

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



Effective:

September 12, 2024 – September 11, 2029

Prepared for
The City of West Linn

Updated:
August 5, 2024, (Resolution # 2024-07)
July 8, 2019
July 15, 2013
2009

This Natural Hazard Mitigation Plan was prepared by:



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FEMA

September 12, 2024

Tootie Smith, Chair
Clackamas County
2051 Kaen Road
Oregon City, Oregon, 97045

Reference: Approval of the Clackamas County Multi-jurisdictional Hazard Mitigation Plan

Dear Chair Smith:

In accordance with applicable¹ laws, regulations, and policy, the United States Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10 has approved the Clackamas County multi-jurisdictional hazard mitigation plan for the following jurisdictions:

Clackamas County	City of Canby	City of Estacada
City of Gladstone	City of Happy Valley	City of Lake Oswego
City of Milwaukie	City of Molalla	City of Oregon City
City of Sandy	City of West Linn	City of Wilsonville
Clackamas Fire District #1	Clackamas River Water	Colton Water District
Oak Lodge Water Services		

The approval period for this plan is from September 12, 2024 through September 11, 2029.

An approved hazard mitigation plan is one of the conditions for applying for and receiving FEMA mitigation grants from the following programs:

- Hazard Mitigation Grant Program (HMGP)
- Hazard Mitigation Grant Program Post-Fire (HMGP-PF)
- Building Resilient Infrastructure and Communities (BRIC)
- Flood Mitigation Assistance (FMA)
- High Hazard Potential Dams Grants Program (HHPD)

Based on FEMA's review, the plan did not include all dam risk. Thus, the participating jurisdictions are not eligible for assistance from the HHPD Grant Program. If any participating jurisdictions with HHPDs are interested in this assistance, they should contact the FEMA Region 10 Hazard Mitigation Planning Team at FEMA-R10-MT_Planning@fema.dhs.gov, to learn more about how to include all dam risks in the plan.

¹ Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and National Dam Safety Program Act, as amended; Title 44 Code of Federal Regulations (CFR) Part 201, Mitigation Planning; and Local Mitigation Planning Policy Guide (FP-206-21-0002).

Chair Smith
September 12, 2024
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Having an approved hazard mitigation plan does not mean that mitigation grant funding will be awarded. Specific application and eligibility requirements for the programs listed above can be found in each FEMA grant program's respective policies and annual Notice of Funding Opportunities, as applicable.

To avoid a lapsed plan, the next plan update must be approved before the end of the approval period, including adoption by the participating jurisdiction(s). Before the end of the approval period, please allow sufficient time to secure funding for the update, including the review and approval process. Please include time for any revisions, if needed, and for participating jurisdictions to formally adopt the plan after the review, if not adopted prior to submission. This will enable each jurisdiction to remain eligible to apply for and receive funding from FEMA's mitigation grant programs with a hazard mitigation plan requirement. Local governments, including special districts, with a plan status of "Approvable Pending Adoption" are not eligible for FEMA's mitigation grant programs with a hazard mitigation plan requirement.

If you have questions regarding your plan's approval or FEMA's mitigation program, please contact Joseph Murray, Mitigation Planner at (503) 378-2911 or joseph.murray@oem.oregon.gov, who coordinates these efforts for local entities.

Sincerely,

Wendy Shaw, P.E.
Risk Analysis Branch Chief

Enclosures

cc: Stephen Richardson, Oregon Department of Emergency Management
Joseph Murray, Oregon Department of Emergency Management

JF:JG:WS

RESOLUTION 2024-07

A RESOLUTION ADOPTING THE CITY OF WEST LINN ADDENDUM IN THE UPDATES TO THE CLACKAMAS COUNTY MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN

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

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

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

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

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

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

WHEREAS, the Oregon Department of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *Clackamas County, Multi-Jurisdictional Natural Hazards Mitigation Plan* and pre-approved it (dated, May 29, 2024) contingent upon this official adoption of the participating governments and entities;

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

WHEREAS, the NHMP is in an on-going cycle of development and revision to improve it's effectiveness; and

WHEREAS, City of West Linn adopts the NHMP and directs the City Manager to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.

NOW, THEREFORE, THE CITY OF WEST LINN RESOLVES AS FOLLOWS:

SECTION 1. The City of West Linn adopts *the Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan* as an official plan; and


SECTION 2. The City of West Linn will submit this Adoption Resolution to the Oregon Department of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the *Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan*.

This resolution was PASSED and ADOPTED this 5th day of August, 2024, and takes effect upon passage.



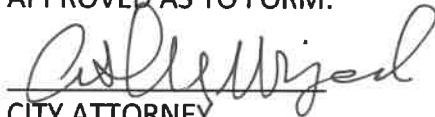
RORY BIALOSTOSKY, MAYOR

ATTEST:



KATHY MOLLUSKY, CITY RECORDER

APPROVED AS TO FORM:



CITY ATTORNEY

Purpose

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

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

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

West Linn adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on August 5, 2024. FEMA Region X approved the Clackamas County NHMP and the City’s addendum on September 12, 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 September 11, 2029.

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 West Linn to update their NHMP.

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

Convener

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

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

This addendum reflects decisions made at the designated meetings and during subsequent work and communication with 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 West Linn HMAC was comprised of the following representatives:

- Dylan Digby, Assistant to the City Manager/Emergency Manager
- Erich Lais, Assistant City Engineer/Interim Director of Public Works
- Darren Wyss, Planning Manager
- Megan Big John, Parks and Recreation Director

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 West Linn addendum to the Clackamas County NHMP. This addendum designates a HMAC and a convener to oversee the development and implementation of action items. Because the City addendum is part of the County’s multi-jurisdictional NHMP, the City will look for opportunities to partner with the County. The City’s HMAC will convene after re-adoption of the West Linn NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The 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, West Linn will implement the NHMP's recommended actions through existing plans and policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Capability Assessment

The Capability Assessment identifies and describes the ability of the City of West Linn 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. As applicable the 2019 NHMP was integrated into these authorities/documents over the last five years (e.g., land use regulations, water system master plan, capital improvement plan, etc.).

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.

West Linn last updated their [Comprehensive Plan](#) in 2016. This plan includes background and analytic sections that support recommendations for, among other things, sustainable economic activity, housing, recreation and open space, transportation, land use livability, and preventing degradation of quality of life in and for West Linn. The Comprehensive Plan provides the basis for other plans, ordinances, and other implementing documents that set forth more detailed direction regarding specific activities and requirements.

Chapter 7 of the Comprehensive Plan addresses with Statewide Planning Goal 7, Natural Hazards. This Chapter incorporates known hazard information from before 2002, focusing on landslides, soil erosion, earthquake damage, and flooding. The goal of its Natural Hazard policies and recommended actions is to

protect life and property from flood, earthquake, other geological hazards, and terrorist threats or attacks.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.

Community Development Code

This Code is designed to set forth the standards and procedures governing the development and use of land in West Linn and to implement the West Linn Comprehensive Plan. It was last amended in September 2023.

Chapter 27 Flood Management Areas

This chapter applies to all flood management areas (equal to Special Flood Hazard Areas) within the jurisdiction of West Linn. This code is based upon the 2021 Oregon Model Flood Hazard Ordinance, and was adopted in February 2022.

The regulatory special flood hazard areas (SFHA) for West Linn are identified in the “Flood Insurance Study: Clackamas County, Oregon and Incorporated Areas,” dated 06/2008 and revised 01/2019, FIRM Panels 41005C0018D, 41005C0019D, 41005C0038D, 41005C0257D, 41005C0259D, 41005C0260D, and 41005C0276D.

Their flood prevention code section is based on the Oregon Model Flood Hazard Prevention code, which includes provisions addressing substantial improvement/substantial damage and higher regulatory standards than required by state or federal regulations, including requirements for critical facilities to be located outside of the SFHA. If no alternative site is available, critical facilities must be elevated three feet or to the height of the 500-year flood, whichever is higher.

Chapter 28 Willamette and Tualatin River Protection

This chapter protects water quality and the scenic integrity of the river corridors on either side of West Linn. Standards within this chapter help protect against bank erosion and flooding.

Chapter 32 Water Resource Area Protection

This chapter complies with Title 13 and Title 3 of Metro’s Urban Growth Management Functional Plan, protecting water quality by moderating storm water impacts and preventing erosion and excessive sedimentation into water bodies. It includes standards that minimize construction of structures and improvements where they are at risk of flooding. This chapter was adopted in 2014.

¹ City of West Linn Comprehensive Plan, 2016.

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 West Linn Community Development Department administers and enforces the 2022 Oregon Fire Code, the 2022 Oregon Structural Specialty Code, Mechanical Specialty Code, Plumbing Specialty Code, Electrical Specialty Code, and Residential Specialty Code. Tualatin Valley Fire & Rescue also participates in plan review for development projects. 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 West Linn Public Works Department is composed of the divisions responsible for environmental services (storm and sanitary sewer), water, streets, and engineering. 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 West Linn 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 West Linn and Clackamas County to explore integration into other planning documents and processes. West Linn has made significant progress in integrating the NHMP into its portfolio of planning processes and programs over the last five years.

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Sanitary Sewer Master Plan 2019

The Sanitary Sewer Master Plan was adopted in 2019 to address the sanitary sewer system needs over the next 20 years. It includes capital improvement and capital maintenance plans for the sanitary sewer system.

Storm Drainage Master Plan 2019

The Storm Drainage Master Plan guides the City's efforts to manage storm water runoff, reduce storm water pollution, and protect/enhance natural habitat areas affected by the drainage system. It acts as the master plan for the city's National Pollutant Discharge Elimination System (NPDES) program and for Total Maximum Daily Load (TMDL) compliance. Recommendations in this plan led to the update of the City's floodplain management regulations, updated erosion control standards, etc. Capital projects identified include culvert replacements at key locations (5th Avenue, Sunset Creek, Maddox Creek), and road improvements to address roadway flooding (Blankenship Road, Mark Lane, Buck Street, Sunset Avenue).

TMDL Implementation Plan

The City maintains a Total Maximum Daily Load (TMDL) Plan (updated in September 2022). The Total Maximum Daily Load (TMDL) program is intended to comply with the Tualatin River Subbasin and Willamette River Basins TMDL order and to address the Revised Willamette Basin Mercury TMDL (effective February 2021). Tributaries within the City limits do not currently meet state water quality standards for several parameters, including bacteria, mercury, chlorophyll a and pH (total phosphorus as a surrogate measure), dissolved oxygen (ammonia and total suspended solids [TSS] as surrogate measures), and temperature. The NHMP actions are incorporated into this document as appropriate. Example projects include riparian planting and revegetation, erosion control education and enforcement, design standards for new and redevelopment, and public outreach.

Water Master Plan 2024

The current Water Master Plan dates to 2008. The update of the Water Master Plan is underway and is expected to be complete in 2024.

Community Wildfire Protection Plan

The Clackamas County Community Wildfire Protection Plan (CWPP) will be incorporated into this Plan as a functioning annex. The CWPP will also be integrated into the City's Capital Improvement Plan (2024-2029 CIP approved June 2023).

Tree City USA

This distinction means West Linn has an active tree care ordinance and public education pieces, among others, which help to maintain a healthy urban forest. Most utilities are underground, and all new utilities are required to be undergrounded, but in case of power outages the city's critical facilities have back up power generation.

National Flood Insurance Program

West Linn participates in the National Flood Insurance Program. The Planning Division is responsible for administering the day-to-day activities of the city's floodplain program.

Specifically, the floodplain manager:

- maintains and administers West Linn'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.

Other program successes include:

- Compliance with SB 13, enacted in 2001, requiring local governments to develop seismic preparation procedures, inform their employees about the procedures, and conduct earthquake drills.

- Adoption of a policy to require undergrounding of power lines in new subdivisions.
- Development Code restrictions regarding construction on steep slopes.
- Adoption of Emergency Operations Plan (2017 update)

Personnel

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

Emergency Management: Dylan Digby, Assistant to City Manager

Public Information Officer: Danielle Choi, Community Relations Coordinator

Floodplain Manager: Darren Wyss, Planning Manager

Capital improvement planning: Erich Lais, Public Works Director

Capital improvement execution: Erich Lais, Public Works Director

West Linn 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

West Linn has implemented recommendations from the last NHMP into its capital improvement projects.

Mitigation activities completed by the City of West Linn include:

- The Police Station was built on a new site (1800 8th Avenue) in 2014 via a 2011 voter approved bond.²
- Seismic strengthening of supports for the West Linn primary water transmission line (24-inch) attached to the underside of the I-205 (Abernethy) Bridge over the Willamette River between West Linn and Oregon City, as part of a general seismic upgrade of the bridge by the Oregon Department of Transportation, 2001-02
- In 2006 a \$77.5 million bond measure (34-133) was passed by southeast Portland metro-area voters to correct seismic safety deficiencies at Tualatin Valley Fire and Rescue Fire by rebuilding [Station 58](#) (Bolton) and [Station 59](#) (Willamette).³
- In 2018, TVF&R completed construction on [Station 55](#) (Rosemont). In 2011, a local school district capital bond was approved to structurally reinforce Bolton Primary, Cedaroak Park Primary, and Stafford Primary schools. The historic Sunset Primary school was demolished⁴ and replaced in September 2017 with a new school per a 2014 school district capital bond.⁵

² Malee, Patrick. Portland Tribune (August 7, 2014). "After three years, police station set for grand opening." <https://pamplinmedia.com/wlt/95-news/229497-92676-after-three-years-police-station-set-for-grand-opening-> (Accessed December 7, 2018)

³ Tualatin Valley Fire & Rescue, "General Obligation Bond". <https://www.tvfr.com/100/General-Obligation-Bond> (Accessed December 5, 2018)

⁴ Kilstrom, Andrew. WestLinnTidings (June 29, 2017) "Sunset: 127 years and counting". <https://pamplinmedia.com/wlt/95-news/364495-244263-sunset-127-years-and-counting> (Accessed December 6, 2018)

⁵ West Linn-Wilsonville School District. "2014 Capital Bond Program". <https://www.wlww.k12.or.us/Bond> (Accessed December 6, 2018)

- Bolton Reservoir (Primary) was seismically upgraded and enlarged to 4 million gallons (2017).
- Robinwood Station Community Center has been seismically renovated (2023).

West Linn has taken mitigation steps to reduce the city's vulnerability in earthquake events.

- Abernethy Bridge is currently under construction with significant seismic resilience.

Ongoing projects that enhance the City's resilience include:

- Construction of new centrally located Public Works and Parks Operations and Maintenance Facility (with emergency generator)
- Replacement and seismic upgrades to the City's water transmission main on the I-205 Abernethy Bridge.
- Upgrades to the City's water telemetry system
- Water Master Plan Update (underway)
- Upgrading of Calaroga sanitary sewer pump station
- Athey Creek Middle School (new)

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](#)⁶.

FEMA Funded Mitigation Successes

- None identified.

Seismic Rehabilitation Grant Program Mitigation Successes

- None identified.

Other Mitigation Successes

- Police Station (new, 1800 8th Avenue)
- Bolton Reservoir seismic improvements
- Seismic strengthening of water transmission line under I-205
- Replacement of Sunset Primary School
- Athey Creek Middle School

Capital Resources

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

Critical facilities with power generators for use during emergency blackouts: Police Station, City Hall, Operations Facility, and Library

Food pantries: West Linn Food Pantry (1683 Willamette Falls Drive)

⁶ 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.

Fueling storage: Generator locations have some fuel storage. Operations facility has a fuel storage tanks for vehicles and equipment.

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

West Linn 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

West Linn 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).

Action Items

Table WL-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 (see Attachment A for more information). 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.

Table WL-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	Reduce threat to critical and essential public facilities.	X	X	X	X	X	X	X	X	X	Parks and Recreation/ Public Works, Engineering	Ongoing	Local Resources, DLCDD TA, FEMA HMA	Low to High	
2	Enhance recognition of hazards, and appropriate mitigation and response activities through public education. Identify, improve, and sustain public and private partnerships and collaborations focused on natural hazard mitigation and risk reduction.	X	X	X	X	X	X	X	X	X	Administration/ Public Works, Parks and Recreation, Building, Planning	Ongoing	Local Resources, FEMA HMA	Low	
3	Maintain a public awareness campaign regarding severe weather mitigation measures and the importance of personal safety.			X					X	X	Administration/ Public Works, Parks and Recreation, Building, Planning	Ongoing	Local Resources, FEMA HMA	Low	
4	Integrate the goals and action items from the Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	X	X	X	X	X	X	X	X	X	Planning/ Public Works, Building, City Council	Ongoing	Local, State, Federal Grants and BRIC	Low	
5	Conduct seismic evaluations on identified critical and essential facilities and infrastructure and implement appropriate structural and non-structural mitigation strategies. (e.g., reservoirs) – Bolton complete since previous NHMP.		X								Public Working – Engineering/ Planning	Long	Local, State and Federal Grants and BRIC	High	

Table WL-1 Action Items

Action Item #	Statement	Impacted Hazard									Implementation and Maintenance					
		Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm	Lead/ Partners	Timeline	Potential Funding Source	Estimated Cost		
6	Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.				X						Planning/ GIS, Public Works	Ongoing	Local Resources. DLCDC TA, FEMA HMA (FMA)	Low		
7	Implement Surface Water Master Plan (storm water) capital improvement projects that can reduce flood threats.				X						Public Works/ Planning	Ongoing	Local Resources. DLCDC TA, FEMA HMA (FMA)	Low to High		
8	Address vulnerabilities of sewer pump stations to potential flood events.				X						Public Works/ Planning	Ongoing	Local Resources. DLCDC TA, FEMA HMA (FMA)	Medium		
9	Acquire flood-prone and repetitive loss properties and preserve as open space (e.g., property at Cedar Oak around stream and natural resource area).				X						Planning/ Public Works, GIS	Long	Local Resources. DLCDC TA, FEMA HMA (FMA)	High		
10	Reduce risk of erosion and soil destabilization by implementing the strategies outlined in the Surface Water Management Plan.				X	X				X	Public Works/ Planning	Ongoing	Local, State, Federal Grants and BRIC	Medium		
11	Maintain a tree hazard program for preventing future hazards, while improving long-term health and care of urban forest.									X	X	X	Parks and Recreation/ Planning, Building, Public Works	Ongoing	Local Resources, FEMA HMA (FMA)	Low

Table WL-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
12	Promote and support wildfire mitigation action items through the Clackamas County Community Wildfire Protection Plan.							X			TVF&R/ Public Works, Parks and Recreation, Building, Planning	Ongoing	Local Resources, FEMA HMA, CWDG	Low to High
13	Encourage private landowners to create and maintain defensible space around homes and other buildings and make home hardening improvements							X			TVF&R/ Public Works, Parks and Recreation, Building, Planning	Ongoing	Local Resources, FEMA HMA, CWDG	Low to High
14	Underground utilities near critical/essential facilities and other vulnerable areas.							X	X	X	Public Works, Parks and Recreation, Building, Planning	Ongoing	Local Resources, FEMA HMA	High

Source: West Linn NHMP HMA, 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

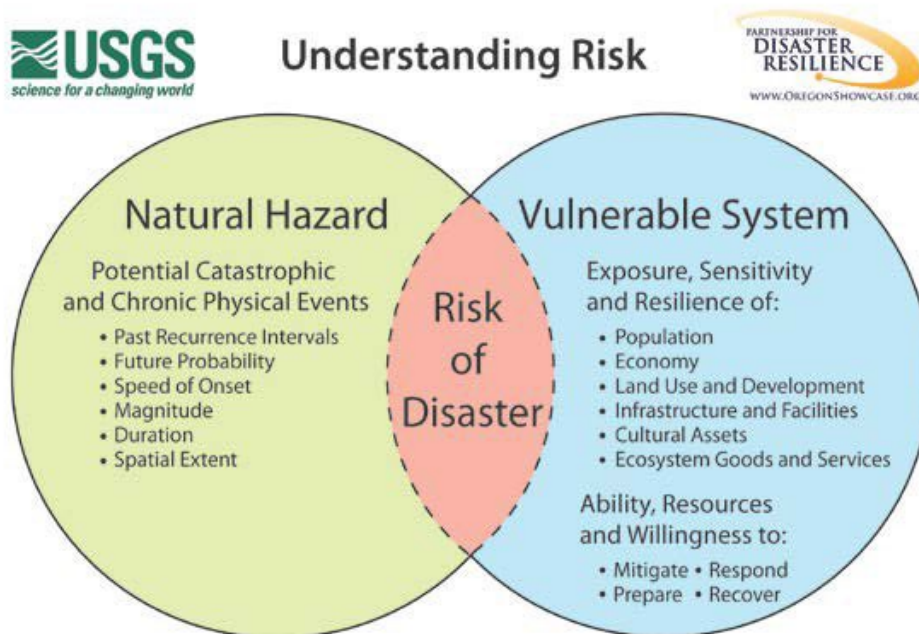
Risk Assessment

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 WL-1. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure WL-1: Understanding Risk



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

Hazard Analysis

The West Linn HMAAC developed their hazard vulnerability assessment (HVA), using their previous HVA and the County’s HVA as a reference. Changes from their previous HVA and the County’s HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to West Linn, which are discussed throughout this addendum. Table WL-2 shows the HVA matrix for West Linn listing each hazard in order of rank from high to low. For local governments, conducting the hazard

analysis is a useful step in planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with a sense of hazard priorities but does not predict the occurrence of a hazard. One chronic hazard (winter storm) and two catastrophic hazards (Cascadia Subduction Zone earthquake and Crustal earthquake) rank as the top hazard threats to the City (Top Tier). Landslide, extreme heat event, flood, and wildfire comprise the next highest ranked hazards (Middle Tier), while drought, windstorm, and volcanic event comprise the lowest ranked hazards (Bottom Tier).

Table WL-2 Hazard Analysis Matrix – West Linn

Hazard	History	Vulnerability	Maximum Threat	Probability	Total Threat Score	Hazard Rank	Hazard Tiers
Winter Storm	12	40	70	63	185	1	<i>Top Tier</i>
Earthquake - Cascadia	2	45	100	35	182	2	
Earthquake - Crustal	6	50	100	21	177	3	
Landslide	14	30	60	63	167	4	<i>Middle Tier</i>
Extreme Heat Event	10	35	70	35	150	5	
Flood	16	25	50	56	147	6	
Wildfire	16	20	50	49	135	8	
Drought	10	15	50	56	131	7	<i>Bottom Tier</i>
Windstorm	14	15	50	42	121	9	
Volcanic Event	2	25	50	7	84	10	

Source: West Linn HMAc, 2023.

Community Characteristics

Table WI-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.

West Linn has grown substantially since its incorporation in 1913 and has an area today of 7.43 square miles. The city is on Interstate 205 and within the southern bounds of the Portland metropolitan area (about 12 miles south of the City of Portland) and is bordered on the east by the Willamette River, and to the southwest by the Tualatin River, on the north by the City of Lake Oswego, and to the west by unincorporated Clackamas County. The City is within the Willamette River watershed.

Because of its location West Linn's climate is consistent with the Marine west coast climate zone, with warm summers and cool, wet winters. West Linn receives most of its rainfall between October and May, and averages 44 inches of rain, and less than one (1) inch of snow, per year.⁷

The easterly and southerly areas of the City that border the Willamette and Tualatin rivers are low-lying - 55 to 60 feet above sea level at Willamette Falls - while the central and northwesterly sections of the City contain a ridge that rises to as high as 650 feet above sea level.

Population, Housing, and Income

West Linn has grown substantially since its incorporation in 1913 and has an area today of 2.26 square miles. It is in the south-central region of Clackamas County, located approximately 29 miles southeast of the City of Portland. The City is within the West Linn River watershed, with the West Linn River about a mile east of the UGB.⁸

Between 2016 and 2021 the City grew by 1,805 people (7%; as of 2022 the population is 27,420). Between 2022 and 2045 the population is forecast to decline by 2% to 26,990. (This decline is based upon two years of negative growth following the COVID-19 pandemic and is likely to reverse over the upcoming years.)

Most of the population is White/Caucasian (82%) and about 18% of the population is Hispanic or Latino. The poverty rate is 5% (3% of children under 18, 6% for people 65 and older), 3% do not have health insurance, and 63% of renters pay more than 30% of their household income on rent (35% for owners). About 63% of the population has a bachelor's degree or higher (less than 3% do not have a high school degree). Approximately 9% of the population lives with a disability (22% of population 65 and older), and 45% are either below 15 (25%) or over 65 (20%) years of age. About 8% of the population are 65 or older and living alone and 6% are single parents.

The City includes a diversity of land uses but is zoned primarily residential. About 87% of housing units are single-family, 13% are multifamily, and less than 1% are mobile homes. Less than one-fifth of homes (16%) were built before 1970 and 44% were built after 1990. Newer homes are more likely to be built to current seismic, flood, wildfire, and other hazard standards. Almost two-thirds (80%) of housing units are owner occupied, 16% are renter occupied, 2% are seasonal homes, and 2% are vacant.

⁷ ["Monthly Average for West Linn, OR"](#) The Weather Channel Interactive, Inc. Retrieved November 1, 2018.

⁸ [Annual Water Quality Report](#) (2017). City of West Linn. Retrieved March 10, 2019.

Transportation and Infrastructure

The City of West Linn is divided by two major regional transportation facilities - Interstate 205, a freeway running east-west through the southerly section of the City and State Highway 43 (Willamette Drive) that connects to I-205 near its southerly terminus and runs north-south through the northerly section of the City all the way to Portland.

Motor vehicles represent the dominant mode of travel through and within West Linn. Four percent (4%) of renters and 1% of owners do not have a vehicle. Most workers drive alone to work (69%); 7% carpool, 2% use public transit, 2% either walk or use a bicycle, and 21% work at home. West Linn contains two interchanges with I-205, the 10th Street interchange in the Willamette neighborhood and the Highway 43 (Willamette Drive) interchange in the Bolton neighborhood. The responsibility and authority, as well as the financial capability, to maintain an adequate level of service for the freeway I-205 rests with Metro and Oregon Department of Transportation (ODOT) authorities. Congestion on I-205, nonetheless, can result in the diversion of traffic onto City streets.

The City's public transit is provided by Portland's TriMet transit system which serves all of the commercially zoned areas. The availability and quality of pedestrian and bicycling facilities (sidewalks, bike lanes, and pathways) is inconsistent, generally newer neighborhoods have facilities. [Road and Base Maps](#) are found on the West Linn website.

Economy

The economy of West Linn is based primarily on service and retail-oriented commercial businesses and the City has more residents than employees. The City's single major industrial employer is the West Linn Paper Company. West Linn's Waterfront Plan will revitalize the area by the Paper Mill. The City, School District, and smaller employers (retail, offices and other professional services) provide for most of the City's employment.

The City of West Linn does not contain a major commercial district or downtown, but rather it possesses four distinct commercial districts. The Historic Willamette District was one of the first commercial and residential areas in West Linn. The commercial area still retains some of the turn-of-the-century architecture along Willamette Falls Drive and features on-street parking and residential units above retail establishments. Newer commercial and office buildings have been built to the north and east of the Historic District, including north of I-205.

About 46% of the resident population 16 and over is in the labor force (12,463 people) and are employed in a variety of occupations including professional (29%), management, business, and financial (28%), sales (12%), office and administrative (11%), and construction, extraction, and maintenance (5%) occupations.

Most workers residing in the city (93%, 10,920 people) travel outside of the city for work primarily to Portland and surrounding areas.⁹ A significant population of people travel to the city for work, (84% of the workforce, 4,665 people) primarily from Portland and surrounding areas.¹⁰

⁹ U.S. Census Bureau. LEHD Origin-Destination Employment Statistics (2002-2021). Longitudinal-Employer Household Dynamics Program, accessed on January 8, 2024 at <https://onthemap.ces.census.gov>.

¹⁰ Ibid.

Table WI-3 Community Characteristics

Population Characteristics		Population	Household Characteristics	
		Growth		
2016 Population Estimate	25,615		Housing Units	
2022 Population Estimate	27,420	7%	Single-Family (includes duplexes)	9,011 87%
2045 Population Forecast*	26,990	-2%	Multi-Family	1,333 13%
Race			Mobile Homes (includes RV, Van, etc.)	48 < 1%
American Indian and Alaska Native		< 1%	Household Type	
Asian		5%	Family Household	7,536 75%
Black/ African American		1%	Married couple (w/ children)	3,123 31%
Native Hawaiian and Other Pacific Islander		< 1%	Single (w/ children)	552 6%
White		82%	Living Alone 65+	812 8%
Some Other Race		< 1%	Year Structure Built	
Two or More Races		4%	Pre-1970	1,621 16%
Hispanic or Latino/a (of any race)			1970-1989	4,215 41%
Limited or No English Spoken	824	3%	1990-2009	4,073 39%
Vulnerable Age Groups			2010 or later	483 5%
Less than 5 Years	1,375	5%	Housing Tenure and Vacancy	
Less than 15 Years	5,452	20%	Owner-occupied	8,360 80%
65 Years and Older	4,778	18%	Renter-occupied	1,638 16%
85 Years and Older	462	2%	Seasonal	184 2%
Age Dependency Ratio		0.60	Vacant	210 2%
Disability Status (Percent age cohort)			Vehicles Available (Occupied Units)	
Total Disabled Population	2,415	9%	No Vehicle (owner occupied)	124 1%
Children (Under 18)	214	3%	Two+ vehicles (owner occupied)	6,745 81%
Working Age (18 to 64)	1,150	7%	No Vehicle (renter occupied)	61 4%
Seniors (65 and older)	1,051	22%	Two+ vehicles (renter occupied)	814 50%
Income Characteristics			Employment Characteristics	
Households by Income Category			Labor Force (Population 16+)	
Less than \$15,000	589	6%	In labor Force (% Total Population)	12,463 46%
\$15,000-\$29,999	367	4%	Unemployed (% Labor Force)	604 5%
\$30,000-\$44,999	649	7%	Occupation (Top 5) (Employed 16+)	
\$45,000-\$59,999	712	7%	Professional & Related	3,578 29%
\$60,000-\$74,999	693	7%	Management, Business, & Financial	3,472 28%
\$75,000-\$99,999	1,154	12%	Sales & Related	1,535 12%
\$100,000-\$199,999	3,277	33%	Office & Administrative	1,333 11%
\$200,000 or more	2,557	26%	Construction, Extraction, & Maint.	590 5%
Median Household Income		\$124,098	Health Insurance	
Gini Index of Income Inequality		0.45	No Health Insurance	813 3%
Poverty Rates (Percent age cohort)			Public Health Insurance	7,007 26%
Total Population	1,263	5%	Private Health Insurance	23,325 86%
Children (Under 18)	215	3%	Transportation to Work (Workers 16+)	
Working Age (18 to 64)	761	5%	Drove Alone	8,501 69%
Seniors (65 and older)	287	6%	Carpooled	805 7%
Housing Cost Burden (Cost > 30% of household income)			Public Transit	255 2%
Owners with a Mortgage	2,007	35%	Motorcycle	0 0%
Owners without a Mortgage	793	30%	Bicycle/Walk	186 2%
Renters	1,029	63%	Work at Home	2,532 21%

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 West Linn. 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 WL-4 includes critical facilities identified in the DOGAMI Risk Report (2024) and assumed impact from individual hazards.

Table WL-4 Critical Facilities in West Linn

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
Athey Creek Middle School					
Bolton Primary School	-	X	X	-	-
Cedar oak Park Primary School	-	X	X	-	-
Rosemont Ridge Middle School	-	-	-	-	-
Sullivan substation	-	X	X	-	-
Sunset Primary School	-	X	X	-	-
Trillium Creek Primary School	-	-	-	-	-
Tualatin Valley Fire and Rescue - Station 55 (Rosemont, ca. 2018)					
Tualatin Valley Fire and Rescue - Station 58 (Bolton, ca. 2010)	-	X	X	-	-
Tualatin Valley Fire and Rescue - Station 59 (Willamette, ca. 2010)	-	X	X	-	-
West Linn City Hall (ca. 2012)					
West Linn Library					
West Linn Adult Community Center					
West Linn High School	-	X	X	-	-
West Linn Police Department/EOC	-	X	X	-	-
West Linn Public Works/Operations	-	X	X	-	-
Willamette Primary School	-	X	X	-	-

Source: DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon (2024)*, Table A-36.

Note: Athey Creek Middle School, TVF&R Stn 55, West Linn City Hall, Library, and Adult Community Center are not included in the DOGAMI analysis.

Critical Infrastructure

Infrastructure that provides necessary services for emergency response include:

Transportation

- Abernathy Bridge (I-205) (rebuilding 2024/2025)
- Arch Bridge (ODOT) (2012 upgrades)
- Fields Bridge (County, Tualatin River, Borland Rd, 2010)
- Weiss Bridge (County, Tualatin River, Petes Mtn Rd)
- Highway 43
- I-205 (ODOT)
- I-205 bridge over Tualatin River
- ODOT overpasses, including Sunset Avenue, West A Street, Broadway Street, 10th Street, OR 43, and Blankenship Road. The Broadway Street overpass may be removed as part of ODOT's I-205 widening project.

Sewer Pump Stations

- Arbor
- Bolton (Tri-City)
- Calaroga
- Cedaroak
- Johnson
- Mapleton
- Marylhurst
- River Heights
- River Street (Tri-City)
- Willamette (Tri-City)

Drinking Water

- Primary and Alternative Water Sources
- South Fork Water
- I-205 Water Line (risk reduced in 2024 with new bridge)
- Lake Oswego Intertie Pump Station

Reservoirs/Pressure Zones

- Bland
- Bolton(+pump station)
- Horton(+pump station)
- Rosemont
- View Drive (Robinwood) (+pump station)
- Willamette (+pump station)

Other critical facilities

- Adult Community Center
- West Linn Public Library

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

- Athey Creek Middle School
- Bolton Primary School
- Cedaroak Park Primary School
- Rosemont Ridge Middle School
- Sunset Primary School
- Trillium Creek Primary School

- West Linn High School

- Willamette Primary School

Commercial Centers

- Cascade Summit
- West Linn Central Village
- Robinwood Commercial Center
- Willamette Main Street

Other essential facilities

- City Parks (potential for debris storage)

Environmental Facilities

Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic and functional ecosystem service for the community. See [West Linn Maps](#) for a map of park and open space areas. West Linn has more than 600 acres of park land, ranging from active-oriented parks with areas for sports, picnicking and playing on playgrounds, to passive-oriented parks for walking, biking, and wildlife viewing.

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:

Assisted Living Facilities

- Rose Linn Care Center
- Tanner Springs Assisted Living
- Small Residential Adult Care Homes

Child Care Centers and Preschools

- Atlas Immersion Academy
- Cascade Montessori
- Kindercare Learning Center
- La Petite Academy, Inc.
- SunGarden Montessori
- Lutheran Church Preschool

Schools

- Athey Creek Middle School
- Bolton Primary School
- Cedaroak Park Primary School
- Rosemont Ridge Middle School
- Sunset Primary School
- Trillium Creek Primary School
- West Linn High School
- Willamette Primary School
- Youth Music Project

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: Gas Stations (5), Paper Mill, Public Works/Operations, and the Water Treatment Plant (Lake Oswego-Tigard).

Economic Assets/Population Centers

Economic assets include businesses that employ large numbers of people and provide an economic resource to the city of West Linn. 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. Our four key economic/business centers

are Willamette (Main Street/Blankenship), Robinwood commercial district, Bolton/West Linn Central Village, and Salamo Rd/City Hall. See [West Linn maps](#) for a listing of commercial areas and multi-family housing.

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.

Examples of the types of properties that should be considered before, during, and after an event include Historic Landmarks (28+), Historic City Hall, McLean House and Park, Willamette Falls Historic District, and Willamette Locks.

Hazard Characteristics

Drought

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

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

The City of West Linn currently obtains its potable water from the South Fork Water Board (SFWB, a wholesale water supplier that is equally owned by Oregon City and West Linn). The SFWB source of water is the Clackamas River that originates, like the Willamette, in the Cascade Range and flows west to its confluence with the Willamette River just east of the City. The SFWB operates a conventional water treatment plant located on the south side of the Clackamas River near its confluence with the Willamette. Its system includes intake facilities, a water treatment plant (located in Oregon City), and a transmission pipeline to a pump station located on Division Street in Oregon City. The water distribution system includes six service zones that are supplied by six storage facilities (reservoirs) and five pumping stations. The Water System Master Plan was last updated in 2008 and is currently in the update process to provide long-term guidance for the development of the City's water system, which is a supporting document for the Comprehensive Plan. The City has a map of their Water System on their website.

Vulnerability Assessment

Due to insufficient data and resources, West Linn is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Lifelines Section and Table WL-4.

Future Projections

According to the Oregon Climate Change Research Institute “Future Climate Projections, Clackamas County,”¹¹ drought, as represented by low summer soil moisture, low spring snowpack, low summer

¹¹ Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

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 West Linn 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 West Linn as well.

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

Figure WL-2 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the city is expected to experience very strong shaking (orange), while areas around the city will experience severe shaking (light red) (shown by the red northeast corner) in a CSZ event.

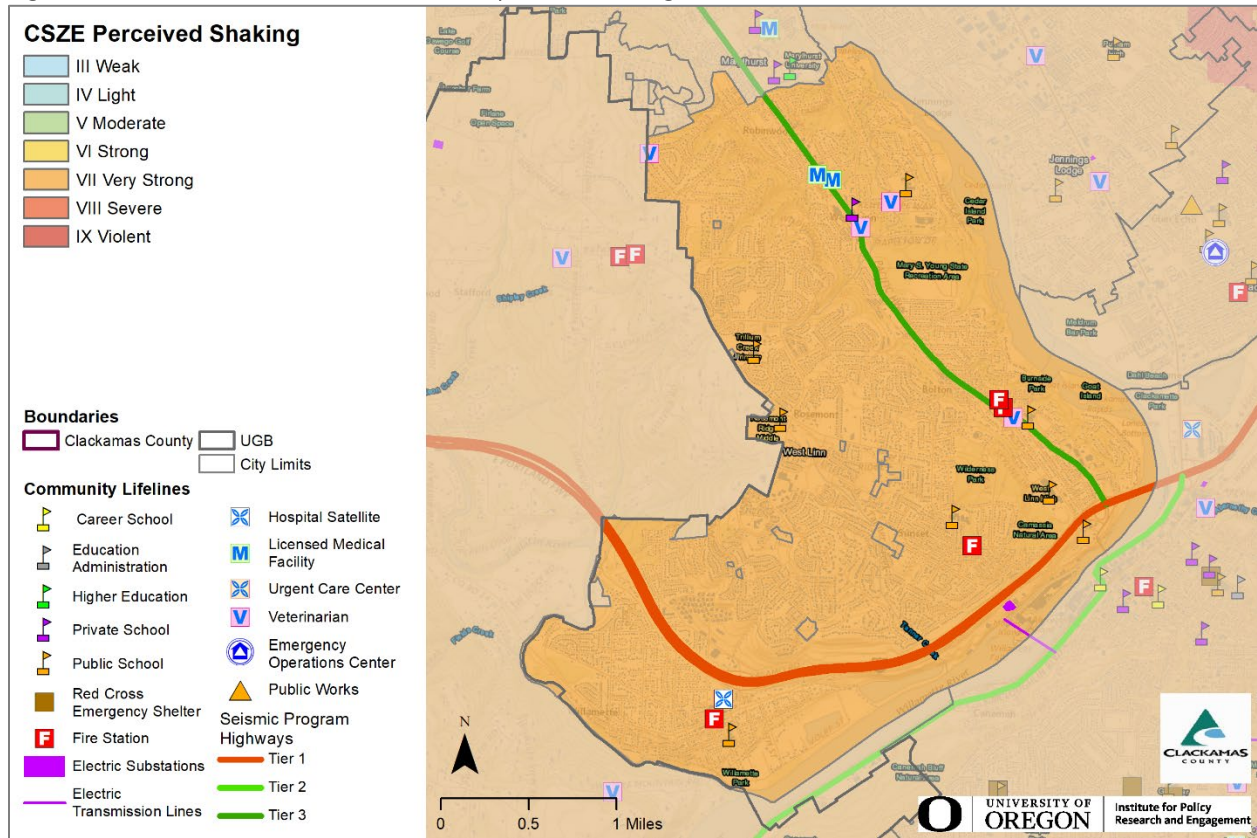
Cascadia Subduction Zone

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

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

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

Figure WL-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

Earthquake (Crustal)

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

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

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 faults include the Bolton fault (running through the city's east edge roughly parallel to Willamette Drive/Highway 43) and Oatfield fault (to the east of the city on the

eastern side of the Willamette River}, Canby-Molalla structural zones located west of the city, and the Mt. Hood Fault in eastern Clackamas County. Historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

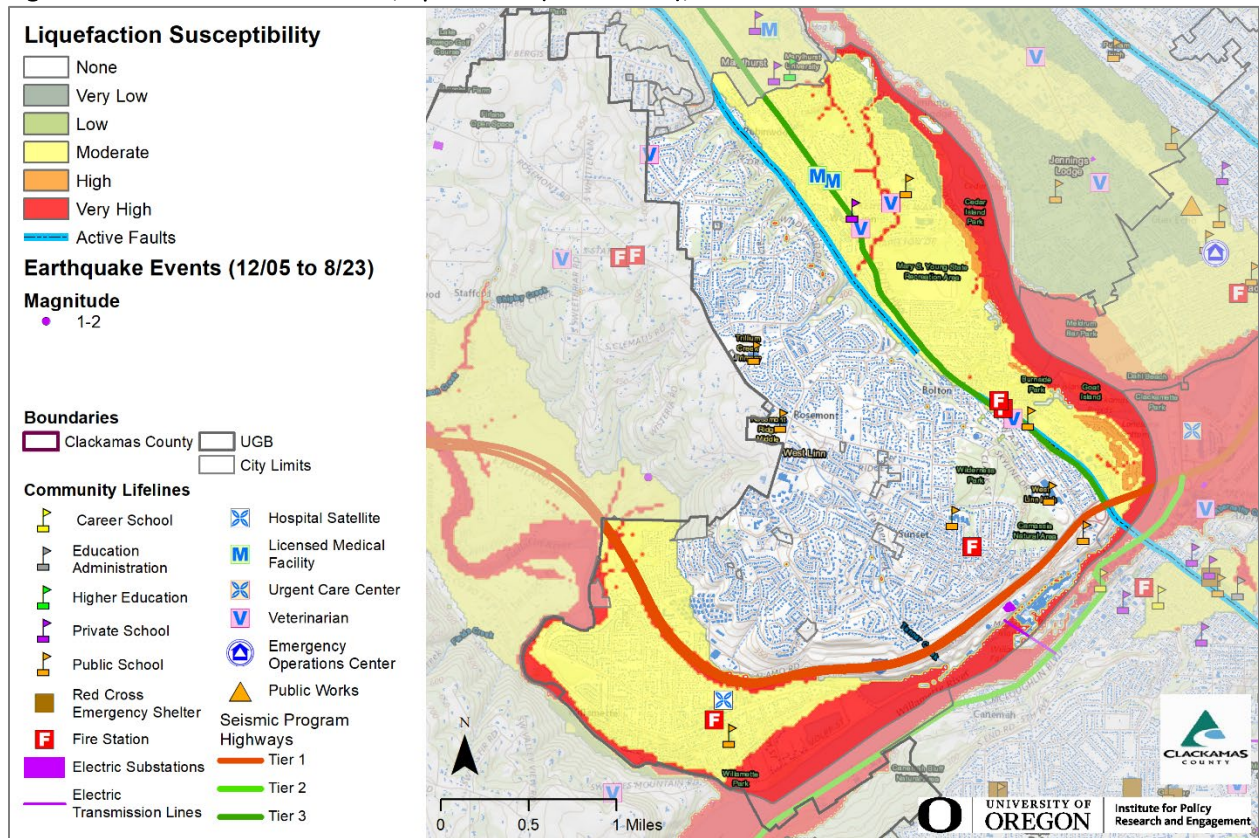
Canby-Molalla Fault Zone

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 West Linn 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 West Linn.

Figure WL-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.

Community assets located in the highest hazard zone for earthquakes include both major hazardous materials fixed sites in West Linn (West Linn Paper Company and Lake Oswego-Tigard Water Treatment Plant) as well as two gas stations. West Linn's infrastructure is particularly vulnerable to earthquake damage. Of the city's nine pump stations, eight are in the moderate to high hazard zones for earthquakes. While the I-205/Abernathy bridge has been seismically retrofitted and is currently being replaced as the first earthquake-ready interstate structure across the Willamette River in the area, its footings lie in the highest hazard zone, as do those for the Oregon City-West Linn Bridge. During a major earthquake, emergency responders may have difficulty performing their duties because their buildings could be impacted by the event.

The Bolton Fire Station, and the Police Department's headquarters are in the moderate to high hazard zones. Areas near the Willamette and Tualatin Rivers are likely comprised of softer soils prone to liquefaction. This can be very destructive to underground utilities such as water and sewer lines. Buildings and water lines can sink into the liquefied ground while sewer pipes, manholes and pump stations (assets partially filled with air) may float to the surface. After the earthquake, the liquefied soil will re-solidify, locking tilted buildings and broken pipe connections into place. In 2018, TVF&R rebuilt Station #55 (Rosemont), and in 2010 they rebuilt Station #58 (Bolton) and Station #59 (Willamette). For a list of facilities and infrastructure vulnerable to this hazard, see the Community Lifelines section and Table WL-4.

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

Seismic building codes were implemented in Oregon in the 1970s; however, stricter standards did not take effect until 1991 and early 2000s. As noted in the community profile, approximately 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 WL-5; each "X" represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), zero (0) have a very high (100% chance) collapse potential, while four (4) have a high (greater than 10% chance) collapse potential. Note: three fire stations and one school have been rebuilt.

For a list of facilities and infrastructure vulnerable to this hazard, see the Community Lifelines section and Table WL-4.

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

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

Table WL-5 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Athey Creek Middle (2900 SW Borland Rd)	Clac_sch73	X			
Bolton Primary (5933 Holmes St)	Clac_sch82		X,X		
Cedaroak Park Primary (4515 S Cedaroak Dr)	Clac_sch85			X	
Rosemont Ridge (20001 Salamo Rd)	Clac_sch79	X			
Stafford Primary (19875 SW Stafford Rd)	Clac_sch93			X	
Sunset Primary (2351 Oxford St) see Mitigation Successes	Clac_sch01	School rebuilt in 2017 per a 2014 bond			
West Linn High (5464 W A St)	Clac_sch02	X			
Willamette Primary (1403 SE 12th St)	Clac_sch72			X,X	
Fire Facilities					
TVF&R Fire Station #58 (Bolton) (6050 Failing St) see mitigation successes	Clac_fir32	Facility rebuilt in 2010 per a 2006 bond			
TVF&R Fire Station #59 (Willamette) (1860 Willamette Falls Drive) see mitigation successes	Clac_fir33	Facility rebuilt in 2010 per a 2006 bond			
Police Facilities					
Police Department (22825 Willamette Drive) see mitigation successes	Clac_pol06	Facility rebuilt in 2014 in a different location per a 2011 bond			

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

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 WL-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 WL-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	9,170	9,170	9,170	9,170
Building Value (\$ Million)	3,817	3,817	3,817	3,817
Building Repair Cost (\$ Million)	117	209	899	1,093
Building Loss Ratio	3%	5%	24%	29%
Debris (Thousands of Tons)	39	64	251	304
Long-Term Displaced Population	96	797	1,679	3,457
Total Casualties (Daytime)	68	99	493	566
Level 4 (Killed)	4	5	32	35
Total Casualties (Nighttime)	19	72	216	347
Level 4 (Killed)	0	2	6	9

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

Cascadia Subduction Zone Scenario

The City of West Linn is expected to have a 3% building loss ratio with a repair cost of \$117 million under the CSZ "dry" scenario, and an 5% building loss ratio with a repair cost of \$209 million under the CSZ

"wet" scenario.¹³ The city is expected to have around 68 daytime or 19 nighttime casualties during the CSZ "dry" scenario and 99 daytime or 72 nighttime casualties during the CSZ "wet" scenario. It is expected that there will be a long-term displaced population of around 96 for the CSZ "dry" scenario and 797 for the CSZ "wet" scenario.¹⁴

Portland Hills Fault Scenario

The City of West Linn is expected to have a 24% building loss ratio with a repair cost of \$899 million under the CSZ "dry" scenario, and a 29% building loss ratio with a repair cost of \$1.093 billion under the CSZ "wet" scenario.¹⁵ The long-term displaced population and casualties are greatly increased for all the Portland Hills Fault scenarios. The city is expected to have around 493 daytime or 216 nighttime casualties during the Portland Hills Fault "dry" scenario and 566 daytime or 347 nighttime casualties during the Portland Hills Fault "wet" scenario. It is expected that there will be a long-term displaced population of around 1,679 for the Portland Hills Fault "dry" scenario and 3,457 for the Portland Hills Fault "wet" scenario.¹⁶

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

Natural Hazard Risk Report for Clackamas County

The **Risk Report (DOGAMI, 2024)**¹⁷ 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): 422 buildings (10 critical facilities), are expected to be damaged for a total potential loss of \$235 million (a loss ratio of about 5%). About 332 residents may potentially be displaced (about 1% of the population).

Crustal event (Canby-Molalla fault M6.8 Deterministic): 926 buildings are expected to be damaged (10 critical facilities), for a total potential loss of \$382 million (a loss ratio of about 9%). About 771 residents may be displaced (about 3% of the population).

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.

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

¹⁴ Ibid, Tables 12-8 and 12-9.

¹⁵ Ibid, Tables 12-10 and 12-11

¹⁶ Ibid, Tables 12-10 and 12-11.

¹⁷ DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (2024), Table A-35.

Flood

The HMAC determined that the City's probability of flooding is **high** and that their vulnerability to flooding is **moderate**. *The probability rating increased, and the vulnerability rating did not change 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 WL-4 illustrates the flood hazard area for West Linn.

Portions of West Linn have areas of floodplain (special flood hazard areas, SFHA). These include the Tualatin, and Willamette Rivers. The Federal Emergency Management Agency (FEMA) regulatory floodplains for each of these rivers are depicted as relatively narrow areas on each side of the channels. On the Willamette River, the floodway is generally confined within high stream banks. On the Tualatin, the floodways cover a somewhat larger area.

Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage, and economic loss from business interruption. It is important for the City to be aware of flooding impacts and assess its level of risk.

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

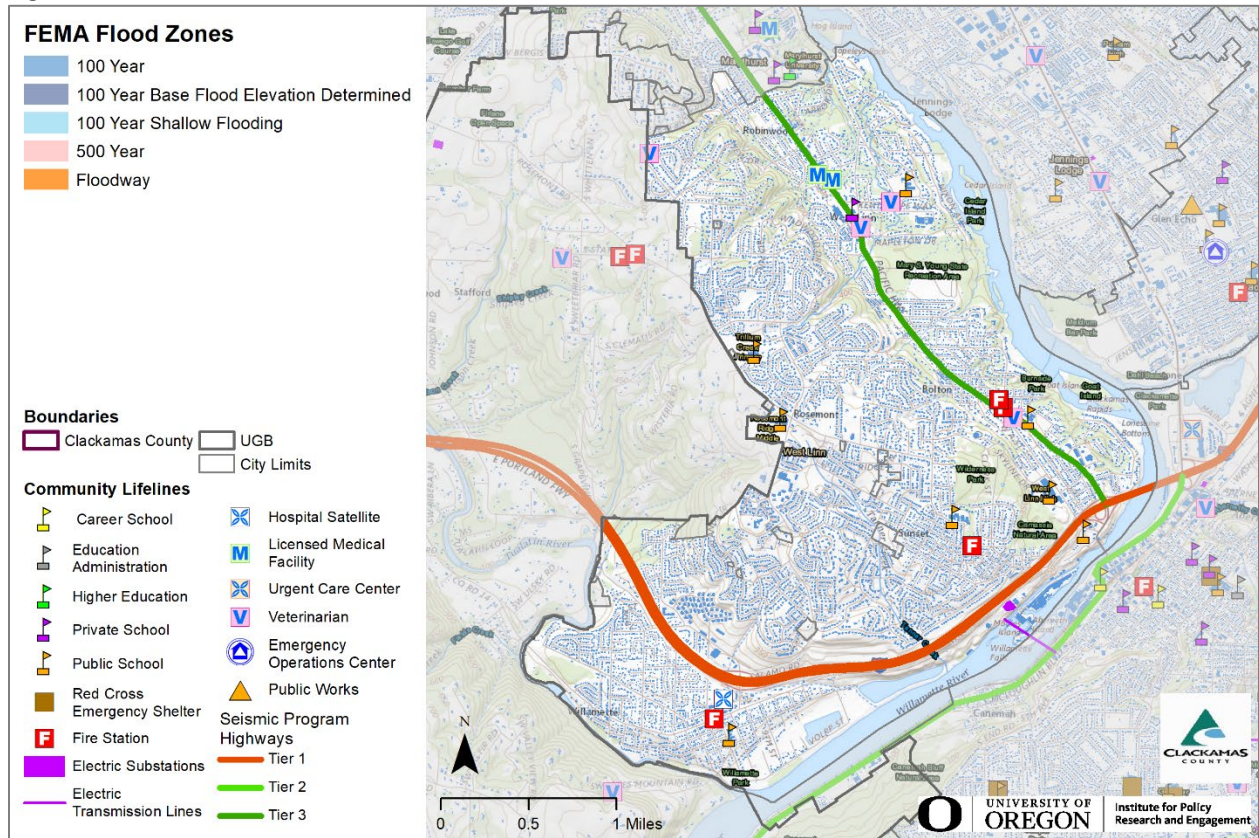
For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of West Linn outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage. City staff has identified sites where local drainage facilities are taxed during high flows, especially where open ditches enter culverts or go underground into storm sewers and works to mitigate the stormwater flood risks in these areas (see the City's 2019 [Surface Water Management Plan](#) for more information).

The speed of onset, lack of warning, and depth of flooding make dam failures a potentially deadly, albeit unlikely, occurrence. There are four major dams upstream of West Linn on the Clackamas River: North Fork, Faraday, River Mill and Timothy. These are operated by Portland General Electric and are subject to the dam safety and warning requirements of the Federal Energy Regulatory Commission. According to the Clackamas County Emergency Operations Plan, areas of West Linn bordering on the Willamette in the vicinity of its confluence with the Clackamas would be inundated by a wall of water 60 - 80 feet high in approximately an hour and a half should the North Fork dam fail under a "probable maximum flood" (a worst-case scenario where all four dams fail). There are no major dams on the Tualatin, and the Willamette River dams are far enough upstream and dispersed so that failures on these two rivers would not be much worse than a regular flood.

The largest flooding event to affect West Linn was the February 1996 flood. The high-water level meant tributaries could not drain into the Tualatin and Willamette River, which led to localized flooding on several backed-up creeks.

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

Figure WL-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

The City completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012, and reviewed and updated, as appropriate, in 2023. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

Relatively few people (about 3% of the total population) live in the floodplain and thus are directly at risk from flooding. Dwelling units within or adjacent to the 100-year floodplain of the Tualatin those located on Swiftshore Avenue, Fields Bridge Park, and the Willamette Park. Residences along the Willamette that could be exposed to 100-year flooding events include those along River Street, Nixon Ave, Calaroga Ct., and Cedar Oak Park. Other properties are vulnerable to urban flooding when the Willamette or Tualatin rivers overflow their banks.

Several economic centers, zoned commercial and industrial, are in the 100-year floodplain (including the site of the former West Linn Paper Company). Studies show that most businesses do not survive extended closure due to disasters, which can thus economically devastate local communities. It will be essential that the economic centers mapped in hazard areas be targeted for business continuity planning.

Additionally, a great deal of infrastructure (bridges, water lines, sewage pump stations, etc.) is in the floodplain. Infrastructure exposed to flooding includes, but is not limited to, Portland General Electric's Sullivan Hydroelectric Plant, Weiss Bridge, Fields Bridge, 1-205 water line, Tri Cities sewage pump

stations, and many more pieces of critical infrastructure that assist in supporting the essential needs of the community. Disruption to this infrastructure could result in transportation issues, power outages, sewage back-up, and affect overall community and environmental health.

A few historic sites, including the Mclean House, are also located in the floodplain. Many older buildings will have difficulty sustaining pressure from flooding events and should be targeted for floodplain retrofitting. For a list of facilities and infrastructure vulnerable to this hazard see the Community Lifelines section and Table WL-4.

Natural Hazard Risk Report for Clackamas County

The Risk Report (DOGAMI, 2024)¹⁸ provides hazard analysis summary tables that identify populations and property countywide that are vulnerable to the flood hazard.

According to the Risk Report 48 buildings (0 critical facilities) could be damaged for a total potential loss of \$72 million (a building loss ratio of about 2%). About 165 residents may be displaced by flood (less than 1% of the population).

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 West Linn was on August 28, 2003. West Linn does not participate in the Community Rating System (CRS). The Community Repetitive Loss record (Table WL-7) identifies two (2) Repetitive Loss Properties¹⁹ and no Severe Repetitive Loss Properties²⁰. For information on the location of the properties, see Volume I, Section 2, Figure 14.

Table WL-7: Community Repetitive Loss Properties

RL #	RL or SRL Property	Occupancy	Mitigated?	Currently NFIP Insured	Rated Flood Zone	Post FIRM	Paid Claims	Total Paid Amount
85733	RL	Single Family	No	Yes	A21	Yes	2	\$23,271
304139	RL	Single Family	No	No	AE	Yes	2	\$10,902
Total							2	\$23,271

Source: FEMA Region X, Regional Flood Insurance Liaison, email February 23, 2023.

Future Projections

According to the Oregon Climate Change Research Institute “Future Climate Projections, Clackamas County,”²¹ 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

¹⁸ DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon (2024)*, Table A-35.

¹⁹ 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.

²⁰ 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.

²¹ Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

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 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 **high** and that their vulnerability to landslide is **moderate**. *The probability rating did not change and the vulnerability rating increased since the previous version of this NHMP.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Although catastrophic landslides have not occurred in West Linn, steep slopes do exist along the banks of the Willamette River, and east of Willamette Drive coincident with the Bolton fault.

Landslide susceptibility exposure for West Linn is shown in Figure WL-5. Most of West Linn demonstrates a low to moderate landslide susceptibility exposure. Approximately 21% of West Linn has very high or high, and approximately 44% moderate, landslide susceptibility exposure.²² However, most of the areas that are identified to exhibit dangerous potential rapidly moving landslides are vacant and often preserved in wooded and dedicated open space. Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard, and assets.

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.

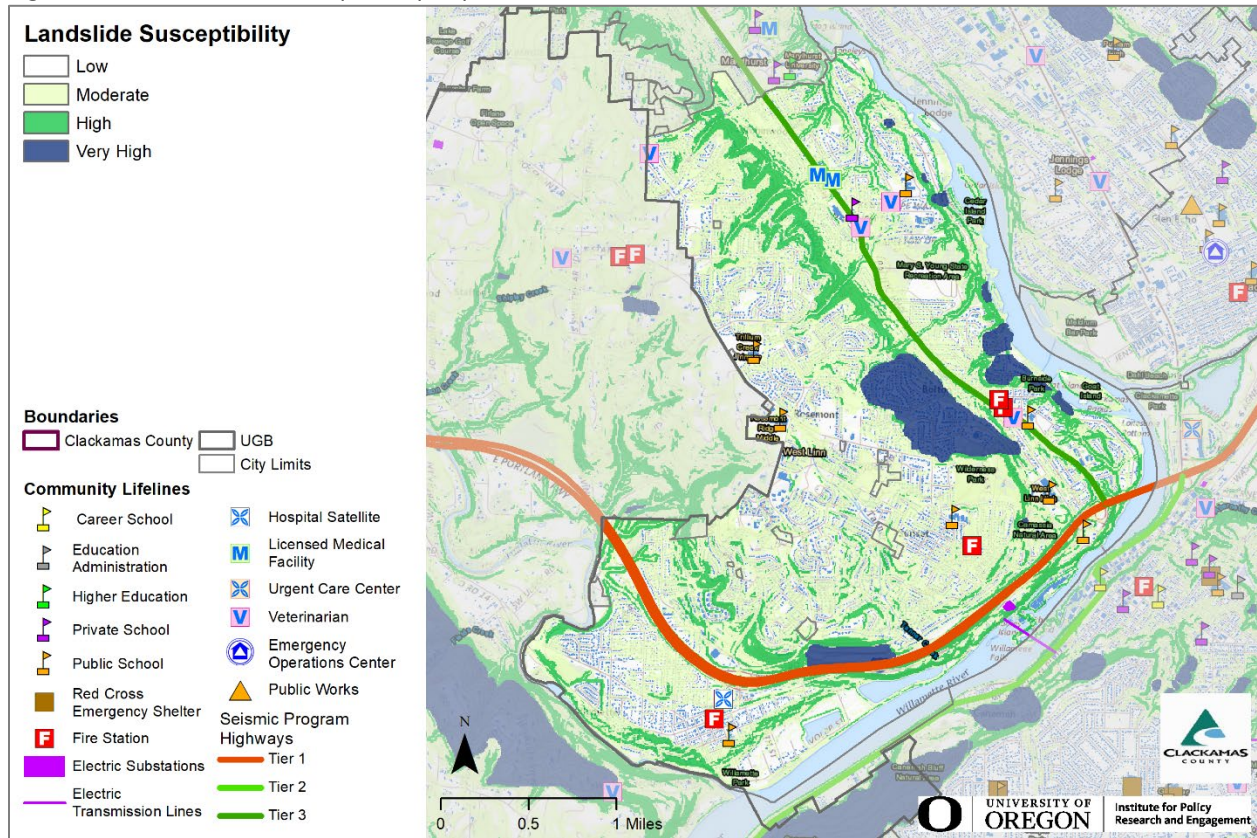
Vulnerability Assessment

DOGAMI completed a statewide landslide susceptibility assessment in 2016 ([O-16-02](#)), general findings from that report are provided above.

Additionally, the City completed an analysis, using the best available data, as a component of the vulnerability assessment in 2009, updated in 2012 and 2018, and reviewed and updated, as appropriate, in 2023. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

²² DOGAMI. [Open-File Report, O-16-02, Landslide Susceptibility Overview Map of Oregon](#) (2016)

Figure WL-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

About 50 percent of the City's population live in potential landslide areas. Two critical facilities are exposed to the landslide hazard -Public Works Operations Building and Library. Three schools that are considered essential facilities are also exposed to the landslide hazard. In addition, critical infrastructure, economic centers, cultural or historic assets, environmental assets, and hazardous material sites are exposed to the landslide hazard. Hazardous materials sites would also suffer damage, resulting in threats to environmental and human health, while disrupting the availability of gasoline for vehicle transport and furthering economic loss because such sites are also sources of employment. For a list of facilities and infrastructure vulnerable to this hazard see the Community Lifelines section and Table WL-4.

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

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

Potential landslide-related impacts are adequately described within Volume I, Section 2, and include infrastructure damages, economic impacts (due to isolation, and/or arterial road closures), property

damages, and obstruction to evacuation routes. Rain-induced landslides, and debris flows can potentially occur during any winter, and thoroughfares beyond City limits are susceptible to obstruction as well. For a list of facilities and infrastructure vulnerable to this hazard see the Community Lifelines section and Table WL-4.

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, 2024)**²³ provides hazard analysis summary tables that identify populations and property countywide that are vulnerable to the landslide hazard.

According to the Risk Report 1,376 buildings are exposed to the *high and very high landslide susceptibility* hazard for a total exposure of \$722 million (a building exposure ratio of about 16%). About 4,882 residents may be displaced by landslides (about 18% of the population). *Note: the exposure number is for all buildings and population exposed to the high and very high landslide susceptibility areas.*

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 **moderate** 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,

²³ DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon (2024)*, Table A-35.

Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit, and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The City of West Linn has experienced life-threatening consequences for vulnerable populations from the few historical 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,”²⁴ 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**. *The probability rating did not change and the vulnerability rating decreased 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 West Linn.

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

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

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.

²⁴ Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

Winter Storm (Snow/Ice)

The HMAC determined that the City's probability for winter storm is **high** and that their vulnerability to winter storm is **high**. *The probability and vulnerability ratings increased 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.

Most winter storms typically do not cause significant damage, but they are frequent and have the potential to impact economic activity. Road and rail closures due to winter weather are a common 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,"²⁵ 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.

Vulnerability Assessment

Due to insufficient data and resources, West Linn is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Lifelines section and Table WL-4.

Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected.

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

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

Consequently, severe storms affect the entire city. Several streets in areas of the City with steep grades are particularly hazardous during snow and ice events and are subject to closure during winter weather events including: Marylhurst Drive (from Hillcrest Drive to Lower Midhill Drive), Hidden Springs Road (from Bluegrass Way to Cottonwood Court), Pimlico Drive (from Palamino Way to Willamette Drive), Summit Street (from Rosemont Road to Skyline Drive), 12th Street (from Tualatin Avenue to Volpp Street), and Skye Parkway (from Troon Drive to Hillside Drive). The City's Snow and Ice Removal Plan is maintained by the Public Works Department and includes provisions to place equipment on designated principal routes throughout the City. For more information see the City's inclement weather information webpage and their Winter Weather Route Map.

The major risk to property results from exposed utilities, especially power lines and water pipes that are damaged by wind, broken tree limbs and cold temperatures. Businesses also suffer economic losses when they must close as the result of the inclement weather and/or the loss of power, which, in turn, disrupts the local supply chain of goods and services. Periods of extended ice coverage hinder emergency response services and limit the mobility of residents, which could result in serious life safety issues. Residents and businesses that are in areas that exhibit the severe storm hazard face some risk of damage from severe storms. Severe weather events are expected to impact nearly all City residents.

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

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

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

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

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

Volcanic Event

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

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

Vulnerability Assessment

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

Natural Hazard Risk Report for Clackamas County

The **Risk Report (DOGAMI, 2024)**²⁶ 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 **medium**, and that their vulnerability to wildfire is **moderate**. *The probability rating increased and the vulnerability rating did not change since the previous version of this NHMP.*

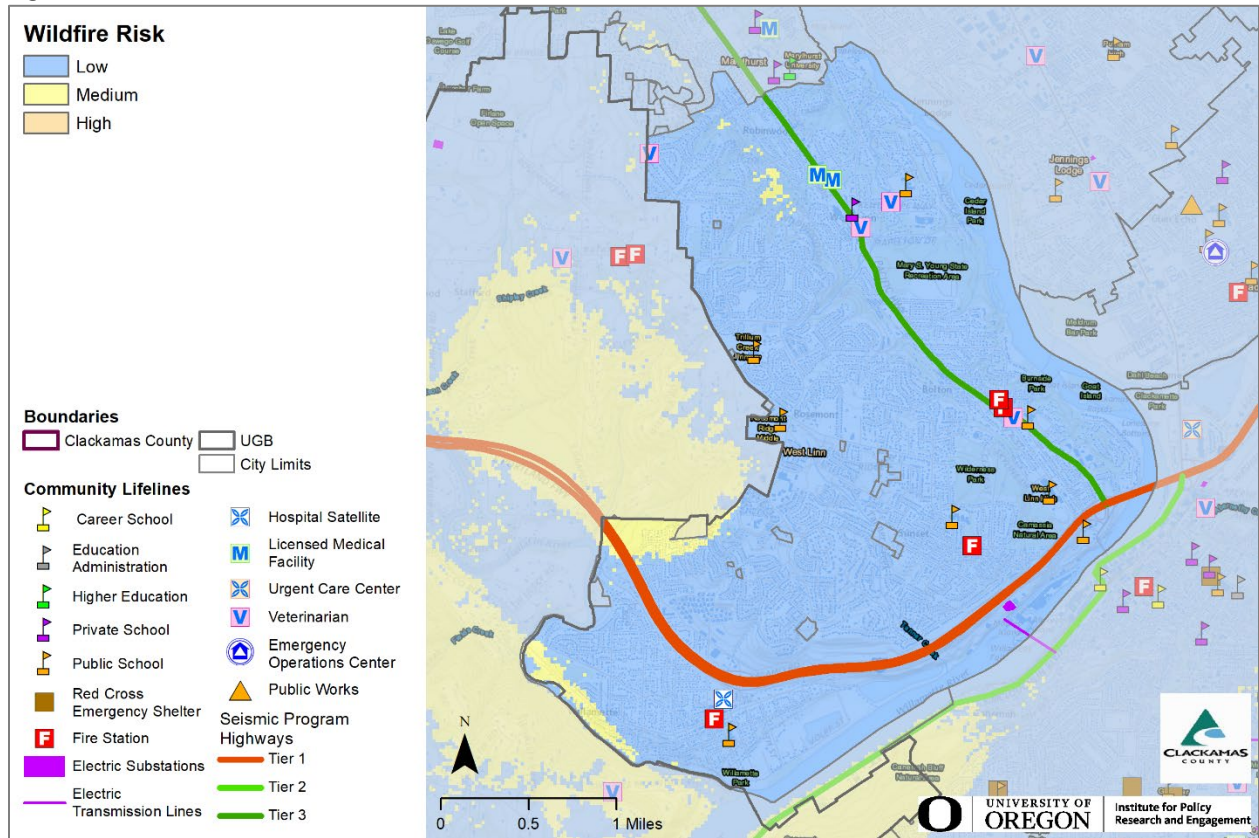
The [Clackamas County Community Wildfire Protection Plan \(CWPP\)](#) is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard. Information specific to West Linn is found in the following chapter: Chapter 9.13: Tualatin Valley Fire and Rescue.

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location, and extent of a wildland fire vary depending on fuel, topography, and weather conditions.

Weather, and urbanization conditions are primarily at cause for the hazard level. West Linn has not experienced a wildfire within City limits, but the city has abundant wooded areas that are a concern in the case of a wildfire event. Figure WL-6 shows overall wildfire risk in West Linn.

²⁶ DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon (2024)*, Table A-35.

Figure WL-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

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

The City is characterized by lush parks, neighborhoods surrounded by mature trees and under story vegetation and development intermingled with the natural landscape. Much of West Linn's undeveloped topography consists of wooded slopes 25 percent or steeper.

These occluded woodlands range in size from 2 to 20 acres and make up a significant portion of the 373 acres of parks and open space managed by the City. Most of the woodlands are surrounded by urban development that are a concern in the case of a wildfire event. Figure WL-6 shows overall wildfire risk in West Linn. The forested hills within, and surrounding West Linn are interface areas including the following High Priority Communities at Risk (CARs): 1-205 Corridor, Skyline Ridge, and Wilderness Park/Camassia Park; and the following Medium Priority CARs: Burnside Park and Maddax Woods, Hidden Springs, Mary S

Young Park, White Oak Savannah, Wildwood Open Space, Wilson Creek Natural/Rosemont Area, and Wisteria. and Wisteria.²⁷

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.²⁸ 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. Increasing periods of high heat, dry conditions, and low precipitation increase the potential for wildfire.

Vulnerability Assessment

Exposure of community assets to natural hazards was determined by manually comparing community assets with each hazard and identifying where assets and hazards intersected. Residences and businesses that border occluded woodlands with slopes greater than 25% are at the greatest risk of loss or damage from wildfires. A great deal of infrastructure is exposed to the wildfire hazard, including West Linn's primary water source. This could affect the efficiency of fire protection professionals during a large-scale wildfire. Vegetation along roadways is also highly dangerous, as negligent motorists provide ignition sources by tossing cigarette butts out car windows. Because schools are generally located near parks and scenic areas, they can be threatened by wildfires. Bolton Middle School, Cedaroak Park School, and West Linn High School and the Library are particularly at risk. A variety of historic landmarks are also included in the high wildfire zones.

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

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

Natural Hazard Risk Report for Clackamas County

The **Risk Report (DOGAMI, 2024)**²⁹ provides hazard analysis summary tables that identify populations and property countywide that are vulnerable to the wildfire hazard.

According to the Risk Report 74 buildings (no critical facilities) are exposed to the *high and (or) moderate (medium) risk wildfire* hazard for a total exposure of \$32.4 million replacement value (a building replacement value exposure ratio of less than 1%). About 228 residents may be displaced by wildfires (less than 1% of the population).

Future Projections

According to the Oregon Climate Change Research Institute "Future Climate Projections, Clackamas County,"³⁰ 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

²⁷ Clackamas County Community Wildfire Protection Plan, *Tualatin Valley Fire and Rescue* (2018), Table 10.13-1.

²⁸ [Oregon Wildfire Risk Explorer](#), date accessed November 9, 2018.

²⁹ DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (2024), Table A-35.

³⁰ Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

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.

Attachment A: Action Item Changes

Table WL-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 WL-1)

Previous NHMP Actions that are Complete:

Multi-Hazard #3, “Identify, protect, and enhance natural resources in accordance with Goal 5.” Complete.

Multi-Hazard #4, “Maintain and incorporate available natural hazard data into City GIS databases and applications.” Complete.

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

None identified.

Table WL-8 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	#2	Not Complete, revised	Yes
-	#3	New	-
Multi-Hazard #3	-	Complete	No
Multi-Hazard #4	-	Complete	No
Multi-Hazard #5	#4	Not Complete	Yes
Earthquake #1	#5	Not Complete, revised	Yes
Flood #1	#6	Not Complete	Yes
Flood #2	#7	Not Complete	Yes
Flood #3	#8	Not Complete	Yes
Flood #4	#9	Not Complete	Yes
Severe Weather #1	#10	Not Complete	Yes
Severe Weather #2	#11	Not Complete	Yes
Wildfire #1	#12	Not Complete	Yes
-	#13	New	-
-	#14	New	-

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 March 5 through March 20, 2024 on the City’s website. The plan was also posted and announced on the County’s website. There were no comments provided. 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

The screenshot shows the City of West Linn website with a navigation bar (Community, Business, Departments, How Do I..., Contact Us) and a search bar. The main content area is titled "West Linn Ready" and features a sidebar with emergency preparedness links. The central focus is a "Natural Hazard Mitigation Plan Update" announcement. The announcement includes a graphic with the text "NATURAL HAZARD PLAN UPDATE Survey" and a list of bullet points detailing the update process and public feedback opportunities. A "Contact Information" box is located at the bottom left of the announcement area.

West Linn Ready

- Emergency Contacts
- Emergency Alerts and Warnings
- Earthquake Preparedness
- Fire Preparedness +
- Flood Preparedness
- Protecting Your Documents
- Winter Weather Preparedness and Resources
- Natural Hazard Mitigation Plan Update**
- Natural Hazards Mitigation Plan

Natural Hazard Mitigation Plan Update

The City of West Linn’s Natural Hazard Mitigation Plan (NHMP) identifies natural hazards that may impact our community and provides the City with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities, and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

We welcome the community’s feedback on our [draft NHMP](#) (attached below).

Please submit comments on the draft 2024 [West Linn NHMP](#) by 5 p.m., March 20, 2024 using the [webform here!](#)

The City of West Linn’s NHMP will be included as addendum to the larger [Clackamas County NHMP](#) as we face many of the same natural hazards and coordinate on emergency preparation and response. The local planning process for this update included a wide range of representatives from city, special districts, county emergency management personnel, and the University of Oregon’s Institute for Policy Research and Engagement.

- The City of West Linn is in the process of updating their existing 2019 Natural Hazards Mitigation Plan (2019). The process should be complete in 2024, pending Oregon Department of Emergency Management, FEMA, and City Council approval.
- Every five years, Federal guidelines require the City’s addendum to the Clackamas County NHMP be updated and submitted to the Federal Emergency Management Agency (FEMA) for approval.
- With re-adoption of a FEMA-approved NHMP, the City maintains its eligibility to apply for federal funding towards natural hazard mitigation projects.
- This work is being performed in cooperation with the University of Oregon’s Institute for Policy Research and Engagement - Oregon Partnership for Disaster Resilience and the Oregon Department of Emergency Management (OEM) utilizing funds obtained from the Federal Emergency Management Agency’s (FEMA) Hazard Mitigation Grant Program. With re-adoption of the plan, West Linn will maintain its eligibility to apply for federal funding towards natural hazard mitigation projects.

If you have any questions regarding the City’s NHMP addendum or the update process in general, please contact: Michael Howard (mrhoward@uoregon.edu), Director for the Oregon Partnership for Disaster Resilience at 541-346-8413; or Dylan Digby (ddigby@westlinnoregon.gov), Assistant to the City Manager.

Contact Information

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 and #2: March 8 and May 24, 2023

During these meetings, 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 #3: 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.