Hathaway Park
- Memorial Park (cultural/historic asset)
- Meridian Creek
- Merryfield Park
- Palermo Park
- River Fox Park
- Sofia Park
- Town Center Park (cultural/historic asset)
- Tranquil Park
- Villebois park system
- Willamette River
- Willamette River Water Treatment Plant Park
- Willow Creek Landover Park

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:

- Coffee Creek Correctional Facility
- Day care facilities
- Schools (see list under essential facilities)

Senior Care Facilities

- Avalon Adult Center
- Brookdale
- Marquis Care at Wilsonville
- Springridge Court at Charbonneau
- The Wilsonville

Other Facilities

- Charleston at Villebois
- Creekside Woods
- Rainwater Gardens at Villebois
- Renaissance at Villebois

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: Kinder Morgan Pipeline, Northwest Natural Pipeline, and Sysco.

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:

- APCON, Inc
- Argyle Square
- Charbonneau Village Town Center
- Coherent
- Crimson Trace Corporation
- DW Fitz
- FLIR Systems
- FOODesign Machinery and Systems, Inc
- Georgia Pacific
- Kinetics
- Mentor Graphics
- Old Town Square
- OrePac
- Pacific Foods Distribution Center
- Pacific Pride
- 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
- Wilsonville Concrete
- Xerox Corporation

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 makes the community 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.

Hazard Characteristics

Drought

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

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 Table WA-4.

Future Projections

According to the Oregon Climate Change Research Institute "Future Climate Projections, Clackamas County,"[6] drought, as represented by low summer soil moisture, low spring snowpack, low summer runoff, and low summer precipitation, is projected to become more frequent in Clackamas County by the 2050s.

Increasingly frequent droughts will have economic and social impacts upon those who depend upon predictable growing periods (ranches, farms, vineyards, gardeners) as well as upon the price and availability of fresh vegetables. It may also stress local jurisdiction's ability to provide water for irrigation or commercial and household use.

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.*

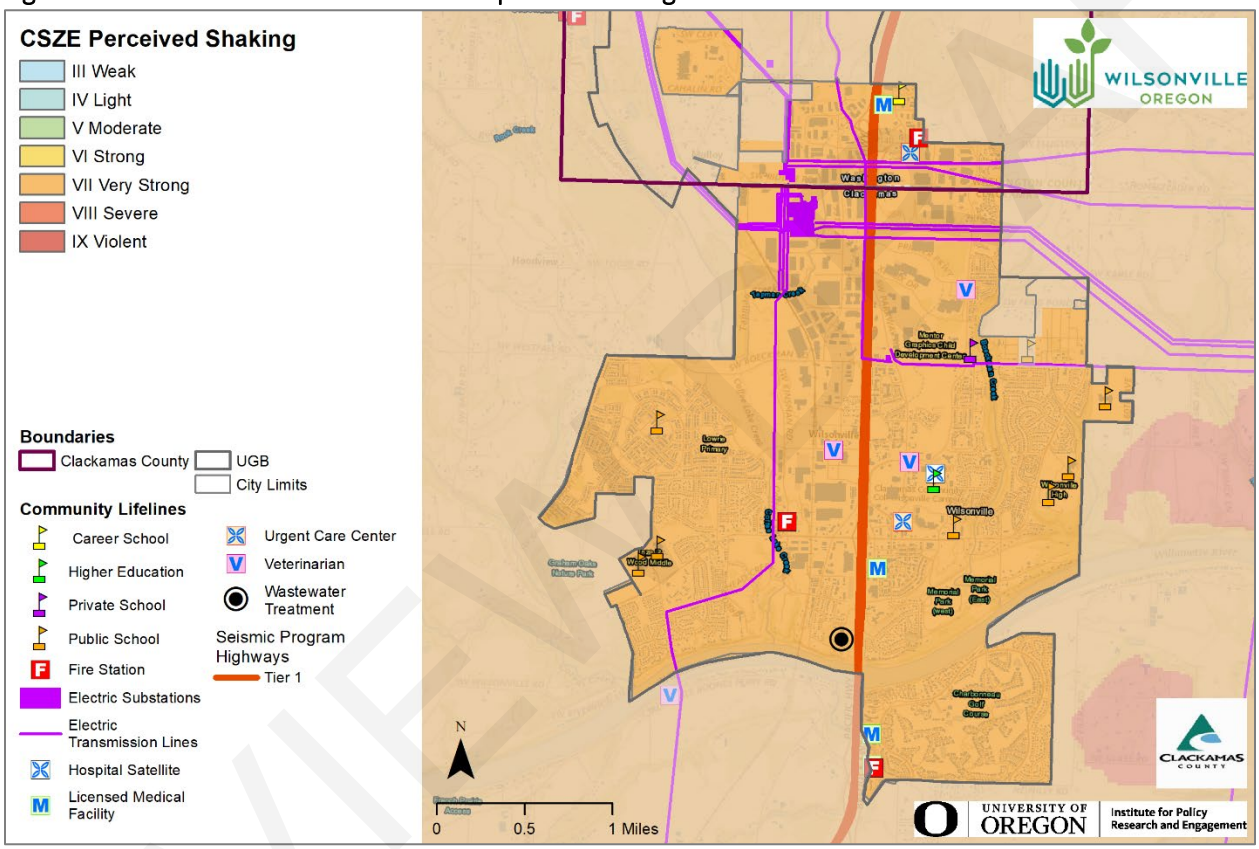
Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Wilsonville as well. The causes and characteristics of an earthquake event are appropriately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

[6] Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

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-Wilsonville Fault 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 around the city will experience severe shaking (light red) (shown by the red northeast corner) in a CSZ event.

Figure WA-2 Cascadia Subduction Zone Expected Shaking



Source: Map created by Oregon Partnership for Disaster Resilience.
Data: Oregon Department of Geology and Mineral Industries. Preparedness Framework Implementation Team (IRIS v3).
Note: To view hazard detail click this link 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]

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

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**. *The probability rating decreased and the vulnerability rating did not change since the previous version of this NHMP.*

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.

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.

Canby-Molalla Fault Zone

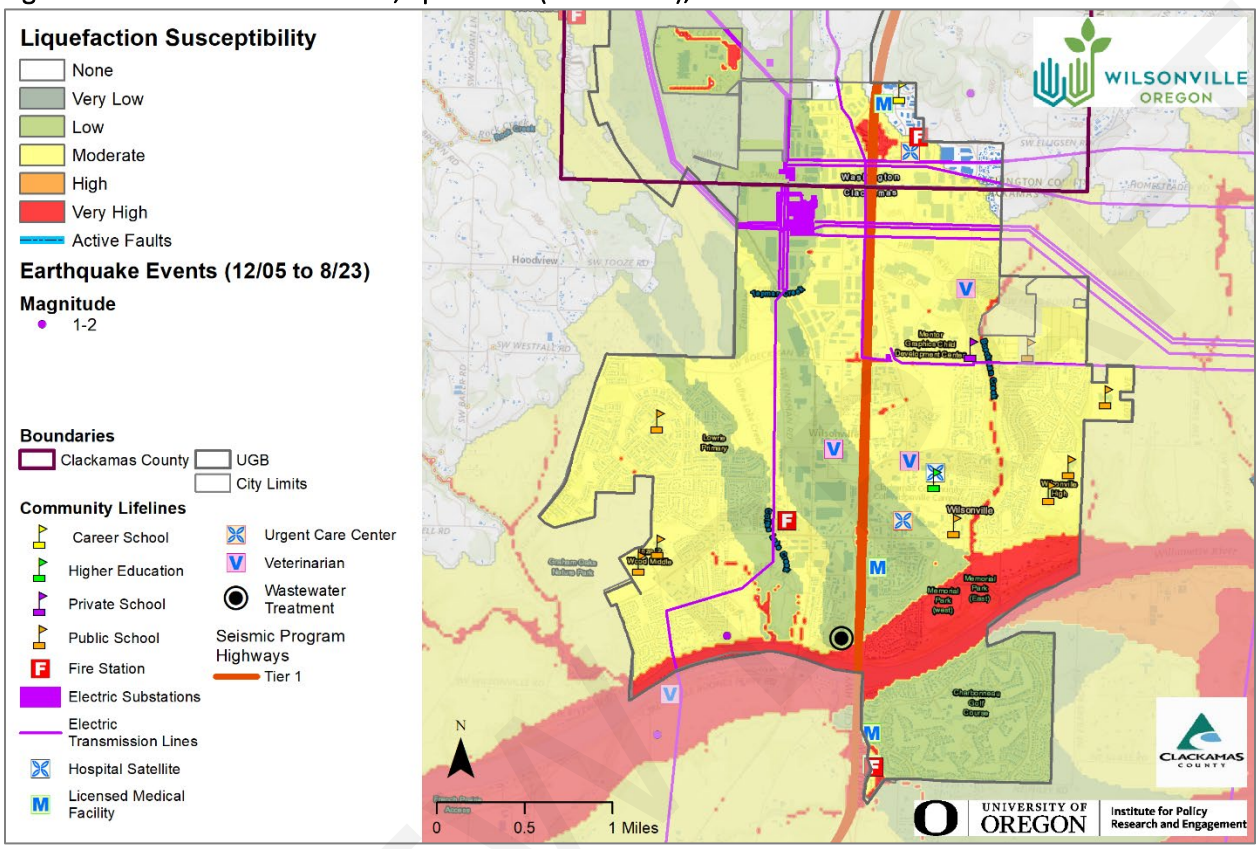
The Canby-Molalla Fault Zone is a series of NE-trending fault that vertically displace the Columbia River Basalt with discontinuous aeromagnetic anomalies that represent significant offset of Eocene basement and volcanic rocks. The fault zone extends for 31 miles from the vicinity of Tigard south through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

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



Source: Map created by Oregon Partnership for Disaster Resilience.
Data: Oregon Department of Geology and Mineral Industries. Preparedness Framework Implementation Team (IRIS v3).
Note: To view hazard detail click this link to access Oregon HazVu

Vulnerability Assessment

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-5; each "X" represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), one (1) 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 Table WA-4.

Table WA-5 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	2007 RVS report did not include structural appendix for this facility			
Lowrie Primary School (28995 SW Brown Rd)	n/a	2007 RVS report did not include structural appendix for this facility			
Meridian Creek Middle School (6300 SW Hazel St)	n/a	2007 RVS report did not include structural appendix for this facility			
Fire Facilities					
Fire Station 52 (TVF&R) (29875 Kinsman Rd) **see mitigation successes**	Clac_fir34	X			
Fire Station 56 & South Operating Center (TVF&R) (8445 Elligsen Rd) **see mitigation successes**	Clac_fir54	2007 RVS report did not include structural appendix for this facility			
Police Facilities					
Police Station (30000 Town Center Loop E)	n/a				
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

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 on 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 nighttime (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 WA-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.

Table WA-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	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 Populatior	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.[8] 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.[9]

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.[10] 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.[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 WA-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and

[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.

the recommendations see: *Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (*2018, O-18-02).

Natural Hazard Risk Report for Clackamas County

The **Risk Report** (DOGAMI, O-24-xx)[12] provides hazard analysis summary tables that identify populations and property countywide that are vulnerable to the earthquake hazard.

Cascadia Subduction Zone event (M9.0 Deterministic): 619 buildings, and (6 critical facilities), are expected to be damaged for a total potential loss of $538.4 million (a loss ratio of 9.7%). About 1,285 residents may potentially be displaced.

Crustal event (Canby-Molalla fault M6.8 Deterministic): 1,704 building are expected to be damaged (11 critical facilities), for a total potential loss of $1.619 billion (a loss ratio of 29%). About 4,597 residents may be displaced (18% of population).

Portland Hills Fault M6.8 Deterministic: 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. 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.

Future Projections

Future development (residential, commercial, or industrial) within Clackamas County will be at risk to earthquake impacts, although this risk can be mitigated by the adoption and enforcement of high development and building standards. Reducing risks to vulnerable populations should be considered during the redevelopment of existing properties.

Flood

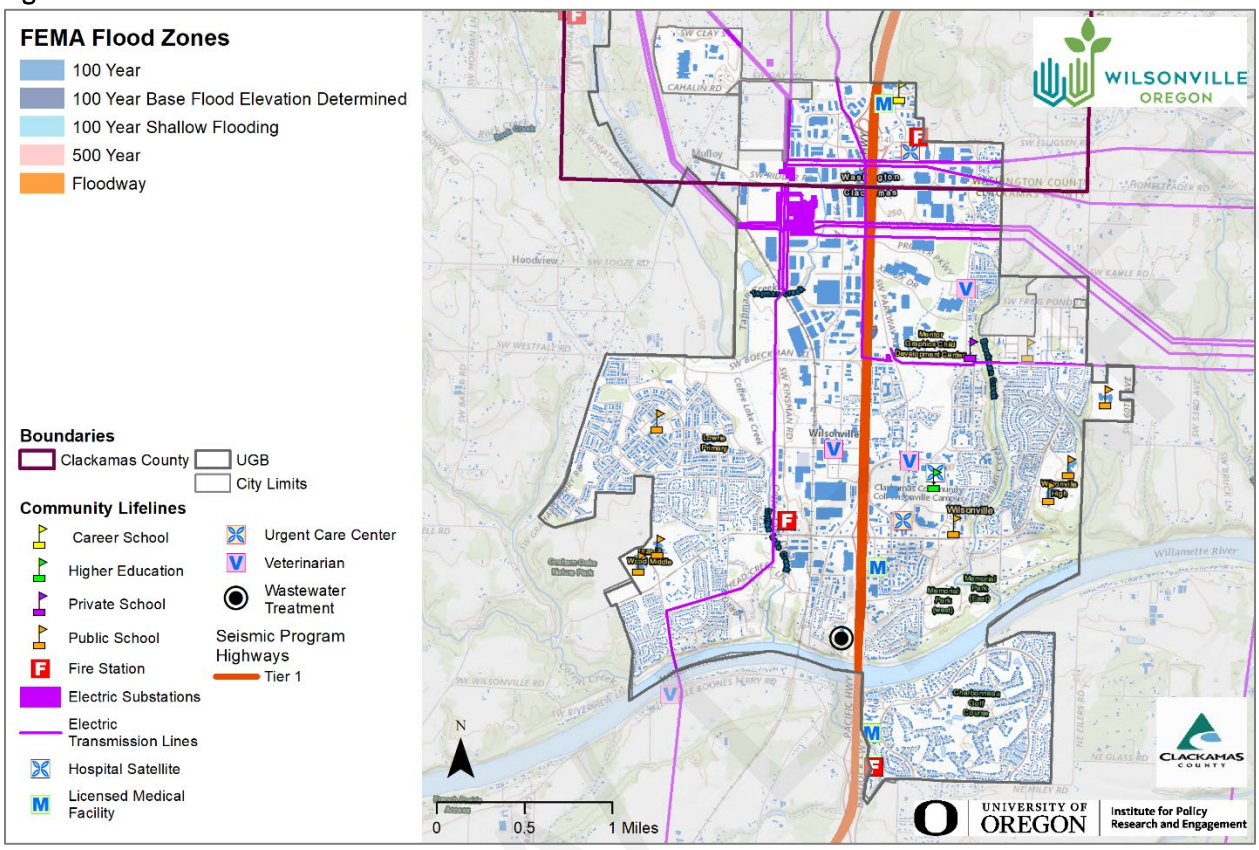
The HMAC determined that the City's probability of flooding is **moderate** and that their vulnerability to flooding is **low**. *The probability rating did not change and the vulnerability rating increased since the previous version of this NHMP.*

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.

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.

[12] DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (O-24-XX, September 2023 Draft), Table A-23.

Figure WA-4 FEMA Flood Zones



Source: Map created by Oregon Partnership for Disaster Resilience.
Data: Oregon Department of Geology and Mineral Industries. Preparedness Framework Implementation Team (IRIS v3).
Note: To view hazard detail click this link to access Oregon HazVu

Vulnerability Assessment

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 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 Table WA-4.

Natural Hazard Risk Report for Clackamas County

The Risk Report (DOGAMI, O-24-xx)[13] provides hazard analysis summary tables that identify populations and property countywide that are vulnerable to the flood hazard.

According to the Risk Report 5 buildings (0 critical facilities) could be damaged for a total potential loss of $201,000 (a building loss ratio of < 1%). About 37 residents may be displaced by flood (a population displacement ratio of less than 1%).

National Flood Insurance Program (NFIP)

FEMA's Flood Insurance Study (FIS), and Flood Insurance Rate Maps (FIRMs) are effective as of June 17, 2008. The City complies with the NFIP through enforcement of their flood damage prevention ordinance and their floodplain management program. The last Community Assistance Visit (CAV) for Wilsonville was on January 14, 2009. Wilsonville does not participate in the Community Rating System (CRS). The Community Repetitive Loss record identifies no (0) Repetitive Loss Property[14] and zero (0) Severe Repetitive Loss Properties[15].

Future Projections

According to the Oregon Climate Change Research Institute "Future Climate Projections, Clackamas County,"[16] winter flood risk at mid- to low elevations in Clackamas County, where temperatures are near freezing during winter and precipitation is a mix of rain and snow, is projected to increase as winter temperatures increase. The temperature increase will lead to an increase in the percentage of precipitation falling as rain rather than snow. The projected increases in total precipitation, and in rain relative to snow, likely will increase flood magnitudes in the region. Vulnerable populations adjacent to

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[13] DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (O-24-XX, September 2023 Draft), Table A-23.

[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.

[16] Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

floodways (including the unhoused, manufactured home communities, and campground occupants) will be more at risk as the winter flood risk increases.

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.*

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 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 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.[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

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 Table WA-5.

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.

Natural Hazard Risk Report for Clackamas County

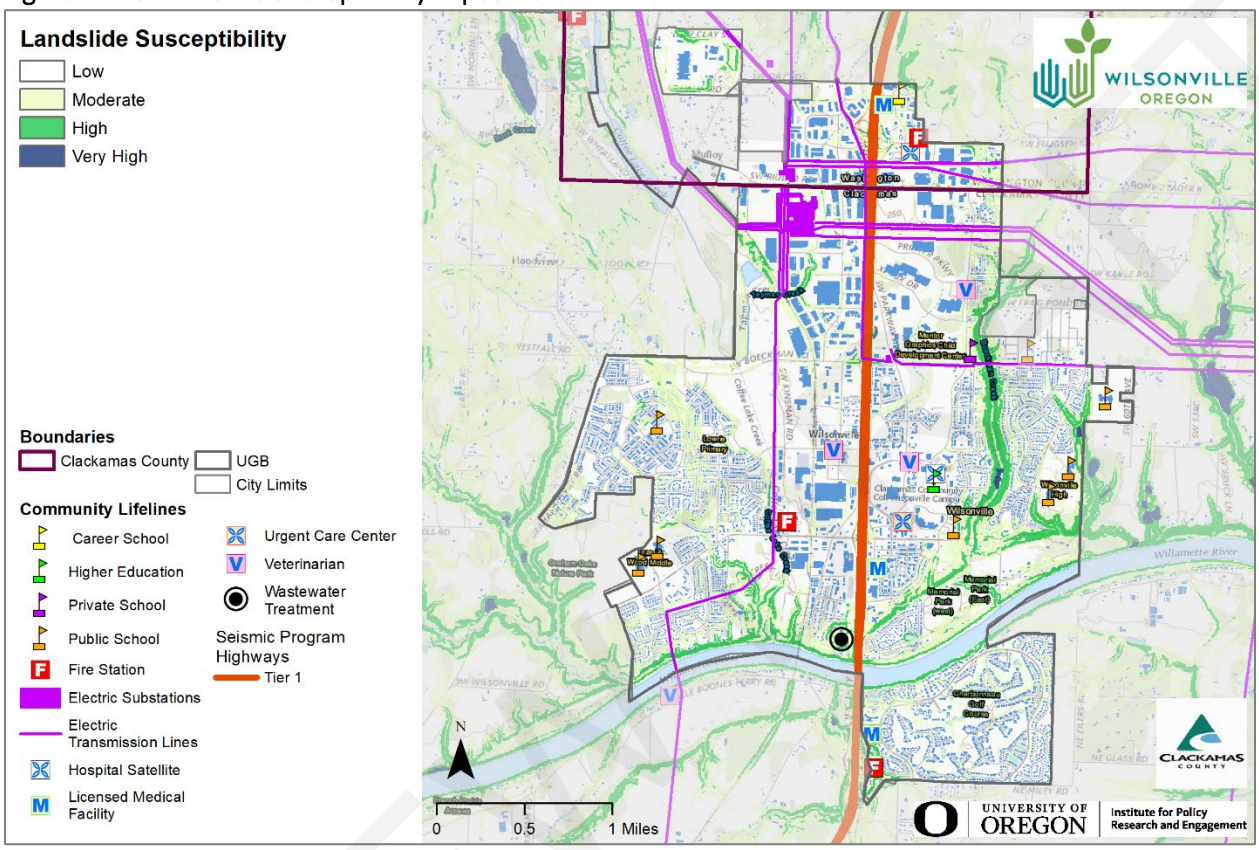
The **Risk Report** (DOGAMI, O-24-xx)[18] provides hazard analysis summary tables that identify populations and property countywide that are vulnerable to the landslide hazard.

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

[18] DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (O-24-XX, September 2023 Draft), Table A-23.

According to the Risk Report 91 buildings are exposed to the *high and very high landslide susceptibility* hazard (0 critical facilities) for a total exposure of $5.5 million (a building exposure ratio of 1%). About 512 residents may be displaced by landslides (a population exposure ratio of 2%).

Figure WA-5 Landslide Susceptibility Exposure



Source: Map created by Oregon Partnership for Disaster Resilience.
Data: Oregon Department of Geology and Mineral Industries. Preparedness Framework Implementation Team (IRIS v3).
Note: To view hazard detail click this link to access Oregon HazVu

Future Projections

Landslides are often triggered by rainfall when the soil becomes saturated. As a surrogate measure of landslide risk, the Oregon Climate Change Research Institute report presents a threshold based on recent precipitation (cumulative precipitation over the previous 3 days) and antecedent precipitation (cumulative precipitation on the 15 days prior to the previous 3 days). By the 2050s under the higher emissions scenario, the average number of days per year in Clackamas County on which the landslide risk threshold is exceeded is not projected to change substantially. However, landslide risk depends on multiple factors, and this metric, which is based on precipitation, does not reflect all aspects of the hazard. Additional triggers, such as earthquakes, wildfires, or development, can increase risks of landslides. Future development along slopes or adjacent to riverbanks will be a greater risk of impact from 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**. *These ratings did not change since the previous version of this NHMP.*

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 experienced life-threatening consequences to vulnerable populations from recent extreme heat events. Changes in climate indicate that the area should expect to see more extreme heat events.

Future Projections

According to the Oregon Climate Change Research Institute "Future Climate Projections, Clackamas County,"[19] the number, duration, and intensity of extreme heat events will increase as temperatures continue to warm. In Clackamas County, the number of extremely hot days (days on which the temperature is 90°F or higher) and the temperature on the hottest day of the year are projected to increase by the 2020s and 2050s under both the lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios. The number of days per year with temperatures 90°F or higher is projected to increase by an average of 12 (range 3–21) by the 2050s, relative to the 1971–2000 historical baselines, under the higher emissions scenario. The temperature on the hottest day of the year is projected to increase by an average of about 7°F (range 2–11°F) by the 2050s. Higher temperatures and longer/more extreme heat events will have negative impacts upon vulnerable populations such as those over 65+, children, those living in older or temporary housing, and field workers.

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.*

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

[19] Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

by rain (which they often are), blowing leaves, and debris clog drainage-ways, which in turn may cause localized urban flooding.

Future Projections

Limited research suggests little if any change in the frequency and intensity of windstorms in the Northwest as a result of climate change. Those impacted by windstorms at present, including older residential or commercial developments with above-ground utilities, poor insulation or older construction, heavy tree canopies, or poor storm drainage, will continue to be impacted by windstorms in the future.

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**. *These ratings did not change since the previous version of this 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.

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.

Future Projections

According to the Oregon Climate Change Research Institute "Future Climate Projections, Clackamas County,"[20] cold extremes will become less frequent and intense as the climate warms. In Clackamas County, the number of cold days (maximum temperature 32°F or lower) per year is projected to decrease by an average of 6 (range -3– -8) by the 2050s, relative to the 1971–2000 historical baselines, under the higher emissions scenario. The temperature on the coldest night of the year is projected to increase by an average of 6°F (range 0– 11°F) by the 2050s.

The intensity of extreme precipitation is expected to increase as the atmosphere warms and holds more water vapor. In Clackamas County, the number of days per year with at least 0.75 inches of precipitation is not projected to change substantially. However, by the 2050s, the amount of precipitation on the wettest day and wettest consecutive five days per year is projected to increase by an average of 15% (range 0–31%) and 10% (range -1–26%), respectively, relative to the 1971–2000 historical baselines, under the higher emissions scenario.

Vulnerable populations will be more likely to experience the negative impacts of winter storms in the future, particularly the unhoused and the elderly.

[20] Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

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 Table WA-4.

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**. *These ratings did not change since the previous version of this NHMP.*

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

Natural Hazard Risk Report for Clackamas County

The **Risk Report** (DOGAMI, O-24-xx)[21] provides hazard analysis summary tables that identify populations and property countywide that are vulnerable to the volcanic event (lahar) hazard.

The Risk Report did not identify population or property within the study area that may be impacted by the profiled volcanic event (lahar) hazard.

Future Projections

Although the science of volcano predictions is improving, it remains challenging to predict a potential volcanic event. Ash fall, which will be the greatest impact, will impact the entire County. Impacts will be felt hardest by property managers (ranches, farmers, etc.) and by those relying upon clean surface water (for drinking water production and irrigation).

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.*

The Clackamas County Community Wildfire Protection Plan (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. Information specific to Wilsonville is found in the following chapter: Chapter 9.13: Tualatin Valley Fire and Rescue.

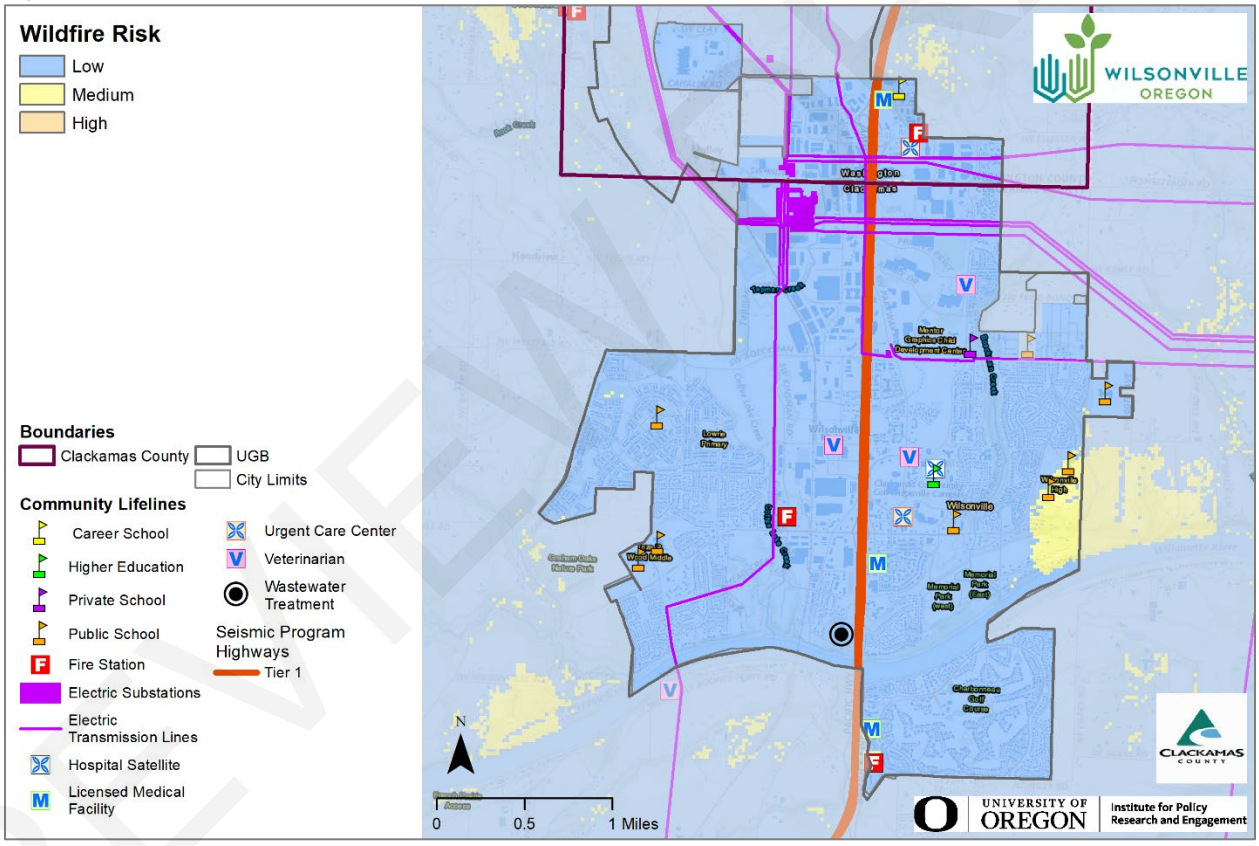
[21] DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (O-24-XX, September 2023 Draft), Table A-23.

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.

Figure WA-6 Wildfire Risk



Source: Map created by Oregon Partnership for Disaster Resilience.
Data: Oregon statewide wildfire risk map created by Oregon State University (unpublished). Preparedness Framework Implementation Team (IRIS v3).
Note: To view additional wildfire risk information click this link to access Oregon Explorer's CWPP Planning Tool

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.[22]

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.[23] 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

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).

Natural Hazard Risk Report for Clackamas County

The Risk Report (DOGAMI, O-24-xx)[24] provides hazard analysis summary tables that identify populations and property countywide that are vulnerable to the wildfire hazard.

According to the Risk Report 49 buildings are exposed to the *high and (or) moderate (medium) risk wildfire* hazard (no critical faclities) for a total exposure of $25.6 million replacement value (a building replacement value exposure ratio of 0.4%). About 235 residents may be displaced by wildfires (a population exposure ratio of 0.9%).

Future Projections

According to the Oregon Climate Change Research Institute "Future Climate Projections, Clackamas County,"[25] wildfire frequency, intensity, and area burned are projected to continue increasing in the Northwest. Wildfire risk, expressed as the average number of days per year on which fire danger is very high, is projected to increase in Clackamas County by 14 (range -6– 34) by the 2050s, relative to the historical baseline (1971–2000), under the higher emissions scenario. Similarly, the average number of days per year on which vapor pressure deficit is extreme is projected to increase by 29 (range 10–44) by the 2050s. Communities at risk to wildfire include those within the urban wildfire interface or along river or creek corridors, where fire can travel quickly. Communities will need to address growing wildfire risks if populations are not restricted from expanding further into higher risk areas.

[22] Clackamas County Community Wildfire Protection Plan, *Wilsonville Fire Department* (2018), Table 10.13-1.

[23] Oregon Wildfire Risk Explorer, date accessed November 9, 2018.

[24] DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (O-24-XX, September 2023 Draft), Table A-23.

[25] Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

Attachment A: Action Item Changes

Table WA-8 is an accounting of the status (complete or not complete) and major changes to actions since the previous NHMP. All actions were renumbered in this update to be consistent with other jurisdictions that are participating in the multi-jurisdictional NHMP. All actions marked not complete are ongoing, are still relevant, and are included in the updated action plan (Table WA-1).

Previous NHMP Actions that are Complete:
Multi-Hazard #2, "Integrate the goals and action items from the Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate." Complete. Part of NHMP implementation program.

Previous NHMP Actions that are Not Complete and No Longer Relevant:

Flood #2, "Coordinate with the Oregon Department of Transportation (ODOT) to increase the capacity of culvert." No longer relevant. Conducted as part of stormwater planning.

Table WA-7 Status of All Hazard Mitigation Actions in the Previous Plan

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

Attachment B: Public Involvement Summary

Members of the steering committee 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 below) was provided from February XX, 2024 through March XX, 2024 on the City's website. The plan was also posted and announced on the County's website. There were X comments provided that have been reviewed and integrated into the NHMP as applicable. Additional opportunities for stakeholders and the public to be involved in the planning process are addressed in Volume III, Appendix B.

A diverse array of agencies and organizations were provided an opportunity to provide input to inform the plan's content through a variety of mechanisms including the opportunity for comment on the draft plan. The agencies and organizations represent local and regional agencies involved in hazard mitigation activities, those that have the authority to regulate development, neighboring communities, representatives of businesses, academia, and other private organizations, and representatives of nonprofit organizations, including community-based organizations, that work directly with and/or provide support to underserved communities and socially vulnerable populations. For more information on the engagement strategy see Volume III, Appendix B.

Website Posting

To be provided

HMAC

The Hazard Mitigation Advisory Committee (HMAC) members possessed familiarity with the community and how it is affected by natural hazard events. The HMAC guided the update process through several steps including goal confirmation and prioritization, action item review and development, and information sharing, to update the NHMP and to make the NHMP as comprehensive as possible. The steering committee met formally on the following date:

Meeting #1: March 20, 2023

During this meeting, the HMAC:

- Reviewed the previous NHMP, and were provided updates on hazard mitigation planning, the NHMP update process, and project timeline.
- Updated recent history of hazard events in the city.
- Reviewed and confirmed the County NHMP's mission and goals.
- Reviewed and provided feedback on the draft risk assessment update including community vulnerabilities and hazard information.
- Reviewed and updated their existing mitigation strategy (actions).
- Reviewed and updated their implementation and maintenance program.
- Discussed the NHMP public outreach strategy.

Meeting #2: December 11, 2023 (via remote conference)

During this meeting, the HMAC:

- Confirmed and provided feedback on the final draft risk assessment update including community vulnerabilities and hazard information provided by DOGAMI (Risk Report).
- Reviewed and confirmed the city's capabilities assessment.
- Reviewed, confirmed, and prioritized the city's mitigation strategies.