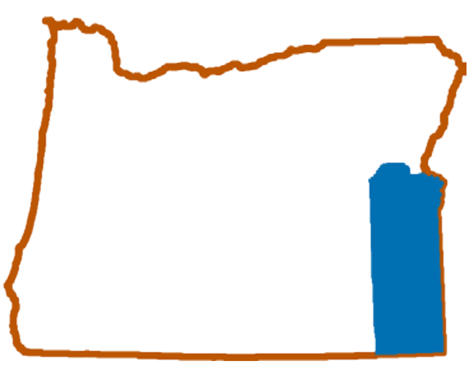





Malheur County

MULTI-JURISDICTION NATURAL HAZARDS MITIGATION PLAN



- Malheur County
- Ontario
- Nyssa
- Vale

FEMA

Effective Month x, 2019 through Month x, 2024

The *2019 Malheur County Multi-Jurisdictional Natural Hazards Mitigation Plan* is a living document that will be reviewed and updated periodically.

Comments, suggestions, corrections, and additions are encouraged to be submitted from all interested parties.

For further information and to provide comments, contact:

Lt. Rich Harriman, Emergency Services Manager
Malheur County Sheriff's Office
151 "B" St.
Vale, OR 97918
Phone 541-473-5120
Email: richard.harriman@malheurco.org

Malheur County developed this Multi-Jurisdictional Natural Hazards Mitigation Plan through a partnership funded by the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation Grant Program. In 2017, the Department of Land Conservation and Development (DLCD) received two Pre-Disaster Mitigation Grants (PDMC-PL-OR-2016-003 and PDMC-PL-10-OR-2016-005) from FEMA through the Oregon Office of Emergency Management (OEM) to assist Malheur County and seven other counties with their NHMPs.

Volume I:
Basic Plan

Source: Ontario train station and city park photos, Tricia Sears, DLCD, May 12, 2018

This page left intentionally blank.

SPECIAL THANKS & ACKNOWLEDGEMENTS

Malheur County developed this Multi-Jurisdictional Natural Hazards Mitigation Plan (NHMP) through a partnership funded by the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation (PDM) Grant Program. In 2017, the Department of Land Conservation and Development (DLCD) received two Pre-Disaster Mitigation grants (PDMC-PL-10-OR-2016-003 and PDMC-PL-10-OR-2016-005) from FEMA through the Oregon's Office of Emergency Management (OEM) to assist Malheur County and seven other counties with their NHMPs.

Partners include:

Malheur County
City of Ontario
City of Nyssa
City of Vale
Oregon's Office of Emergency Management (OEM)
Federal Emergency Management Agency (FEMA) Region X
Oregon Department of Land Conservation and Development (DLCD)

Project Steering Committee:

Department of Land Conservation & Development Staff:

Tricia Sears, Natural Hazards Planner

Malheur County

Representatives from the following organizations served as Steering Committee members for the Malheur County Natural Hazards Mitigation Plan update process.

Convener, Rich Harriman	Lieutenant, Malheur County Emergency Management
Jamie Willet	Malheur County, Planning
Dave Fenstemacher	Malheur County Health Department, Emergency Coordinator
Gina Lewis	Malheur County, GIS Specialist (maps)
Craig Geddes	Malheur County, Environmental Health
Adele Dockter	City of Adrian City Mayor
Bob Webb	City of Adrian, Fire Chief
Marie Kershner	City of Jordan Valley, Mayor
Al Crouch	Bureau of Land Management (BLM), Fire Mitigation/Education Specialist
Jason Simmons	BLM, Assistant Fire Management Officer (Fuels)

Todd Gregory	BLM, Assistant Fire Management Officer (Ops) (former)
Don Rotell	BLM, Supervisory Natural Resource Specialist

City of Nyssa

Jim Maret	City of Nyssa, City Manager
Ray Rau	City of Nyssa, Chief of Police
Eric Menchaca	City of Nyssa, Fire Chief
Duane Petty	City of Nyssa, Public Works Lead

City of Ontario

Adam Brown	City of Ontario, City Manager
Cal Kunz	City of Ontario, Police Chief
Kari Ott	City of Ontario, Finance
Terry Leighton	City of Ontario, Fire Chief

City of Vale

Katy Lamb	City of Vale, City Manager
Mike McLaughlin	City of Vale, Mayor
Chad Cooper	City of Vale, Public Works
Jess Tolman	City of Vale, Fire Chief

Other Participants

Brule Lehman	Owyhee Irrigation District, Vegetation & Environmental Coordinator/ SPCC
Jay Chamberlain	Owyhee Irrigation District, Manager
Pam Uyeki	St. Alphonsus Hospital, Trauma/Emergency Preparedness Coordinator
Katherine Sherman	St. Alphonsus Hospital, RN
Heidi Ragsdale	Eastern Oregon Center for Independent Living, Independent Living Specialist
David Armstrong	Tri-County Love, Inc., Executive Director (former)
Kyle McCauly	Cascade Natural Gas, Engineer Associate
Brittany White	Malheur Council on Aging & Community Services (MCOACS), Transportation Project Manager
Tom Davis	ODOT, D-14 Operations Coordinator
Dylan Martin	Idaho Power
Kaitlyn Kyro (formerly Stratton)	Idaho Emergency Management Office, Payette County
Robert Batcheller	Amateur Radio Emergency Services, Engineer

Bob Dickinson	Malheur County Ambulance Service District (ASD), Director
Jane Padgett	Oregon Department of Human Services, Business Integrity/ Community Development
Mark Redmond	Malheur County Education Service District, Superintendent
Loni Thomas (formerly Debban)	Malheur Council on Aging & Community (MCOACS)
Lindsay Atagai	Malheur County Health Department, Director (former)
Emily Mateer	Valley Family Health Care, Staff & Compliance Officer
Mindy Volmer	Valley Family Health Care, Facilities Manager
Martin Heisig	American Red Cross
Belinda Heisig	American Red Cross
Brandon Tarvin	Lifeways, HM14, OFD
Molly Smith	Southwest District Health, Idaho, Health Educator
Maria Ramos	Southwest District Health, Volunteer and student in Emergency Management, Idaho St. University
Linda Pratzner	Southwest District Health, Idaho, Administrative Assistant
TJ Wilson	Southwest District Health, Idaho, PHD3 Planner

Project Managers:

Tricia Sears, Natural Hazards Planner, DLCD

Rich Harriman, Lieutenant, Malheur County Emergency Management

About the Oregon Department of Land Conservation and Development

Oregon's statewide land use planning program — originated in 1973 under Senate Bill 100 — provides protection of farm and forest lands, conservation of natural resources, orderly and efficient development, coordination among local governments, and citizen involvement. The program affords all Oregonians predictability and sustainability to the development process by allocating land for industrial, commercial and housing development, as well as transportation and agriculture. The Department of Land Conservation and Development (DLCD) administers the program. A seven-member volunteer citizen board known as the Land Conservation and Development Commission (LCDC) guides DLCD. Under the program, all cities and counties have adopted comprehensive plans that meet mandatory state standards that address land use, development, housing, transportation, and conservation of natural resources. Periodic review of plans and technical assistance in the form of grants to local jurisdictions are key elements of the program.[1]

Plan Template Disclaimer

The *2019 Malheur County Natural Hazards Mitigation Plan* update is based in part on a NHMP template developed by the University of Oregon's Institute for Policy Research and Engagement (IPRE) - Oregon Partnership for Disaster Resilience (OPDR) and used in the *2014 Malheur County NHMP*. At that time, OPDR provided copies of the plan templates to communities for use in developing or updating their NHMPs. The template is structured to address the requirements contained in 44 CFR 201.6. The basic format of the *2014 Malheur County NHMP* has been retained for this *2019 Malheur County NHMP* update, but considerable modifications have been made. Emphasis is placed on identifying and describing the unique attributes of the counties and cities.

[1] DLCD, http://www.oregon.gov/LCD/Pages/about_us.aspx, Accessed November 14, 2018

Malheur County
Multi-Jurisdictional
Natural Hazards Mitigation Plan

Table of Contents

Executive Summary

Malheur County developed and updated this *2019 Malheur County Multi-jurisdictional Natural Hazards Mitigation Plan* (*2019 Malheur County NHMP*) to prepare for the short- and long-term effects resulting from natural hazards. It is not possible to predict exactly when the hazards will occur, or the extent to which they will affect the community. However, with careful planning and collaboration among the whole community- public agencies at local, state and federal levels; private sector organizations; businesses; families and individuals; non-profit groups; schools and academia; media outlets; faith based and community organizations - it is possible to create a resilient community that benefits from mitigation planning and short- and long-term recovery planning.[1]

The Federal Emergency Management Agency (FEMA) defines mitigation as ". . . the effort to reduce loss of life and property by lessening the impact of disasters . . . through risk analysis, which results in information that provides a foundation for mitigation activities that reduce risk." Said another way, natural hazard mitigation is a method of reducing or alleviating the impacts to life, property, and the environment resulting from natural hazards through short- and long-term strategies. Example strategies include policy changes, such as updated ordinances, and projects, such as seismic retrofits to critical facilities; and education and outreach to targeted audiences, such as Spanish speaking residents or the elderly. Natural hazard mitigation is the responsibility of the whole community. Mitigation actions in NHMPs implement these strategies.

> *44 CFR 201.6 – The local mitigation plan is the representation of the jurisdiction's commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards. . . .*

Why Develop this Mitigation Plan?

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 pre- and post- disaster federal funds. Local and federal approval of this plan ensures that Malheur County and the Cities of Ontario, Nyssa, and Vale will remain eligible for these funds.

> *44 CFR 201.6(a)(1) – A local government must have a mitigation plan approved pursuant to this section in order to receive HMGP project grants . . .*

Who Participated in Developing the Plan?

The *2019 Malheur County NHMP* is the result of a collaborative effort between Malheur County, the Cities of Ontario, Nyssa, and Vale, special districts, citizens, public agencies, non-profit organizations, the private sector, regional organizations, and DLCD. A project steering committee guided the plan development process.

[1] FEMA, Whole Community, https://www.fema.gov/whole-community, accessed December 20, 2018.

The Malheur County NHMP Steering Committee included representatives from a broad range of organizations including:

> *44 CFR 201.6(c)(1) – Documentation of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.*

- Malheur County
- City of Nyssa
- City of Ontario
- Owyhee Irrigation District
- St. Alphonsus Hospital
- Eastern Oregon Center for Independent Living
- Tri-County Love, Inc.
- Idaho Power
- Emergency Management Office, Payette County, Idaho
- Cascade Natural Gas
- Amateur Radio Emergency Services
- Malheur County Education Service District
- Malheur Council on Aging & Community Services
- Malheur County Health Department
- Malheur County Ambulance Service District
- Valley Family Health Care
- Southwest District Health, Idaho
- Lifeways
- American Red Cross
- Oregon Department of Human Services
- Oregon Department of Land Conservation and Development (DLCD)
- Oregon Department of Transportation (ODOT)
- United States Department of the Interior – Bureau of Land Management

See the Acknowledgements section for the full list of organizations and representatives that participated on the NHMP Steering Committee.

In collaboration with DLCD, the Malheur County Emergency Manager convened the planning process. The Malheur County Emergency Manager will take the lead in implementing, maintaining and updating the NHMP. Malheur County is dedicated to directly involving the public in the continual review and update of the NHMP. The County will post the *2019 Malheur County Multi-jurisdictional Natural Hazards Mitigation Plan* on the County's website. The Cities will also post the NHMP on their websites.

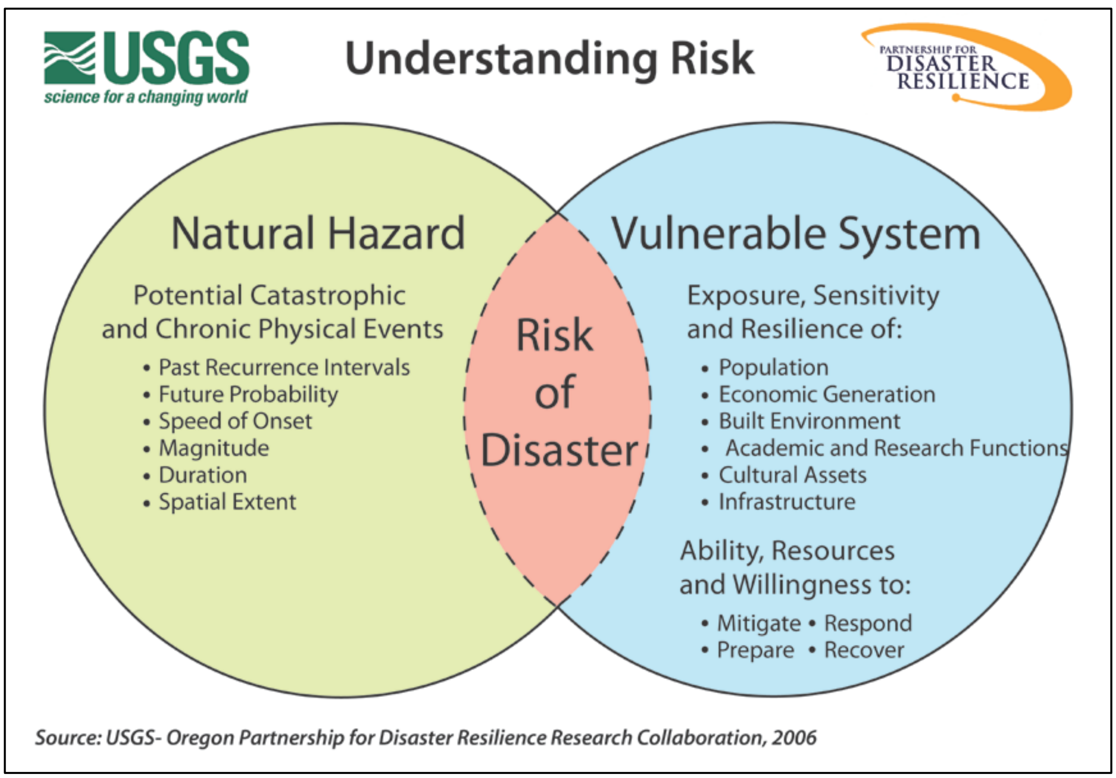
The Malheur County NHMP Steering Committee also serves as the Emergency Management Team (EMT) and the Local Emergency Planning Committee (LEPC); this triple duty high energy group meets each month. As part of this NHMP process, the group has established LEPC bylaws and within the bylaws set the requirement that the NHMP will be reviewed and discussed twice per year as part of the meetings. This will help ensure the NHMP is a living document that is used and stays connected to the plans, policies, and programs of the involved jurisdictions and other NHMP Steering Committee members. In addition, the EMPG grant requires review of the NHMP twice per year.

How Does this Mitigation Plan Reduce Risk?

44 CFR 201.6(c)(2) – A Risk Assessment that provides the factual basis for activities proposed in the strategy . . .

The NHMP will assist in reducing risk from natural hazards in Malheur County by identifying resources, information, and strategies for risk reduction. It will help guide and coordinate mitigation activities throughout Malheur County. A key part of the NHMP is the risk assessment. It consists of three phases: hazard identification, vulnerability assessment, and risk analysis, as illustrated in Figure ES-1.

Figure ES-1 Understanding Risk



Source: 2014 Malheur County NHMP, Oregon Partnership for Disaster Resilience, 2006.

By identifying and understanding the relationship between natural hazards, vulnerable systems, and existing capacity, Malheur County is better equipped to identify and implement actions aimed at reducing the overall risk to natural hazards. Section 2 Risk Assessment and Volume II Hazard Annexes provide details on the natural hazards in Malheur County and the Cities, as well as the vulnerabilities and risks. Mitigation actions are identified to help reduce risk; see Section 3 Mitigation Strategy for details.

What is the County's Overall Risk to Hazards?

Malheur County, along with the Cities of Ontario, Nyssa, and Vale, reviewed and updated their risk assessment to evaluate the probability of each natural hazard as well as the vulnerability of the community to that hazard. All the previously identified natural hazards were retained for this NHMP. They noted that in the future, they will consider air quality as a natural hazard. The NHMP Steering Committee performed the Hazard Vulnerability Assessment (HVA) at the April 12, 2018 meeting. Table ES-1 below summarizes the risk score and risk level for each hazard as determined by the Steering Committee. See also Section 2 Risk Assessment for additional information.

Table ES-1 Natural Hazards, Risk Scores, and Risk Levels

HAZARD	RISK SCORE	RISK LEVEL (H-M-L)
Droughts	240	High
Winter Storms	226	High
Wind Storms	195	High-Medium
Floods	188	High-Medium
Wildfire	175	High-Medium
Severe Weather	165	High-Medium
Extreme Temperature	126	Medium
Volcanic Events	124	Medium
Dust Storms	116	Medium
Earthquakes	64	Low
Landslides	60	Low

Source: Malheur County NHMP Steering Committee, 2018

What is the Plan's Mission?

44 CFR 201.6(c)(3)(i) – A description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

The mission of the Malheur County NHMP is to:

To create a disaster-resilient Malheur County by building partnerships, reducing risk, preventing loss, and protecting life, property, and the environment from future natural hazard events.

What are the Plan Goals?

The plan goals describe the overall direction that the participating jurisdiction's agencies, organizations, and citizens can take toward mitigating risk from natural hazards. Below is a list of the plan goals. Note that although numbered, the goals are not prioritized.

Goal 1: *Protect Infrastructure, Safeguard Economy*

Implement projects and activities to lessen the impacts of natural hazards on infrastructure and property, protect the local economy, and reduce economic hardship in post-*disaster situations.*

Goal 2*: Increase Education, Outreach and Awareness*

Implement education programs to increase awareness of hazards and risk reduction practices for citizens, government, and business.

Goal 3: *Strengthen Organizational and Community Capacity*

Develop, strengthen, and sustain community partnerships among public and private sector stakeholders to build upon local resources for mitigation efforts.

Goal 4: *Reduce the Threat to Life Safety*

Minimize the threat to life in disaster events through mitigation activities that improve community notification and preparation.

Goal 5: *Protect Natural and Cultural Resources*

Strengthen land use planning and natural resource management to protect natural systems and allow them to serve mitigation functions. Develop measures to protect cultural resources from natural hazard risks.

How are the Mitigation Actions Organized?

44 CFR 201.6(c)(3)(ii) – A section that identifies and analyzes a comprehensive range of specific mitigation actions . . .

The mitigation actions are organized within a Mitigation Actions Table included within Section 3 Mitigation Strategy (full descriptions of each mitigation action are provided in Appendix A Action Item Forms). The NHMP Steering Committee agreed to use the risk level rankings from the Hazard Vulnerability Assessment (HVA) (shown in summary in Table ES-1) as a way to prioritize the mitigation actions. As a result of this, the high priority actions are all of the multi-hazard (MH) actions and the hazard-specific actions for drought and winter storms. Droughts and winter storms are the two hazards with the highest risk scores. The Mitigation Actions Table 2019 NHMP is Table 2-5 in the Section 3 Mitigation Strategy.

Data collection, research, Steering Committee discussion, and the public participation process resulted in the development of the mitigation actions. The Mitigation Actions Table 2019 NHMP, Table 3-3, portrays the overall plan framework and identifies links between the plan goals and actions. The table documents the title of each action along with the coordinating organization, timeline, and the plan goals addressed. Each participating jurisdiction is identified and an x marks the applicability of the mitigation action to that jurisdiction.

How will the plan be implemented?

> *44 CFR 201.6(c)(3)(iii) – An action plan describing how the actions . . . will be prioritized, implemented and administered . . .*
>
> *44 CFR 201.6(c)(4) – A plan maintenance process . . .*

Section 4 Plan Implementation and Maintenance details the formal process that will ensure that the *2019 Malheur County NHMP* remains an active and relevant document. The plan will be implemented, maintained and updated by a designated convener. The Malheur County Emergency Manager is the designated convener and is responsible for overseeing the review and implementation processes. The plan maintenance process includes a schedule for monitoring and evaluating the plan twice per year and updating the NHMP every five years to maintain eligibility for pre- and post- disaster funds from FEMA. This section of the NHMP describes how the communities will integrate public participation throughout the plan maintenance process.

Plan Adoption

> *44 CFR 201.6(c)(5) – Documentation that the plan has been formally adopted by the governing body of the jurisdiction . . .*
>
> *44 CFR 201.6(d) – Plan review [process] . . .*

Once the NHMP is locally reviewed and deemed ready, the Plan Convener and DLCD submit it to the State Hazard Mitigation Officer at the Oregon's Office of Emergency Management (OEM). OEM reviews the plan and submits it to the Federal Emergency Management Agency (FEMA – Region X) for review. This review will address the federal criteria outlined in FEMA Interim Final Rule 44 CFR Part 201.6.

Upon pre-approval by FEMA, indicated by a letter provided from FEMA to Malheur County called the "Approval Pending Adoption" (APA) the County will then adopt the NHMP via resolution. Following County adoption, the other participating jurisdictions will need to adopt it. Once FEMA is provided with final resolution documentation, they will formally approve the *2019 Malheur County NHMP*. At that point Malheur County will maintain their eligibility for the Hazard Mitigation Assistance (HMA) pre- and post- disaster funds. These funds are distributed through the Pre-Disaster Mitigation (PDM) program, the Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program.

The accomplishment of the *2019 Malheur County NHMP* goals and actions depends upon regular NHMP Steering Committee participation and support from County and City leadership. Thorough familiarity with this NHMP will result in the efficient and effective implementation of mitigation actions and a reduction in the risk and the potential for loss from future natural hazard events.

Copies of the resolutions of approval from Malheur County and the Cities of Ontario, Nyssa, and Vale will be included in this NHMP once they are received. Copies of the FEMA APA and final approval letters will also be included in this NHMP when they are received.

SECTION I: INTRODUCTION

This section provides a general introduction to natural hazards mitigation planning in Malheur County. In addition, it addresses the planning process requirements contained in 44 CFR 201.6(b) thereby meeting the planning process documentation requirement contained in 44 CFR 201.6(c)(1). The section concludes with a general description of how the plan is organized.

What is Natural Hazard Mitigation?

The Federal Emergency Management Agency (FEMA) defines mitigation as ". . . the effort to reduce loss of life and property by lessening the impact of disasters . . . through risk analysis, which results in information that provides a foundation for mitigation activities that reduce risk."[1] Said another way, natural hazard mitigation is a method of permanently reducing or alleviating the losses of life, property, and injuries resulting from natural hazards through short- and long-term strategies. Example strategies include policy changes, such as updated ordinances; projects, such as seismic retrofits to critical facilities; and education and outreach to targeted audiences, such as Spanish speaking residents. Natural hazard mitigation is the responsibility of the "Whole Community" – individuals and families; private businesses and industries; non-profit groups; schools and academia; media outlets; faith based and community organizations; and federal, state, and local governments.[2]

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.

Why Develop a Mitigation Plan?

Malheur County developed this Natural Hazards Mitigation Plan (NHMP), along with the Cities of Ontario, Nyssa, and Vale in an effort to reduce future loss of life and damage to property resulting from natural hazards. The current Malheur County NHMP Steering Committee is doing an update to the existing NHMP that was approved on May 2, 2014 by FEMA and valid through May 1, 2019.

It is not possible to predict exactly when natural hazard events will occur, or the extent to which they will affect community assets. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the impacts and losses that can result from natural hazards.

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 pre- and post- disaster

---

[1] FEMA, *What is Mitigation?* http://www.fema.gov/what-mitigation, accessed December 20, 2018,

[2] FEMA, *Whole Community*, https://www.fema.gov/whole-community, accessed December 20, 2018.

mitigation funds. Local and federal approval of this plan ensures that Malheur County and the Cities of Ontario, Nyssa, and Vale will remain eligible for pre- and post-disaster mitigation funding.

What Federal Requirements Does This Plan Address?

DMA2K is a key piece of federal legislation addressing natural hazards mitigation planning. It reinforces the importance of mitigation planning and emphasizes planning for natural hazards before they occur. As such, this Act established the Pre-Disaster Mitigation (PDM) grant program and requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP).

Section 322 of the Act specifically addresses mitigation planning at the state and local levels. State and local jurisdictions must have approved NHMPs to qualify to receive post-disaster HMGP funds. Mitigation plans must demonstrate that their proposed mitigation actions are based on a sound planning process that accounts for the risk to the individual and their capabilities. Chapter 44 Code of Federal Regulations (CFR), section 201.6, also requires a local government to have an approved NHMP in order to receive HMGP project grants.[3]

Pursuant of Chapter 44 CFR, the Natural Hazard Mitigation Plan planning processes shall include opportunity for the public to comment on the plan during review, and the NHMP shall include documentation of the public planning process used to develop the plan.[4] The NHMP update must also contain a risk assessment, mitigation strategy and a plan maintenance process that has been formally adopted by the governing body.

Development of the *2019 Malheur County NHMP* was pursued in compliance with subsections from 44 CFR 201.6 guidelines. These four subsections address plan requirements, the planning process, plan content, and plan review.

- Subsection (a) provides an outline of the overall plan requirements, including an overview of general plan components, exceptions to requirements, and multi-jurisdictional participation.
- Subsection (b) outlines the requirements of the planning process, with particular focus on public involvement in the update process, as well as the role of local agencies, organizations and other relevant entities in the development process, as well as standards for adequate levels of review and incorporation of existing plans and policies.
- Subsection (c) outlines requirements concerning the plan update's content, including an overview of necessary components for the update's planning process, risk assessment, mitigation strategy, plan maintenance, and overall process documentation.
- Subsection (d) outlines the steps and agencies required for proper review of the plan before finished plans are adopted by their respective communities.

[5]The *2019 Malheur County NHMP* must be submitted to Oregon's Office of Emergency Management (OEM) for initial plan review, and then it is submitted to FEMA for review and federal approval.[6]

---

[3] Code of Federal Regulations, Chapter 44. Section 201.6, subsection (a), https://www.law.cornell.edu/cfr/text/44/201.6

[4] ibid, subsection (b).

[5] ibid, subsection (c).

[6] ibid, subsection (d).

Once FEMA provides the Approval Pending Adoption letter, the local jurisdictions –Malheur County and the Cities of Ontario, Nyssa, and Vale - must approve the NHMP. Once the local jurisdictions have provided resolutions showing the adoption of the NHMP, FEMA will send the approval letter with the dates of the NHMP approval. The approval period is for five years.

Additionally, the Emergency Management Performance Grant (EMPG), which helps fund local emergency management programs, also requires a FEMA-approved NHMP.

What is the Policy Framework for Natural Hazards Planning in Oregon?

Planning for natural hazards is an integral element of Oregon's statewide land use planning program, which began in 1973. All Oregon cities and counties have comprehensive plans and implementing ordinances that are required to comply with the Statewide Planning Goals. The challenge faced by state and local governments is to keep this network of local plans coordinated in response to the changing conditions and needs of Oregon communities.

Statewide land use planning Goal 7, Areas Subject to Natural Hazards, calls for local plans to include inventories, policies and ordinances to guide development in or away from hazard areas. Goal 7, along with other land use planning goals, has helped to reduce losses from natural hazards. Through risk identification and the recommendation of risk-reduction actions, this NHMP aligns with the goals of the jurisdictions' comprehensive plans, and helps each jurisdiction meet the requirements of statewide land use planning Goal 7.

The primary responsibility for the development and implementation of risk reduction strategies and policies lies with local jurisdictions. However, resources exist at the state and federal levels. Some of the key agencies in this area include OEM, Oregon Building Codes Division (BCD), Oregon Department of Forestry (ODF), Oregon Department of Geology and Mineral Industries (DOGAMI), and the Department of Land Conservation and Development (DLCD).

How was the Update to the NHMP Developed?

The Malheur County NHMP Steering Committee with the collaboration of DLCD staff updated the *2014 Malheur County NHMP*. The *2014 Malheur County NHMP* was approved by FEMA on May 2, 2014 and is valid through is May 1, 2019. The Ontario Addendum was adopted on April 21, 2014; the Nyssa Addendum was adopted on May 13, 2014, and the Vale Addendum was adopted on April 9, 2014.

The Malheur County NHMP Steering Committee includes the Cities of Nyssa, Ontario and Vale. A roster of the Steering Committee is included in the Acknowledgements section of this NHMP. The Malheur County NHMP Steering Committee also serves as the Emergency Management Team (EMT) and the Local Emergency Planning Committee (LEPC); there are meetings each month for this triple duty high energy group.

The Malheur County NHMP Steering Committee formally convened at three meetings (April 12, 2018; June 14, 2018; and August 9, 2018) with the DLCD Natural Hazards Planner, in person, to discuss and revise the plan. In addition, the DLCD Natural Hazards Planner called in for discussion about mitigation actions, outreach, and the project timeline during the November 8, 2018 NHMP/ EMT/ LEPC meeting. Also, the DLCD Natural Hazards Planner called in for discussion about the draft

NHMP and review comments, as well as project timeline public outreach during the January 10, 2019, February 14, 2019, and April 11, 2019 NHMP/ EMT/ LEPC meetings.

Steering Committee members contributed data and information, did outreach and advocacy for the NHMP, and reviewed and updated the NHMP in collaboration with DLCD.

An open public involvement process is essential to the development of an effective NHMP. To develop a comprehensive approach to reducing the effects of natural disasters, the planning process includes opportunity for the public, neighboring communities, local and regional agencies, as well as, private and non-profit entities to comment on the plan during review.[7] Malheur County and the Cities of Ontario, Nyssa, and Vale maintained a publicly accessible website throughout the planning process and provided opportunities for the general public to provide feedback. In addition, there were flyers made and distributed about the NHMP, and outreach at events. See Appendix B Planning and Public Process.

How is the Plan Organized?

Each volume of the NHMP provides specific information and resources to assist readers in understanding the hazard-specific issues facing county and city residents, businesses, and the environment. Combined, the sections work in synergy to create a NHMP that furthers the community's mission to reduce or eliminate risk to people and their property from hazards and their effects. This NHMP structure enables stakeholders to use the section(s) of interest to them; see the Table of Contents in addition to the descriptions below. The Cities of Ontario, Nyssa, and Vale participated in the process along with Malheur County and the other organizations on the NHMP Steering Committee. See the Acknowledgements for a list of participating organizations and their representatives. See Appendix B Planning and Public Process for more information.

Volume I: Basic Plan

Executive Summary

The executive summary provides an overview of the FEMA requirements plans process and highlights the key elements of the risk assessment, mitigation strategy, and implementation and maintenance strategy.

Section 1: Introduction

The Introduction briefly describes the countywide mitigation planning efforts and the methodology used to develop the plan.

Section 2: Risk Assessment

Section 2 provides the factual basis for the mitigation strategies contained in Section 3. Additional information is included within Appendix C, Community Profile, which contains an overall description of Malheur County and the Cities of Nyssa, Ontario and Vale.

---

[7] Code of Federal Regulations, Chapter 44. Section 201.6, subsection (a), https://www.law.cornell.edu/cfr/text/44/201.6

The Risk Assessment section includes a brief description of community sensitivities and vulnerabilities and an overview of the hazards further addressed in Volume II Hazard Annexes. Climate is also discussed in the Risk Assessment, the Hazard Annexes, and Appendix F.

The Risk Assessment allows readers to gain an understanding of Malheur County's, and other jurisdictions', sensitivities – those community assets and characteristics that may be impacted by natural hazards, as well as the County's, and other jurisdictions', resilience – the ability to manage risk and adapt to hazard event impacts. The Risk Assessment provides summary information on the jurisdictions' participation in the National Flood Insurance Program (NFIP) with additional details in the Flood Annex.

Section 3: Mitigation Strategy

This section documents the plan vision, mission, goals, and actions and also describes the components that guide implementation of the identified mitigation strategies. Mitigation actions are based on community sensitivity and resilience factors and the hazard assessments in Section 2 Risk Assessment and Volume II Hazard Annexes. In Section 3, the status of the *2014 Malheur County NHMP* mitigation actions is identified in Table 3-2, and the mitigation actions for the *2019 Malheur County NHMP* are identified in Table 3-3.

Section 4: Plan Implementation and Maintenance

This section provides information on the implementation and maintenance of the plan. It describes the process for prioritizing projects, and includes a suggested list of tasks for updating the plan to be completed at the semi-annual and five-year review meetings. There is a five-year update cycle for the NHMP.

As mentioned previously, the Malheur County Steering Committee also serves as the Emergency Management Team (EMT) and the Local Emergency Planning Committee (LEPC); there are meetings each month for this triple duty high energy group. As part of this NHMP process, the group is establishing LEPC bylaws and within the bylaws set the requirement that the NHMP will be reviewed and discussed twice per year as part of the meetings. This will help ensure that the NHMP is a living document that is used and stays connected to the plans, policies, and programs of the involved jurisdictions and other Steering Committee members. In addition, the EMPG grant requires review of the NHMP twice per year.

Volume II: Hazard Annexes

The hazard annexes describe the risk assessment process and summarize the best available local hazard data. A hazard summary is provided for each of the hazards addressed in the plan. The summary includes hazard history, location, extent, vulnerability, impacts, and probability.

The hazard specific annexes included with this NHMP are the following:

- Drought;
- Earthquake;
- Flood;
- Landslide;
- Severe Weather, including
  - Dust Storm
  - Extreme Temperature

  - Wind Storm, and
  - Winter Storm
- Volcanic Event; and
- Wildfire.

Volume III: Mitigation Resources

The resource appendices are designed to provide the users of the *2019 Malheur County NHMP* with additional information to assist them in understanding the contents of the NHMP, and with potential resources to assist with plan implementation.

Appendix A: Action Item Forms

This appendix contains the detailed mitigation action item forms for each of the mitigation actions identified in this NHMP.

Appendix B: Planning and Public Process

This appendix includes documentation of all the countywide public processes utilized to update the plan. It includes invitation lists, meeting agendas, sign-in sheets, screen shots from websites, and copies of flyers, as well as any other public involvement methods.

Appendix C: Community Profile

The Community Profile describes Malheur County and participating cities from a number of perspectives to help define and understand the regions sensitivity and resilience to natural hazards. The information represents a snapshot in time of the current sensitivity and resilience factors in the region when the plan was updated. Sensitivity factors can be defined as those community assets and characteristics that may be impacted by natural hazards, (e.g., special populations, economic factors, and historic and cultural resources). Community resilience factors can be defined as the community's ability to manage risk and adapt to hazard event impacts (e.g., governmental structure, agency missions and directives, and plans, policies, and programs).

Appendix D: Economic Analysis of Natural Hazard Mitigation Projects

This appendix describes FEMA's requirements for benefit/cost analysis in natural hazards mitigation, and two other approaches: the cost effectiveness and the STAPLE/E. The Oregon Partnership for Disaster Resilience (OPDR) developed this appendix in the previous NHMP. It has been retained and slightly modified.

Appendix E: Grant Programs and Resources

This appendix lists state and federal resources (including funding) and programs.

Appendix F: Future Climate Projections Reports

This appendix includes two reports provided by the Oregon Climate Change Research Institute (OCCRI): *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports* and *Future Climate Projections Malheur County: A Report to the Oregon Land Conservation* *and Development*. Both reports are dated August 2018. These reports were funded by DLCD using a small portion of the PDM 16 grant funds obtained by DLCD.

Appendix G: Malheur County NHMP Success Stories

These are stories illustrate when a community in Malheur County identifies a problem or concern and then works to solve it. These stories were identified and provided by the members of the Malheur County NHMP Steering Committee.

Appendix H: Malheur County HAZUS Global Reports for Crustal and Probabilistic Scenarios

This report was prepared by DOGAMI in 2007. It was never published but it was included in the *2014 Malheur County NHMP*. It contains scenarios for crustal and probabilistic earthquakes including maps and descriptions of the impacts. HAZUS is an earthquake loss estimation model that was developed by FEMA and the National Institute of Building Sciences. Using HAZUS, the described impacts are to buildings, critical facilities, transportation, and utilities. It describes the social impacts and economic loss. Also, it describes fires that can follow earthquakes, and debris generation. A similar report was produced for Lake County and Harney County.

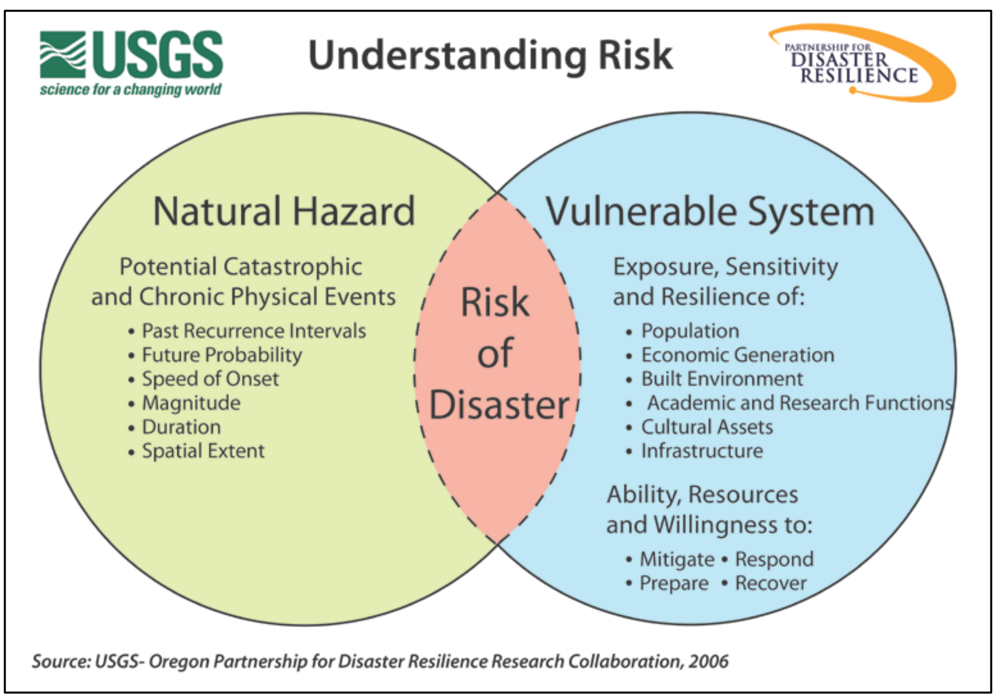
SECTION 2: RISK ASSESSMENT

This section of the NHMP 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 hazards 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 information presented below, along with hazard specific information presented in Volume II Hazard Annexes and in Appendices F and H, and the community characteristics presented in Appendix C Community Profile will be used as the local level rationale for the risk reduction actions identified as mitigation actions in Section 3 Mitigation Strategy. The risk assessment process is graphically depicted in Figure 2-1 below. Ultimately, the goal of hazard mitigation is to reduce the area where hazards and vulnerable systems overlap, which is the area called the risk of disaster.

Figure 2-1 Understanding Risk

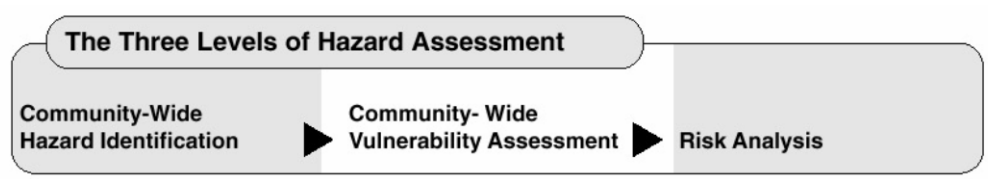


Source: *2014 Malheur County NHMP*, Oregon Partnership for Disaster Resilience, 2006.

What is a Risk Assessment?

A risk assessment consists of three phases: hazard identification, vulnerability assessment, and risk analysis, as illustrated in the following graphic.

Figure 2-2 Three Phases of a Risk Assessment



Source: *Planning for Natural Hazards: Oregon Technical Resource Guide*, 1998

The first phase, **hazard identification**, involves the identification of the geographic extent of a hazard, determining a hazards causes and characteristics, its intensity, and its probability of occurrence. This level of assessment typically involves producing a map. The outputs from this phase can also be used for land use planning, management, and regulation; public awareness; defining areas for further study; and identifying properties or structures appropriate for acquisition or relocation.[1]

The second phase, **vulnerability assessment**, combines the information from the hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard, and attempts to predict how different types of property and population groups will be affected by the hazard. This step can assist in justifying changes to building codes or development regulations, property acquisition programs, policies concerning critical and public facilities, taxation strategies for mitigating risk, and informational programs for members of the public who are at risk.[2]

The third phase, **risk analysis**, involves estimating the damage, injuries, and costs likely to be incurred in a geographic area over a period of time. Risk can be described quantitatively, qualitatively, or both. Risk has two measurable components: (1) the magnitude of the harm that may result, defined through the vulnerability assessment, and (2) the likelihood or probability of the harm occurring. An example of a product that can assist communities in completing the risk analysis phase is HAZUS, a risk assessment software program for analyzing potential losses from floods, hurricane winds and earthquakes. In Hazards U.S. – Multi-Hazard (HAZUS-MH) current scientific and engineering knowledge is coupled with the latest geographic information systems (GIS) technology to produce estimates of hazard-related damage before, or after a disaster occurs.

Multi-jurisdictional Risk Assessment - §201.6(c) (2) (iii): For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

The planning area for this NHMP is Malheur County, both unincorporated and incorporated areas. Information provided in this Risk Assessment section is supplemented by the Hazard Annexes and

[1] Burby, *Cooperating with Nature* (Washington, DC: Joseph Henry Press, 1998), 126.

[2] Ibid, 133.

Appendix F Future Climate Projections Reports and Appendix H Malheur County HAZUS Global Reports for Crustal and Probabilistic Scenarios.

Hazard Identification

Malheur County identifies eleven natural hazards that could have an impact on the County and the Cities, as shown in Table 2-1. For specific information pertaining to individual hazards, see Volume II Hazard Annexes. Note that Severe Weather is listed as a separate hazard, but the description includes dust storms, tornadoes, extreme temperatures, wind storms, rain storms, and winter storms. This was done at the Steering Committee's request for the *2019 Malheur County NHMP*.

Table 2-1 identifies the hazards identified by the Steering Committee in relationship to the hazards identified in the *2015 Oregon NHMP* for Southeastern Oregon in Region 8, which includes Harney and Malheur Counties. Notably, the *2015 Oregon NHMP* does not include ratings for Malheur County for extreme temperature (heat) and severe weather.

Table 2-1 Malheur County Hazard Identification

Hazard Identified in Malheur County NHMP*	Hazard identified in Oregon NHMP**
Winter Storms	Winter Storms
Wind Storms	Wind Storms
Earthquakes	Earthquakes
Droughts	Droughts
Floods	Floods
Volcanic Events	Volcanoes
Wildfire	Wildfire
Landslides	Landslides
Extreme Temperature	NA
Dust Storm	Dust Storm
Severe Weather	NA

Source: *Malheur County NHMP Steering Committee, 2018, and **2015 Oregon NHMP, Region 8: Southeast Oregon

This Hazard Identification section includes descriptions for each natural hazard in the following ways: significant changes since the *2014 Malheur County NHMP*, characteristics, and the location/extent. For additional details on the history of events for each hazard, the relationship with climate projections, and maps of the hazards, see Volume II Hazard Annexes and Appendix F.

As part of the NHMP update process, there is a requirement to examine changes in development. Climate change and climate resilience are important parts of this discussion. According to the UN Intergovernmental Panel on Climate Change (IPCC), climate resilience is defined as "the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation (IPCC, 2014b, p. 1772)."

In Appendix F Future Climate Projections Reports, the Oregon Climate Change Research Institute's (OCCRI) *Future Climate Projections Malheur County: A Report to the Oregon Department of Land Conservation and Development* and the *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports*, provide important information regarding the influence and impacts of climate change on existing natural hazards events such as heavy rains, river flooding, drought, heat waves, cold waves, wildfire, and air quality. The overview discusses all eight of the counties while the respective individual county reports are specific to each county. OCCRI's research and analysis focuses on how climate change is expected to influence natural hazards.

The overview describes results for the natural hazards using climate metrics in summary and as a comparison. For example, "Drought conditions, as represented by snowpack, is projected to become more frequent whereas drought conditions represented by low summer soil moisture and low summer runoff may become less frequent in Malheur County by the 2050s compared to the historical baseline." There is a very useful table that is a "summary of projected direction of changes in climate change-related risk of natural hazard occurrence across eight Oregon Counties."

Each county report describes county-specific projected changes in climate metrics related to selected natural hazards. The reports present future climate projections for the 2020s (2010-2039 average) and the 2050s (2040-2069 average) compared to the 1971-2000 average historical baseline. Each hazard in the report has a box highlighting "key messages" that call out the main points of the research and analysis for that hazard.

In addition to Appendix F, climate related information is included in the Introduction of Volume II Hazard Annexes in the "Predicted Climate Variability**"** section.

The Hazard Vulnerability Analysis/Assessment and the analysis of risk are included after the Hazard Identification of this Risk Assessment. This analysis covers all of the identified natural hazards in a broad manner. Note that Table 2-7 Critical Facilities, Critical Infrastructure, and Lifelines, identifies whether the asset would be impacted by a specific natural hazard. For a more detailed assessment of the hazard-specific vulnerability, see Volume II Hazard Annexes.

Federal Disaster and Emergency Declarations

Looking at the past events that have occurred in Malheur County can provide a general sense of the hazards that have caused significant damage in the County. Where trends emerge, disaster declarations can help inform hazard mitigation project priorities.

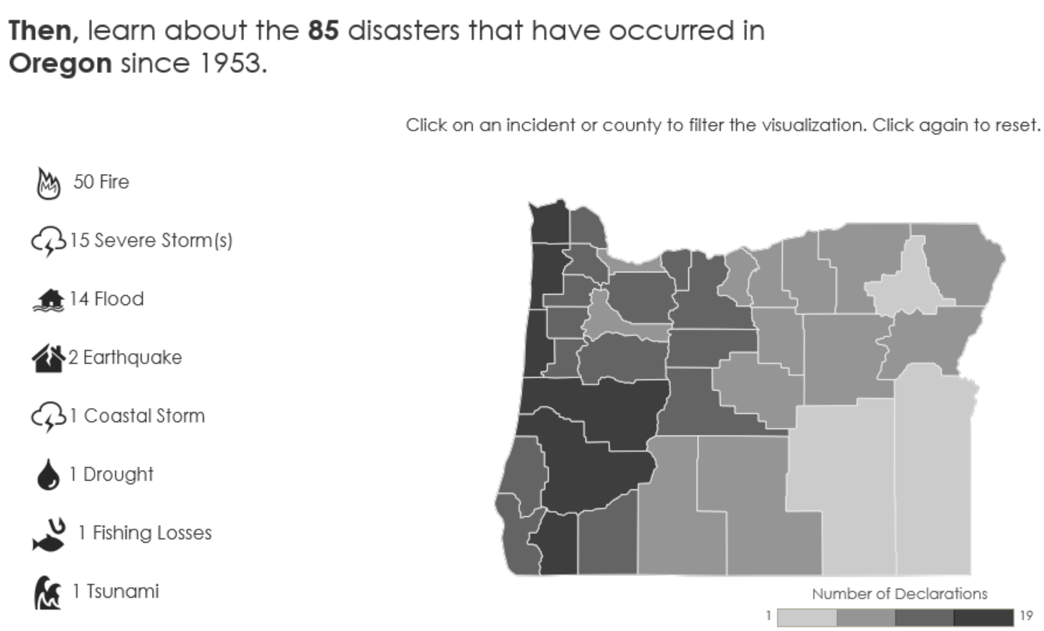
President Dwight D. Eisenhower approved the first federal disaster declaration in May 1953 following a tornado in Georgia. Since then, federally declared disasters have been approved within every state as a result of natural hazard related events. When governors ask for presidential declarations of major disaster or emergency, they stipulate which counties in their state they want included in the declaration.

A Major Disaster Declaration provides a wide range of federal assistance programs for individuals and public infrastructure, including funds for both emergency and permanent work. An Emergency

Declaration is more limited in scope and without the long-term federal recovery programs of a Major Disaster Declaration. Generally, federal assistance and funding are provided to meet a specific emergency need or to help prevent a major disaster from occurring. Fire Management Assistance is provided after a State submits a request for assistance to the Federal Emergency Management Agency (FEMA) Regional Director at the time a "threat of major disaster" exists.

As of December 2018, FEMA has approved a total of 33 federal major disaster (DR) declarations, two emergency (EM) declarations and 39 fire management assistance (FM) declarations in Oregon. There are also 37 Fire Suppression Authorizations (FSA) on record for Oregon. The total number of disasters in Oregon is 111 as identified in the FEMA "Disaster Declarations by State/Tribal Government" list on their website[3] However, this contrasts with the 85 declared disasters that FEMA has listed for Oregon on their state by state "Historical Disaster Data" website. The "Historical Disaster Data" website includes the graphic shown in Figure 2-3, illustrating the types of disasters and the location of the disasters.[4]

Figure 2-3 Disaster Declarations in Oregon Since 1953



Source: FEMA, https://recovery.fema.gov/state-profiles/HistoricalDisasterData, accessed December 19, 2018

Table 2-2 summarizes the disaster declarations declared in Oregon that have directly affected Malheur County since 1953. The table shows that the two major disaster (DR) declarations for Malheur County have been weather related. There have been two emergency declarations (EM)

[3] FEMA, *Declared Disasters by Year or State*, https://www.fema.gov/disasters/grid/state-tribal-government/88. Accessed November 20, 2018.

[4] FEMA, Historical Disaster Data, https://recovery.fema.gov/state-profiles/HistoricalDisasterData. Accessed December 19, 2018.

that have affected Malheur County. There have not been any fire management assistance (FM) declarations for Malheur County. [5]

Table 2-2 FEMA Major Disaster, Emergency, and Fire Management Declarations for Malheur County

Declaration Number	Declaration Date	Incident Period	Incident	Individual Assistance	Public Assistance Categories
DR-1510	19-Feb-04	26-Feb-03 to 14-Jan-04	Severe Winter Storm	None	A, B, C, D, E, F, G
DR-184	24-Dec-64	24-Dec-64 to 24-Dec-64	Heavy rains and flooding	Yes	A, B, C, D, E, F, G
EM-3228	7-Sep-05	29-Aug-05 to 01-Oct-05	Hurricane Katrina Evacuation	None	B
EM-3039	29-Apr-77	29-Apr-77 to 29-Apr-77	Drought	None	A, B

Source: FEMA, Oregon Disaster History. Major Disaster Declarations, https://www.fema.gov/disasters, accessed December 19, 2018 and reaffirms the data in the *2014 Malheur County NHMP*.

Drought

Significant changes since 2014 NHMP

In the *2014 Malheur County NHMP* drought was ranked in third place for the risk scores, with winter storms and floods ahead of it. In the Hazard Vulnerability Analysis (HVA) for the *2019 Malheur County NHMP*, the Steering Committee awarded 240 out of 240 possible points for drought, making it the number one ranked natural hazard for Malheur County out of the eleven total natural hazards.

Characteristics

Droughts are common in Oregon, especially in eastern Oregon. They occur in all parts of the state in both summer and winter months. Droughts appear to be recurring and they can have a profound effect on the economy, particularly the hydro-power and agricultural sectors. Droughts can have particularly significant impact on farming communities, the financial impact of which affects the economic stability of the county.

The environmental consequences also are far-reaching. They include insect infestations in forests and fields, and the lack of water to support endangered fish species. In recent years, the state has addressed drought emergencies through the Oregon Drought Council. This interagency (state/federal) council meets to discuss forecasts and to advise the Governor as the need arises.

The Oregon State University Extension Service published a report in June 1979 following the 1977 drought (EM-3039). Highlights of the survey findings indicate that the 1977 drought affected 80% of ranches in eastern Oregon (including Malheur County), decreased forage, increased purchase of

[5] FEMA, *Declared Disasters by Year or State*, https://www.fema.gov/disasters/grid/state-tribal-government/88. Accessed November 20, 2018.

feed, reduced rate of gain of cattle, delayed breeding, herd health problems and increased water hauling and equipment investments[6].

Location/Extent

The extent of drought events depends upon the degree of moisture deficiency, and the duration and size of the affected area. Typically, droughts occur as regional events and often affect more than one city and county.

Malheur County has a history of many drought events, dating back to 1904 according to the Significant Historic Hazard Events Tables in Table DR-1 within the Volume II Drought Annex of this NHMP. From this table it could be said that the incidence of drought in Oregon is between three and six years. The table notes the dates, locations, and a description of the event, identifying if there was a disaster declaration related to it.

Malheur County is susceptible to droughts because of its location east of the Cascades and within the high desert. The region experiences dry conditions annually during the summer months from June to September. For more information on the drought hazard in Malheur County see the Drought Annex in Volume II Hazard Annexes.

According to OCCRI's *Future Climate Projections* report, "Drought conditions, as represented by low spring snowpack, is projected to become more frequent whereas drought conditions represented by low summer soil moisture and low summer runoff may become less frequent in Malheur County by the 2050s compared to the historical baseline." See Appendix F for more information.

Dust Storms

Significant changes since 2014 NHMP

In the *2014 Malheur County NHMP* dust storms were ranked in eight place for the risk scores, out of eleven natural hazards. In the *2019 Malheur County NHMP*, dust storms were ranked in ninth place.

Characteristics

A dust storm is a strong, violent wind that carries fine particles such as silt, sand, clay, and other materials, often for long distances. Dust storms usually arrive with little warning and advance in the form of a big wall of dust and debris. The dust is blinding, making driving safely a challenge. A dust storm may last only a few minutes at any given location, but often leave serious car accidents in their wake, occasionally massive pileups. The arid regions of Central and Eastern Oregon can experience sudden dust storms on windy days.

Location/Extent

The areas of most concern to dust storm events are on highways that have a potential to cause a collision. These types of dust storms were considered by the Steering Committee during a worst-case scenario type event.

---

[6] Oregon State University Extension Services, *Effects of the 1977 Drought on Eastern Oregon Ranches* (1979), retained from 2014 Malheur County NHMP.

The Severe Weather Significant Historic Hazard Events Table, Table SW-7, includes several dust storms. The table notes the dates, locations, and a description of the event, identifying if there was a disaster declaration related to it. The SC noted that dust storms reduce visibility and can have dramatic impacts to people. A discussion occurred during the SC meeting about looking at statistics at hospitals to see if there is an uptick in people going there with respiratory issues after a dust storm. For more information on the dust storm hazard in Malheur County see the Severe Weather Annex in Volume II Hazard Annexes.

According to OCCRI's *Future Climate Projections* report, "Limited research suggests that the risk of dust storms in summer would decrease in eastern Oregon under climate change in areas that experience an increase in vegetation cover from the carbon dioxide fertilization effect." See Appendix F for more information.

Earthquake

Significant changes since 2014 NHMP

In the *2014 Malheur County NHMP* earthquakes were ranked in seventh place and in the *2019 Malheur County NHMP* they were ranked in tenth place.

Characteristics

Oregon and the Pacific Northwest are susceptible to earthquakes from these sources: 1) shallow crustal events within the North American Plate; 2) deep intra-plate events within the subducting Juan de Fuca Plate; 3) the off-shore Cascadia Subduction Zone; and 4) earthquakes associated with renewed volcanic activity.[7]

The Cascadia Subduction Zone and the subduction process is responsible for most of the earthquakes in the Pacific Northwest as well as for creating the volcanoes in the Cascades. Researchers recently calculated the likelihood of a Magnitude 8 to 9 Cascadia Subduction Zone earthquake at 37% over the next 50 years. The last such event occurred in January of 1700, causing a tsunami in Japan.[8] See the Earthquake Annex in Volume II.

Location/Extent

The areas most susceptible to ground amplification and liquefaction have young, soft alluvial sediments, found along river and stream channels. The extent of the damage to structures and injury and death to people will depend upon the type of earthquake, proximity to the epicenter and the magnitude and duration of the event. Buildings, dams, levees and lifelines including water, sewer, storm water and gas lines, transportation systems, and utility and communication networks are particularly at risk. Also, damage to roads, bridges and water systems will make it difficult to respond to post-earthquake fires.

---

[7] DLCD, *Planning for Natural Hazards: Oregon Technical Resource Guide*, Community Planning Workshop, (2000): 8-8. https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

[8] Oregon Seismic Safety Policy Advisory Commission (OSSPAC), *The Oregon Resilience Plan: Reducing Risk and Improving Recovery for the Next Cascadia Earthquake and Tsunami, Report to the 77th Legislative Assembly*, February 2013, https://www.oregon.gov/oem/documents/oregon_resilience_plan_final.pdf

In 2004 a swarm of over 100 earthquakes occurred in Jordan Valley under Antelope Reservoir in southeast Malheur County; the largest event measured at magnitude 3.6. There are several faults in that region that are capable of causing damage as shown in the Earthquake Annex, Figure EQ-7.

Southeastern and Central Oregon have experienced multiple earthquakes of an estimated magnitude of four and greater since recorded history, with larger earthquakes in 1906, 1920, 1923, 1958, 1968, and 1993. The Malheur County region has experienced minor earthquakes in the past 20 years, most of which were only felt by seismic equipment. Primary earthquake hazards include ground shaking amplification, liquefaction, and earthquake-induced landslides.

The SC described concerns about high impacts from earthquakes such as landslides, road closures, downed power supplies, and limitations to resources (such as groceries, fuel, and so forth) coming in and out of Malheur County. They noted that there was a 1984 earthquake in Idaho that they felt in Ontario. They also noted that earthquakes happen locally in Malheur County but rarely have any impact to people.

In Volume II Hazard Annexes, the Earthquake Annex has earthquakes identified in Table EQ-1, Significant Historic Hazard Events; the table note the dates, locations, and a description of the event, identifying if there was a disaster declaration related to it. For more information on the Earthquake hazard in Malheur County see the Earthquake Annex in Volume II Hazard Annexes.

Earthquake was not one of the identified climate change metrics therefore OCCRI's *Future Climate Projections* report does not include information about earthquakes.

Extreme Temperatures

Significant changes since 2014 NHMP

In the *2014 Malheur County NHMP* extreme temperature was ranked in seventh place. In the *2019 Malheur County NHMP* extreme temperature was again ranked in seventh place, in a tie with earthquakes.

Characteristics

Malheur County can also be a place of extreme temperature events. From extreme cold spells to extreme heat waves, extreme temperature events have the potential to inflict serious health damage. In extreme heat environments the body must work harder to maintain a normal temperature, these conditions can induce heath related illnesses, particularly among vulnerable population types.[9] Extreme cold events can be defined similarly - where conditions get so severe that health related illnesses occur. To be extreme, the temperature would be quite a bit over or under the typical temperature

Location/Extent

Extreme temperature events can occur throughout Malheur County; however the places most vulnerable places are within the areas of greater population including the Cities of Nyssa, Ontario and Vale. The SC noted that consecutive hot days have increased and in the past 10 years they have

9 FEMA, *Extreme Heat*, http://www.ready.gov/heat

set records for that. In Ontario, they sometimes open warming and cooling centers in extreme temperature or severe weather events. Extreme temperatures are identified in Table SW-7, Significant Historic Hazard Events Table; the table notes the dates, locations, and a description of the event, identifying if there was a disaster declaration related to it. For more information on the extreme temperatures hazard in Malheur County see the Severe Weather Annex in Volume II Hazard Annexes.

In OCCRI's *Future Climate Projections* report, there are three findings each for heat waves and cold waves. These are included here and further explanation can be found in Appendix F.

- Extreme heat events are expected to increase in frequency, duration, and intensity due to continued warming temperatures.
- In Malheur County, the frequency of hot days with temperatures at or above 90 F is projected to increase on average by 38 days (with a range of 21 to 50 days) by the 2050s under the higher emissions scenario compared to the historical baseline.
- In Malheur County, the temperature of the hottest day of the year is projected to increase by 8 F (with a range of 3 to 11 F) by the 2050s under the higher emissions scenario compared to the historical baseline
- Cold extremes are still expected to occur from time to time, but with much less frequency and intensity as the climate warms.
- In Malheur County, the frequency of days at or below freezing is projected to decline on average by 13 days (with a range of 6 to 18 days) by the 2050s under the higher emissions scenario compared to the historical baseline.
- In Malheur County, the temperature of the coldest night of the year is projected to increase by 10 F (with a range of 2 to 16 F) by the 2050s under the higher emissions scenario compared to the historical baseline.

Flood

Significant changes since 2014 NHMP

In the *2014 Malheur County NHMP* floods were ranked in first place. In the *2019 Malheur County NHMP* floods ranked in fourth place.

Characteristics

The principal types of flooding that occurs in Malheur County include riverine, flash, shallow area, urban, and snow melt. Major flooding events occur in Malheur County approximately every ten years. Riverine and snow-melt are the most common types of flooding; however, major flash flooding events have also occurred in Malheur County's history. See Table FL-1 in the Flood Annex in Volume II Hazard Annexes.

<u>Flash floods</u>

Flash floods usually result from intense storms dropping large amounts of rain within a brief period. Flash floods usually occur in the summer during thunderstorm season, appear with little or no warning, and can reach full peak in a few minutes. They are most common in the arid and semi-arid central and eastern areas of the state where there is steep topography, little vegetation and intense but short-duration rainfall. Flash floods can occur in both urban and rural settings, often along smaller rivers and drainage ways.

In flash flood situations, waters rise rapidly, generally move at high velocities and often carry large amounts of debris. In these instances a flash flood may arrive as a fast moving wall of debris, mud, water or ice. Material can accumulate at a natural or man-made obstruction and restrict the flow of water. Water held back in such a manner can cause flooding both upstream and then later downstream if the obstruction is removed or breaks free.

Ice Jams

Ice jams commonly happen during the winter and early spring, while the river is still frozen. Sudden warming at higher altitudes can melt waters resulting in increased runoff of water and ice into large reaches of frozen river below. On the way downstream, the ice can "jam" in narrow places on the river or against a road crossing, effectively damming the river, sometimes followed by a sudden breach and release of the water and ice.

Riverine floods/ Snow melt (spring) Flooding

Riverine floods occur when water levels in rivers and streams overflow their banks. Most communities located along such water bodies have the potential to experience this type of flooding after spring rains, heavy thunderstorms or rapid runoff from snow melt. Riverine floods can be slow or fast rising, but usually develop over a period of days.

Flooding throughout the region is most commonly linked to the spring cycle of melting snow. The weather pattern that produces these floods occurs during the winter months and has come to be associated with La Nina events, a three to seven year cycle of cool, wet weather. In brief, cool, moist weather conditions are followed by a system of warm, moist air from tropical latitudes. The intense warm rain associated with this system quickly melts foothill and mountain snow. Above-freezing temperatures may occur well above pass levels (4,000-5,000 feet). Some of Oregon's most devastating floods are associated with these events.

Shallow area floods

These floods are a special type of riverine flooding. FEMA defines a shallow area flood hazard as an area that is inundated by a 100-year flood with a flood depth between one to three feet. Such areas are generally flooded by low velocity sheet flows of water.

Urban floods

Urban flooding occurs where land has been converted from fields or woodlands to developed areas consisting of homes, parking lots, and commercial, industrial and public buildings and structures. In such areas the previous ability of water to filter into the ground is often prevented by the extensive impervious surfaces associated with urban development. This in turn results in more water quickly running off into watercourses, which causes water levels to rise above pre-development levels. During periods of urban flooding streets can rapidly become swift moving rivers and basements and backyards can quickly fill with water. Storm drains may back up with yard waste or other flood debris leading to further localized flooding. Another source of urban flooding is grading associated with development. In some cases, grading can alter changes in drainage direction of water from one property to another.

Location/ Extent

Spring runoff has caused significant riverine flooding in the County, resulting in damage along the Malheur, Snake, and Owyhee Rivers, in addition to some smaller tributaries. Most spring flooding has been precipitated by a particular combination of factors: ground saturation followed by a heavy ground freeze, a heavy snowpack in higher elevations, and then spring rains and Chinook winds causing sudden snow melt.

Malheur County experiences flash flood warnings every year. Generally, these have occurred in remote, sparsely populated areas of the county and have resulted in no widespread property or infrastructure damage. Some crop damage has occurred. Additionally, flash flooding risk is exacerbated by wildfire, which destroys flood mitigating vegetation and weakens soil, thus increasing an area's vulnerability to severe flood-induced erosion. Irrigation districts have reported chronic minor problems with debris clogging along open irrigation canals as a result of flash floods.

Ice jams on the Snake and Malheur Rivers have created flood conditions in the past and will continue to do so due to local topography. According to an Army Corps of Engineers report, this type of flooding is predictable, with the determining factor being a daily high temperature at Glenn's Ferry, Idaho of 5 degrees F for five consecutive days. This will result in ice jams in the Ontario area. There are several bridges in the County which can jam up with ice and debris flow in the aftermath of weather events such as the freezing and melting events mentioned above.

Bridges which can be sites of ice jamming:

- 36th St Bridge outside Ontario (upgraded to reduce ice jam flood risk)
- Union Pacific railroad trestle near Nyssa

Malheur County experiences flooding with winter storms and summer thunderstorms, with wind and hail occurring in summer months. There are many flood events listed in the Flood Significant Historic Hazard Events Table, FL-1, for Malheur County and they occur in any given month. The table notes the dates, locations, and a description of the event, identifying if there was a disaster declaration related to it. The SC noted that they built levees after the 1957 flood and that alleviated much of the flooding issue. For more information on the flood hazard in Malheur County see the Flood Annex in Volume II Hazard Annexes.

OCCRI's *Future Climate Projections* report states, "Flood risk to Malheur County is expected to increase based on project increases in non-regulated peak flow magnitudes on the Snake River at Nyssa and the Owyhee River. Because basins in Malheur County are mixed rain-snow basins, they are sensitive to warming temperatures and resulting hydrologic changes including increasing and earlier seasonal peak flows."

Landslide

Significant changes since 2014 NHMP

In the *2014 Malheur County NHMP* landslides were ranked fourth. In the *2019 Malheur County NHMP* the Steering Committee ranked landslides in eleventh place.

Characteristics

In Oregon, a significant number of locations are at risk to dangerous landslides. While not all landslides result in private property damage, many landslides impact transportation corridors, fuel and energy conduits, and communication facilities. They can also pose a serious threat to human life.

Landslides can be classified into one of the following six types of movements: (1) slides, (2) flows, (3) spreads, (4) topples, (5) falls, or (6) complex[10]. In addition, landslides may be broken down into the following two categories: (1) rapidly moving; and (2) slow moving[11]. Rapidly moving landslides are typically "off-site" (debris flows and earth flows) and present the greatest risk to human life. Rapidly moving landslides have caused landslide-related injuries and deaths in Oregon, including eight deaths in 1996 following La Niña storms[12]. Slow moving landslides tend to be "on-site" (slumps, earthflows, and block slides) and can cause significant property damage, but are less likely to result in serious human injuries[13].

Landslides vary greatly in the volumes of rock and soil involved, the length, width, and depth of the area affected, frequency of occurrence, and speed of movement. Some characteristics that determine the type of landslide are slope of the hillside, moisture content, and the nature of the underlying materials.[14]

Location/Extent

In general, areas at risk to landslides have steep slopes (25 percent or greater,) certain soil types, drainage flow, cut and fill work, or a history of nearby landslides. In otherwise gently sloped areas, landslides can occur along steep river and creek banks, and along ocean bluff faces. At natural slopes under 30 percent, most landslide hazards are related to excavation and drainage practices, or the reactivation of preexisting landslide hazards.[15]

The severity or extent of landslides is typically a function of geology and the landslide triggering mechanism. Rainfall initiated landslides tend to be smaller, and earthquake induced landslides may be very large. Even small slides can cause property damage, result in injuries, or take lives. Natural conditions and human activities can both play a role in causing landslides. The incidence of landslides and their impact on people and property can be accelerated by development.[16]

While Malheur County has rarely experienced major landslides, there are areas in the County that are potentially vulnerable as identified by the Steering Committee in *the 2014 Malheur County NHMP*. The areas are noted as being "at greater landslide risk due to steep slopes and unstable

---

[10] OPDR and OEM, *2012 Oregon Natural Hazards Mitigation Plan*, https://oregonexplorer.info/content/oregon-natural-hazard-mitigation-plan-2012

[11] DLCD, *Planning for Natural Hazards: Oregon Technical Resource Guide*, Community Planning Workshop, (1999). https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

[12] Ibid

[13] Ibid.

[14] Ibid.

[15] OPDR and OEM, *2012 Oregon Natural Hazards Mitigation Plan*, https://oregonexplorer.info/content/oregon-natural-hazard-mitigation-plan-2012

[16] DLCD, *Planning for Natural Hazards: Oregon Technical Resource Guide*, Community Planning Workshop, (1999). https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

ground." As described in the *2014 Malheur County NHMP* and affirmed by the Steering Committee in 2018, these areas are the following:

- The westernmost 20-30 miles of Highway 20 near Juntura.
- Lytle Boulevard, which is the only major access road for Owyhee Dam, experiences chronic minor rock fall and debris due to the steepness of the slope into which the road was constructed. The Malheur County road department maintains this road and if serious rock fall or landslide activity occurred, access to and from the dam could be completely cut off until the debris was cleared. No such serious incidents have occurred.
- Owyhee Dam is also vulnerable in certain places along the reservoir and its canal system to landslides and debris flow – a major landslide into Owyhee Dam when full could cause spillover and temporary flooding. One area at the dam site prone to chronic minor landslides has been reinforced and thus far has had no further landslide activity.
- Along the banks of Lake Owyhee (Owyhee Reservoir).
- A portion of Oregon Highway 201 near the northern border of the County (known locally as "The Slides") experiences chronic ground instability and must be re-coated with asphalt annually at a cost of $30,000/year to ODOT. However, it is a low-volume road and is not slated for major repair efforts on the state or local level, so while it is documented as a concern, no Action Items have been developed for this concern at this time.
- The City of Nyssa's three-million gallon water storage tank sits atop a hillside adjacent to Main Street (highway 26) that is prone to erosion from irrigation of nearby fields. It this erosion continues without reinforcing the tank and hillside, it is at risk of damaging 2 nearby houses and blocking Highway 26.
- There are no other landslide event descriptions specific to Malheur County in the *2014 Malheur County NHMP*. The SC stated that some landslides could occur, most likely related to Hwy 201, especially by Huntington (in Baker County) and where ODOT uses asphalt.

Table LS-1, Landslides Significant Historic Hazard Events, notes the dates, locations, and a description of the event, identifying if there was a disaster declaration related to it. Most of the landslides listed are statewide disaster declarations. For more information on the landslide hazard in Malheur County see the Landslide Annex in Volume II Hazard Annexes.

Landslide was not one of the identified climate change metrics, therefore OCCRI's *Future Climate Projections* report does not include information about landslides.

Severe Weather

Significant changes since 2014 NHMP

In the *2014 Malheur County NHMP* severe weather was ranked fourth. In the *2019 Malheur County NHMP* severe weather was ranked sixth.

The Steering Committee decided to retain Severe Weather as a separate hazard for the Hazard Vulnerability Analysis, thus a risk score and a risk level for that hazard was identified. However, the Steering Committee also identified a risk score and risk level for some of the hazards within the

Severe Weather hazard – dust storms, winter storms, wind storms, and extreme temperature. Rain storms and tornadoes were not identified with separate risk scores and risk levels.

Characteristics

Because Malheur County is located in an arid high desert region, severe thunderstorms with significant quantities of rain are not as frequent an occurrence as in other parts of the state. However, when these events do occur, they can exacerbate or cause other hazards, including landslides and flash floods. Lightning is another significant concern that stems from thunderstorms, as it is a primary source of wildfires in the summer fire season.

Microbursts are another thunderstorm-related hazard. A microburst is a localized column of rapidly sinking air, producing damaging divergent and straight-line winds, often with precipitation, sized 4 km or less. Microbursts are similar to tornadoes and can produce winds of over 75 mph. Winds from microbursts have been recorded up to 49 mph in the county. Tornadoes are infrequent, but they have occurred historically in the County and have caused damages to property (no injuries or deaths have been recorded).

Location/Extent

All of Malheur County is vulnerable to severe weather although impacts are typically isolated to small areas affected by localized events. The magnitude or severity of severe weather is determined by a number of meteorological factors including the amount of rainfall/ hail, extent, and event duration. Areas within the County that are particularly vulnerable to severe weather include flat stretches of road (both rural and highway); canyons (susceptible to flash floods) and farms and agricultural lands. In Ontario, they sometimes open warming and cooling centers in extreme temperature or severe weather events.

For more information on the severe weather hazard in Malheur County see the Severe Weather Annex in Volume II Hazard Annexes. The Severe Weather Significant Historic Hazard Events Table, Table SW-7, includes winter storms, wind storms, rain storms, dust storms, tornadoes, and extreme temperature. The table notes the dates, locations, and a description of the event, identifying if there was a disaster declaration related to it.

OCCRI's *Future Climate Projections* report identified the following important points:

- The intensity of extreme precipitation events is expected to increase slightly in the future as the atmosphere warms and is able to hold more water vapor.
- In Malheur County, the magnitude of precipitation on the wettest day and wettest consecutive five days per year is projected to increase on average by about 19% (with a range of 2 to 35%) and 13% (with a range of -7% to 28%), respectively, by the 2050s under the higher emissions scenario compared to the historical baseline.
- In Malheur County, the frequency of days with at least ¾" of precipitation and the frequency of days exceeding a threshold for landslide risk is not projected to change substantially.

Volcanic Event

Significant changes since 2014 NHMP

In the *2014 Malheur County NHMP* volcanic events were ranked sixth. In the *2019 Malheur County NHMP* volcanic events ranked eighth out of eleven natural hazards.

Characteristics

Malheur County and the Pacific Northwest lie within the "ring of fire", an area of very active volcanic activity surrounding the Pacific Basin. Volcanic events occur regularly along the ring of fire, in part because of the movement of the Earth's tectonic plates. Volcanic events have the potential to coincide with numerous other hazards including ash fall, earthquakes, lava flows, pyroclastic flows, lahars and debris flows, and landslides. Ash fall and earthquakes are the two associated hazards that have the potential to impact Malheur County directly.

Location/Extent

Active volcanoes that could impact Malheur County include Mt. Hood, Mt. Jefferson, Newberry Volcano, and the Three Sisters among others. If any of these volcanoes erupted, there could be a possibility of ash that could affect air quality and/or the water quality. The extent of damage from these hazards depends on the distance from the volcano, vent location, and type of hazardous events that occur during an eruption. The indirect effects of volcanoes must be considered as well; including disruption of engines of motor vehicles, reduced visibility when driving, and vulnerable populations, such as people with asthma, suffering respiratory impacts.

Although not highly vulnerable to most direct volcanic hazards such as blast effects, relatively nearby volcanoes could inundate the area with ashfall sufficient to impact transportation and cause widespread health concerns. The SC noted that if Yellowstone goes "50,000 years past due" it could impact them. Volcanic events are identified in Table EQ-1 Significant Historic Volcanic Events; it notes the dates, locations, and a description of the event, identifying if there was a disaster declaration related to it. For more information on the volcanic event hazard in Malheur County see the Volcanic Event Annex in Volume II Hazard Annexes.

Volcanic events were not a climate change metric, so OCCRI's *Future Climate Projections* report does not include volcanic events.

Wildfire

Significant changes since 2014 NHMP

Wildfire was ranked fourth in the *2014 Malheur County NHMP* and in the *2019 Malheur County NHMP* it was ranked fifth out of eleven natural hazards.

Characteristics

Wildfires are common to the arid areas of central and eastern Oregon, as such the potential for losses due to Wildland-Urban Interface (WUI) fires in the urbanized region should not be ignored. Fire is an essential part of Oregon's ecosystem, but it is also a serious threat to life and property. Wildfires that have the potential to affect Malheur County can be divided into these categories: WUI, wildland, firestorms, and prescribed burns. Ignition of a wildfire may occur naturally from lightning or from human causes such as debris burns, arson, careless smoking, and recreational activities or from an industrial accident. Once started, fuel, topography, weather and development conditions affect fire behavior.

Location/Extent

In Eastern Oregon, large costly fires have become regular events, disrupted communities, cost millions of dollars in suppression and recovery costs, and increased the risk to private property owners. According to the Oregon Department of Forestry, "large fires that threaten dwellings are 48% more expensive to fight, and the likelihood of human-caused fires exponentially increases with the addition of each new home. Throughout Oregon's wildland-urban interfaces historically normal fires have become economically and socially unacceptable due to the scale of damage they cause.[17]

According to the Oregon Forest Resources Institute (OFRI), "Despite fire suppression systems regarded as best-in-class for private and public lands, lightning and human-caused wildfires ravaged the state's forest and rangelands, making 2017 one of the worst wildfire seasons on record." The OFRI also noted that both small and significant fires occurred in Oregon in 2017, burning 665,000 acres of forest and rangeland in more than 2,000 fires. The report from OFRI describes how wildfires directly impact our lives by examining these categories: air quality and health; sporting events; travel and tourism; employment and the economy; transportation; local impact; and long-term effects. The overall cost for fire suppression in Oregon in 2017 was $454 million. [18]

The extent of damage to Malheur County from WUI fires is dependent on a number of factors, including temperature, wind speed and direction, humidity, proximity to fuels, and steepness of slopes. WUI fires can be intensified by development patterns, vegetation and natural fuels, and can merge into unwieldy and unpredictable events. In addition, wildfire also threatens timber products, cattle ranching and agricultural areas near grasslands. Communities and areas particularly susceptible to wildfires include populated areas on the edges of wild land brush and wooded areas.

Malheur County is prone to wildfires and the Wildfire Significant Historic Hazard Events table supports that; the table notes the dates, locations, and a description of the event, identifying if there was a disaster declaration related to it. See Table WF-1 in the Wildfire Annex in Volume II Hazard Annexes.

The *Malheur County Community Wildfire Protection Plan* was approved February 18, 2009. It includes detailed analysis of every area under threat of wildfire, an assessment of the risk posed to each area, the state of wildfire prevention, and protection in Malheur County, and finally, protection action items. Table 2-3 shows areas within the County that are considered to have high or moderate risk to wildfire; the wildland urban interface community name is shown followed by its score (out of a possible 23) in parentheses.

[17] Oregon Department of Forestry, *Oregon Forests Report*, 2007-2009.

[18] Oregon Forest Resources Institute, *Impacts of Oregon's 2017 Wildfire Season: Time for a Crucial Conservation*, January 2, 2018.

Table 2-3 Communities at Risk to Wildfire

High	Moderate
Ontario Heights (19)	**Crowley (16)**
Riverside (19)	Rockville (16)
Vale (19)	**Burns Junction (16)**
Owyhee Reservoir (18)	McDermitt (16)
Harper (17)	**Rome (16)**
Juntura (17)	Nyssa (15)
Adrian (17)	**Basque Station (15)**
Jordan Valley (17)	Annex (15)
	Ironside (14)

Source: Malheur County CWPP, 2009

The areas where development meets vegetative fuels, such as forestland, are commonly referred to as the wildland-urban interface (WUI). Often these areas where development is next to areas with heavy fuel loads (vegetation) do not have adequate defensible space. Wildfires impact agriculture, buildings, transportation, utilities, and business. Smoke exposure is a hazard throughout Malheur County when there are wildfires. Roads close because of smoke visibility issues, animals on the rangelands can be affected, and people have respiratory issues.

During the April 12, 2018 SC meeting, the SC described that they see an uptick in the number of hospital admissions for respiratory conditions when there are wildfires. During additional discussion about air quality issues in Malheur County at the SC meeting on June 14, 2018, the SC decided that they may add air quality as natural hazard during the next NHMP update. For more information on the wildfire hazard in Malheur County see the Wildfire Annex in Volume II Hazard Annexes.

OCCRI's *Future Climate Projections* report states, "Wildfire risk, as expressed through the frequency of very high fire danger days, is projected to increase under future climate change. In Malheur County, the frequency of very high fire danger days per year is projected to increase on average by about 40% (with a range of -1 to +83%) by the 2050s under the higher emissions scenario compared to the historical baseline." See Appendix H for more details.

Wind Storm

Significant changes since 2014 NHMP

In the *2014 Malheur County NHMP* wind storms were ranked fifth. In the *2019 Malheur County NHMP* wind storms were ranked third.

Characteristics

Extreme winds occur throughout Oregon, and most communities have some level of vulnerability to wind storms. Wind storms can result in collapsed or damaged buildings, damaged or blocked roads and bridges, damaged traffic signals, streetlights, and parks, among other impacts. Roads blocked by fallen trees during a windstorm may have severe consequences to people who need access to emergency services. Emergency response operations can be complicated when roads are blocked or when power supplies are interrupted. Wind storms can trigger flying debris, which can also damage utility lines; overhead power lines can be damaged even in relatively minor wind storm events. Industry and commerce can suffer losses from interruptions in electric service and from extended road closures.

Although rare, tornados can and do occur in Oregon. Tornadoes are the most concentrated and violent storms produced by the earth's atmosphere. They are created by a vortex of rotating winds and strong vertical motion, which possess remarkable strength and cause widespread damage. Smaller wind events, often known as, "dust devils", occur in Malheur County and pose some risk to the local community.

Location/Extent

The damaging effects of wind storms may extend for distances of 100 to 300 miles from the center of storm activity. Wind storms in Malheur County usually occur from October to March, and their extent is determined by their track, intensity (the air pressure gradient they generate), and local terrain.

Oregon and other western states experience tornadoes on occasion, many of which have produced significant damage and occasionally injury or death. Most of the tornadoes that develop in Oregon are caused by intense local thunderstorms. These storms also produce lightning, hail, and heavy rain, and are more common during the warm season from April to October.[19] Several of the more significant windstorms in Malheur County have occurred during this period.

High winds can occur throughout the year, toppling trees and power lines. Buildings, agriculture, utilities, transportation, and business are impacted. The SC stated that the wind blows at a particularly high level during March and April. High winds can aggravate wildfires and volcanic events that result in ashfall. One person on the SC noted that wind speeds greater than 25 mph trigger the response of the irrigation district.

For more information on the wind storm hazard in Malheur County see the Severe Weather Annex in Volume II Hazard Annexes. The Significant Historic Hazard Events Table, Table SW-7, includes winter storms and wind storms. The list is substantial, revealing a long history of events. The table notes the dates, locations, and a description of the event, identifying if there was a disaster declaration related to it.

In OCCRI's *Future Climate Projections* report, "Limited research suggests very little, if any, change in the frequency and intensity of wind storms in the Pacific Northwest as a result of climate change."

Winter Storm

Significant changes since 2014 NHMP

In the *2014 Malheur County NHMP* winter storms were ranked second and in the *2019 Malheur County NHMP* they were ranked second again. The risk score in 2018 was only five points less than that for drought which is the first ranked natural hazard for Malheur County.

[19] George Taylor and others, *A History of Tornadoes in Oregon*, Oregon Climate Service – Oregon State University (1996). Retained from *2014 Malheur County NHMP*.

Characteristics

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 Malheur County typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

Winter storms are relatively common in eastern Oregon, where the air is generally cold enough for snow and ice, when a Pacific storm is associated with an air mass from the Gulf of Alaska, a major snowstorm may ensue.

Like snow, ice storms are comprised of cold temperatures and moisture, but subtle changes can result in varying types of ice formation, including freezing rain, sleet, and hail. Freezing rain can be the most damaging of ice formations. While sleet and hail can create hazards for motorists when it accumulates, freezing rain can cause the most dangerous conditions within a community. Ice buildup can bring down trees, communication towers, and wires creating hazards for property owners, motorists, and pedestrians alike.

Location/Extent

All of Malheur County is vulnerable to winter storms and impacts typically extend region-wide. The magnitude or severity of severe winter storms is determined by a number of meteorological factors including the amount and extent of snow or ice, air temperature, wind speed, and event duration. Areas within the county that are particularly vulnerable to winter storms include unsanded, flat stretches of road (both rural and highway); farms and agricultural lands. Winter storms are very common throughout Malheur County, within the cities and the unincorporated areas. Heavy snow and ice can severely impact buildings, agriculture, transportation, utilities, and business.

For more information on the winter storm hazard in Malheur County see the Severe Weather Annex in Volume II Hazard Annexes. The Severe Weather Significant Historic Hazard Events Table includes winter storms and wind storms. It is a substantial table, revealing a long and detailed list of events. The table, Table SW-7, notes the dates, locations, and a description of the event, identifying if there was a disaster declaration related to it.

In OCCRI's *Future Climate Projections* report, winter storms was not a metric. Therefore, the report does not include winter storms.

Hazard Vulnerability Analysis

Malheur County's Hazard Analysis was last completed in 2013 as part of *2014 Malheur County NHMP*. The *2019 Malheur County NHMP* provided a good opportunity to revisit the hazards, update the analysis, and reorder the mitigation action priorities as necessary.

Malheur County's natural hazards are:

- Winter Storms
- Wind Storms
- Earthquakes
- Droughts

- Floods
- Volcanic Events
- Wildfire
- Landslides
- Extreme Temperature
- Dust Storm
- Severe Weather – includes flash flood rain events

The methodology for this **hazard analysis** was first developed by FEMA in 1983. It was gradually refined by Oregon's Office of Emergency Management (OEM) and shared with local jurisdictions across Oregon. Although nearly every jurisdiction in Oregon uses this process, the range of values is relative only within the individual jurisdiction; unless two or more jurisdictions conduct their analyses at the same time and utilize the same criteria in determining the values to apply. It is not meant to compare one jurisdiction to another. These calculations and hazard analysis should not be applied to other jurisdictions without familiarization with the process applied.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible), one order of magnitude from lowest to highest**. Vulnerability** and **probability** are the two key components of the methodology.

- **Vulnerability** examines both typical and maximum credible events.
- **Probability** endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard.

Vulnerability accounts for approximately 60% of the total score, and probability accounts for approximately 40%.

This particular hazard analysis is an early step in determining the risk – the potential for harm – facing a community. When complete, it provides a table of relative risks to focus planning priorities on those hazards most likely to occur and cause the most damage. This analysis, therefore, is constructed to:

- Establish priorities for planning, capability development, and hazard mitigation,
- Identify needs for hazard mitigation measures,
- Educate the public as well as public officials about hazards and vulnerabilities, and
- Make informed judgments about potential risks.

Values assigned are very subjective.
"One person's rare event could be another's frequent!"

DESIGNATION	RATING
LOW	0 to 3
MEDIUM	4 to 7
HIGH	8 to 10

History is the record of previous occurrences requiring a response.

Low: 0-1 event in the past 10 years
Medium: 2-3 events in the past 10 years

High: 4+ events in the past 10 years

The weight factor for the history category is 2.

Vulnerability is a measure of the percentage of the population and property likely to be affected during an occurrence of an incident.

Low: <1% affected
Medium: 1 – 10% affected
High: >10% affected

The weight factor for the vulnerability category is 5.

Maximum Threat is a measure of the highest percentage of the population or property which could be impacted under a worst-case scenario.

Low: <5% affected
Medium: 5 – 25% affected
High: >25% affected

The weight factor for the maximum threat category is 10.

Probability is a measure of the likelihood of a future event occurring within a specified period of time.

Low: more than 10 years between events
Medium: from 5 to 10 years between events
High: likely within the next 5 years

The weight factor for the probability category is 7.

By multiplying the *weight factors* associated with the categories by the *severity ratings*, we can arrive at a sub-score for history, vulnerability, maximum threat, and probability for each hazard. This information was captured in a table showing each of those four sub-scores as well as the total score for the hazard. Adding the sub-scores will produce a **total** score, called the risk score, for each hazard.

Table 2-4 2018 Hazard Vulnerability Analysis scores for Malheur County includes the full list of natural hazards and their sub-scores for the components that comprise the risk score.

Table 2-4 2018 Hazard Vulnerability Analysis

HAZARD	HISTORY WF = 2	VULNERABIL ITY WF = 5	MAX THREAT WF = 10	PROBABILIT Y WF = 7	RISK SCO RE
Winter Storms	2 x **8**	5 x **8**	10 x **10**	7 x **10**	**226**
Wind Storms	2 x **10**	5 x **7**	10 x **7**	7 x **10**	**195**

Earthquakes	2 x	**1**	5 x	**1**	10 x	**5**	7 x	**1**	**64**
Droughts	2 x	**10**	5 x	**10**	10 x	**10**	7 x	**10**	**240**
Floods	2 x	**10**	5 x	**7**	10 x	**7**	7 x	**9**	**188**
Volcanic Events	2 x	**1**	5 x	**3**	10 x	**10**	7 x	**1**	**124**
Wildfire	2 x	**10**	5 x	**7**	10 x	**5**	7 x	**10**	**175**
Landslides	2 x	**4**	5 x	**2**	10 x	**2**	7 x	**1**	**60**
Extreme Temperature	2 x	**8**	5 x	**5**	10 x	**5**	7 x	**5**	**126**
Dust Storm	2 x	**8**	5 x	**2**	10 x	**2**	7 x	**10**	**116**
Severe Weather	2 x	**10**	5 x	**5**	10 x	**5**	7 x	**10**	**165**

Source: Malheur County (includes Nyssa, Vale and Ontario) NHMP Steering Committee, April 12, 2018.

The total risk scores from the HVA are listed in Table 2-5 as the risk score. After establishing the risk scores they were put into levels using a high, medium, and low designation, as shown in Table 2-5.

Table 2-5 Natural Hazards, Risk Scores, and Risk Levels

HAZARD	RISK SCORE	RISK LEVEL (H-M-L)
Droughts	240	High
Winter Storms	226	High
Wind Storms	195	High-Medium
Floods	188	High-Medium
Wildfire	175	High-Medium
Severe Weather	165	High-Medium
Extreme Temperature	126	Medium
Volcanic Events	124	Medium
Dust Storms	116	Medium
Earthquakes	64	Low
Landslides	60	Low

Source: Malheur County (includes Nyssa, Vale and Ontario) NHMP Steering Committee, April 12, 2018.

The Hazard Vulnerability Analysis for the NHMP update was performed at the April 12, 2018 Malheur County NHMP Steering Committee (SC) meeting. During the meeting, the SC decided to retain all the existing natural hazards. This Hazard Analysis Summary was prepared on May 17, 2018.

During the June 14, 2018 SC meeting, the SC stated they would like to revise this Hazard Vulnerability Analysis Summary to add the statement that they will consider adding air quality as a natural hazard in the next NHMP update process.

In the 2014 Malheur County NHMP, a Malheur County Hazard Vulnerability Analysis was prepared and also one was prepared specifically for each of the Cities of Nyssa, Vale, and Ontario.

For the *2019 Malheur County NHMP*, the Hazard Vulnerability Analysis involves the same jurisdictions: Malheur County and the Cities of Nyssa, Vale, and Ontario. The SC agreed that one Hazard Analysis could be performed together with all the jurisdictions participating. This would be efficient and demonstrate collaboration. The group recognized that it would be very important to capture all the comments, as well as similarities and differences between the jurisdictions.

In this assessment, as described previously, four measures characterizing risk – history, vulnerability, maximum threat, and probability – are assessed as to severity, weighted, and added together to derive a relative risk score for each hazard. The weights for each measure are noted within the matrix above in Table 2-4 2018 Hazard Vulnerability Analysis.

For the Hazard Analysis discussion, DLCD provided a document called Significant Historic Hazard Events Tables. This document included tables of significant events for each of Malheur County's natural hazards. The tables noted the dates, locations, and a description of the event, identifying if there was a disaster declaration related to it. DLCD staff invited SC members to review and comment on the information; in particular, to add events that had impacted them. These Significant Historic Hazards Events Tables are found in Volume II Hazard Annexes for each of the natural hazards that affect Malheur County.

To begin the discussion with the SC, DLCD staff asked the SC what they thought were their most common and impactful hazards are. The SC said droughts and winter storms. Interestingly, the risk score results supported the droughts and winter storms as high level hazards, with droughts as #1 and winter storms as #2 in the rankings.

Malheur County has eleven natural hazards. Looking at the 2013 risk scores and rankings in comparison to the 2018 results, floods dropped from #1 to #4; droughts moved from #3 to #1; and winter storms remained at #2. Interestingly, in 2013 wildfire and landslides tied for #4 while in the 2018 results wildfire was #5 and landslides was #11.

In reviewing the overall risk scores for each hazard, DLCD staff noticed several tiers. As shown above in the table above, staff identified risk scores into risk levels of high, high-medium, medium, and low. These are shown in a progression of color from red as high to yellow as low.

Discussion occurred regarding the definitions of the weighted measures. For example, when defining vulnerability and maximum threat, the percentages are based on those "affected." Questions arose as to how much impact or influence is considered "affected" to the population and property. It was noted that more than half of the population in Malheur County is within the cities. This revealed the highest percentage of population would be impacted in the cities, but yet substantial impacts are also felt in geographically wide but less populated areas. Estimating the appropriate percentage for vulnerability and maximum threat provided some challenge.

The group came to consensus on the ratings for each of the four HVA measures, as well as the total score, for each hazard. Most of the hazards were discussed in detail by the SC.

Table 2-6 2018 Total Risk Scores and Rankings with 2013 Total scores and Rankings for Comparison

HAZARD	2018 SCORES	2018 RANKING	2013 SCORES	2013 RANKING
Droughts	240	1	190	3
Winter Storms	235	2	191	2
Wind Storms	195	3	155	5
Floods	188	4	240	1
Wildfire	175	5	165	4
Severe Weather	165	6	165	4
Extreme Temperature	126	7	72	7
Volcanic Events	124	8	134	6
Dust Storms	116	9	52	8
Earthquakes	64	10	72	7
Landslides	60	11	165	4

Source: Tricia Sears, DLCD, June 25, 2018

Community Vulnerability

Vulnerability is a measure of the exposure of the built environment to hazards. The exposure of community assets to hazards is critical in the assessment of the degree of risk a community has to each hazard. Identifying the facilities and infrastructure at risk from various hazards can assist the county in prioritizing resources for mitigation, and can assist in directing damage assessment efforts after a hazard event has occurred. The exposure of county and city assets to each hazard and potential implications are explained in each hazard section.

Vulnerability includes the percentage of population and property likely to be affected under an "average" occurrence of the hazard. Community vulnerabilities are an important supplement to the NHMP risk assessment. For more in-depth information regarding specific community vulnerabilities, reference Appendix C Community Profile.

Population

The socio-demographic qualities of the community population such as language, race and ethnicity, age, income, and educational attainment are significant factors that can influence the community's ability to cope, adapt to and recover from natural disasters. Historically, 80 percent of the disaster burden falls on the public.[20] Of this number, a disproportionate burden is placed upon special needs groups, particularly children, the elderly, the disabled, minorities, and low-income persons. Population vulnerabilities can be reduced or eliminated with proper outreach and community mitigation planning. For planning purposes, it is essential Malheur County, Nyssa, Ontario and Vale consider both immediate and long-term socio-demographic implications of hazard resilience.

Population Vulnerabilities

- As of 2016, 17.4% of Malheur County's population is over the age of 65 while neighboring Harney County has 23.6% of the population over the age of 65 and Wheeler County has 32.3% in that category.[21]
- The Malheur County total fertility rate is 2.78 while Oregon's is 1.79[22].
- The amount of Hispanic or Latino population has increased from 25.6% in 2000 to 31.5% in 2010[23].
- Malheur County has a per capita personal income of $30,255 which ranked last in the list "County Components of Per Capita Personal Income" for Oregon counties.[24]

Economy

Economic diversification, employment and industry are measures of economic capacity. However, economic resilience to natural disasters is far more complex than merely restoring employment or income in the local community. Building a resilient economy requires an understanding of how the component parts of employment sectors, workforce, resources and infrastructure are interconnected in the existing economic picture. The current and anticipated financial conditions of a community are strong determinants of community resilience, as a strong and diverse economic base increases the ability of individuals, families and the community to absorb disaster impacts for a quick recovery. It is imperative that Malheur County, Nyssa, Ontario and Vale recognize that economic diversification is a long-term issue; more immediate strategies to reduce vulnerability should focus on risk management for the dominant industries.

[20] Hazards Workshop Session Summary #16, *Disasters, Diversity, and Equity*, University of Colorado, Boulder (2000).

[21] Oregon Employment Department, *The Employment Landscape of Rural Oregon*. May 2017, https://www.qualityinfo.org/documents/10182/13336/The+Employment+Landscape+of+Rural+Oregon?version=1.0

[22] Portland State University, Population Research Center, *Oregon Population Forecast Program Regional Forecast Meeting October 24, 2018*, https://www.pdx.edu/prc/current-documents-and-presentations, accessed March 6, 2019.

[23] Ibid.

[24] Oregon Employment Department, *The Employment Landscape of Rural Oregon*. May 2017, https://www.qualityinfo.org/documents/10182/13336/The+Employment+Landscape+of+Rural+Oregon?version=1.0

Economic Vulnerabilities

- According to the Oregon Employment Department, the Malheur County unemployment rate in October 2018 was 4.4%. The total number of unemployed people was 525 while the nonfarm employment was 12,300. In the event of a large-scale disaster, unemployment has the potential to rise when businesses and companies are unable to overcome the ramifications of the hazard event.[25]
- Although rural Oregon housing is more affordable relative to metropolitan areas, it is among the least affordable compare with other rural communities across the nation. [26]
- More than 40% of rural Oregon employment is concentrated in natural resources, leisure and hospitality (tourism), and government. [27]
- Anticipated job growth in Malheur County, according to employment projections for the 2014-2024 period, is less than 5%. Government, education and health services, and retail trade are the top sources of projected replacement openings – each industry will need to replace about 700 workers by 2024.[28]
- In the event of a natural disaster, manufacturing and government sectors may not be as vulnerable in the short term as other sectors; however, other large industries such as retail and wholesale trade may be significantly affected by a disaster as these industries tend to rely on a stable disposable income, which may decline following a disaster.
- Counties in southern Oregon and eastern Oregon have high shares of land owned by the federal government, with Malheur, Lake, and Harney Counties topping 70 percent of the land owned by the federal government. [29]
- In Malheur County, 73% of the land is owned by the federal government, 5% is owned by the State, and less than 1% is owned by Tribes. [30]

Environment

The capacity of the natural environment is essential in sustaining all forms of life including human life, yet it often plays an underrepresented role in community resiliency to natural hazards. The natural environment includes land, air, water and other natural resources that support and provide space to live, work and recreate.[31] Natural capital such as wetlands and forested hill slopes play significant roles in protecting communities and the environment from weather-related hazards, such as flooding and landslides. When natural systems are impacted or depleted by human activities, those activities can adversely affect community resilience to natural hazard events.

---

[25]Oregon Employment Department, https://www.qualityinfo.org/eastern-oregon, Accessed November 20, 2018.

[26] Oregon Employment Department, *The Employment Landscape of Rural Oregon.* May 2017, https://www.qualityinfo.org/documents/10182/13336/The+Employment+Landscape+of+Rural+Oregon?version=1.0

[27] Ibid.

[28] ibd.

[29] Ibid.

[30] ibid.

[31] Mayunga, J. *Understanding and Applying the Concept of Community Disaster Resilience: A Capital-Based approach. Summer Academy for Social Vulnerability and Resilience Building,* (2007).

Environmental Vulnerabilities

- Dynamic weather and relatively flat, arid land across eastern Malheur County are indicators of hazard vulnerability when combined with the changing climate and severe weather related events. Both wet and dry cycles are likely to last longer and be more extreme, leading to periods of deeper drought and more frequent flash flooding. Less precipitation in the summers and subsequently lower soil moisture with hotter temperatures will likely increase the amount of vegetation consumed by wildfire.
- Extended drought periods affect snowpack and agricultural irrigation.
- The combination of a growing population and development intensification can lead to the increasing risk of hazards, threatening loss of life, property and long-term economic disruption if land management is inadequate.

In Appendix F Future Climate Projections Reports, the Oregon Climate Change Research Institute's (OCCRI) *Future Climate Projections Malheur County: A Report to the Oregon Department of Land Conservation and Development* and the *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports*, provide important information regarding the influence and impacts of climate change on existing natural hazards events such as heavy rains, river flooding, drought, heat waves, cold waves, wildfire, and air quality.

National Flood Insurance Program (NFIP)

The Malheur County Flood Insurance Rate Maps (FIRMs), like much of eastern Oregon, are not modernized. Below is a recap of current information related to the NFIP in Malheur County and the incorporated cities. For more details see the Flood Annex section of the Hazard Annexes. Table FL-2 Flood Insurance Details, which shows information as of November 2018 for Malheur County and the incorporated cities.

Malheur County and incorporated cities:[32]

- Have 109 National Flood Insurance Program (NFIP) policies in force;
- Have 26 paid claims;
- Are not members of the Community Rating System (CRS);
- Have no repetitive loss and no severe repetitive loss building claims; and
- The last Community Assistance Visit (CAV) in Malheur County was on September 27, 2011 with the City of Ontario.

Critical Infrastructure, Critical Facilities, and Lifelines

Critical facilities (i.e. police, fire, and government facilities), housing supply, and physical infrastructure are critical during a disaster and are essential for proper functioning and response. The lack or poor condition of infrastructure can negatively affect a community's ability to cope, respond and recover from a natural disaster. Following a disaster, communities may experience

[32] Celinda Adair, Department of Land Conservation and Development, November 30, 2018 and David Lentzner, Department of Land Conservation and Development, personal communication, December 14, 2018.

isolation from surrounding cities and counties due to infrastructure failure. These conditions force communities to rely on local and immediately available resources.

Critical Infrastructure, Critical Facilities, and Lifelines: Definitions

One definition of **critical infrastructure** is “Systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters” (U.S. Department of Homeland Security [U.S. DHS], n.d.).

A definition of **critical facilities**: **“**Structures and institutions necessary, in the community’s opinion, for response to and recovery from emergencies. Critical facilities must continue to operate during and following a disaster to reduce the severity of impacts and accelerate recovery” (*2015 Hazard Mitigation Assistance (HMA) Guidance,* FEMA).

A definition of **lifelines**: “Lifelines include utility systems (potable water, wastewater, oil, natural gas, electric power facilities and communication systems) and transportation systems (airways, bridges, roads, tunnels and waterways). Communication facilities are also important lifelines.” (*Portland Local Energy Assurance Plan,* 2012).

The table below, Table 2-7, includes assets for Malheur County and the Cities of Nyssa, Ontario, and Vale. The asset is a critical or essential facility, critical infrastructure, or lifeline for Malheur County and/or the individual cities. The exact location of the asset is not identified in this list. The x’s represent the hazard that could impact the asset. Note that the hazard of snow/ winter storm is specifically called out instead of being included in the severe weather hazard category. For Table 2-7, severe weather includes dust storm, rain storm, wind storm, and extreme temperature.

As discussed by Malheur County NHMP Steering Committee members regarding Table 2-7:

- Hazards may physically impact the hospital, like a flood getting into the basement or an earthquake damaging the building. However, it is noted that the hospital will be impacted/affected by all of the hazards because of the role and function of the hospital.

- Schools are often used as shelters in times of a disaster. For example, fire camps have been set up in schools so that personnel fighting wildfires have lodging. Buses can be used to evacuate people and move supplies.

Table 2-7 Critical Facilities, Critical Infrastructure, and Lifelines

Malheur County Asset Identification	Drought	Earthquake	Flood	Landslide	Severe Weather	Wildfire	Snow/ winter storm	Volcanic Event
Malheur County								
Health Department		X	X		X		X	X
Environmental Health Department		X	X		X	X	X	X
County Road District 1		X	X	X	X	X	X	X
Assessed Rural Road Districts		X	X	X	X	X	X	X
Court House		X	X		X		X	X
Sheriff Office and Public Safety Answer Point (911) (PSAP)/EOC		X	X		X		X	X
Ambulance Service District and Veteran Affairs		X	X		X		X	X
Hospital - St Alphonsus Medical Center	X	X	X	X	X	X	X	X
Schools – Listed by School District								
Adrian SD:								
Adrian Elementary School		X			X	X	X	X
Adrian High School		X			X	X	X	X
Annex SD:								
Annex Charter School		X	X		X	X	X	X
Arock SD:								
W.W. Jones Elementary		X	X		X	X	X	X
Harper SD:								
Harper Charter School		X	X		X	X	X	X
Huntington SD:								
Huntington Charter School	N/A							
Jordan Valley SD:								
Jordan Valley Elementary		X	X		X	X	X	X
Jordan Valley High School		X	X		X	X	X	X
Rockville, Elementary School		X	X		X	X	X	X
Juntura SD:								

Malheur County Asset Identification	Drought	Earthquake	Flood	Landslide	Severe Weather	Wildfire	Snow/ winter storm	Volcanic Event
Juntura Elementary School		X	X		X	X	X	X
Nyssa SD:								
Nyssa High School		X	X		X	X	X	X
Nyssa Middle School		X	X		X	X	X	X
Nyssa Elementary		X	X		X	X	X	X
Ontario SD:								
Ontario High School		X	X		X	X	X	X
Ontario Middle School		X	X		X	X	X	X
Aiken Elementary School		X	X		X	X	X	X
Alameda Elementary School		X	X		X	X	X	X
Cairo Elementary School		X	X		X	X	X	X
May Roberts Elementary		X	X		X	X	X	X
Pioneer Elementary School		X	X		X	X	X	X
Vale SD:								
Vale High School		X	X		X	X	X	X
Vale Middle School (current)		X	X		X	X	X	X
Vale Middle School (new building)		X	X		X	X	X	X
Vale Elementary School		X	X		X	X	X	X
Willowcreek Elementary		X	X		X	X	X	X
Other Schools								
Four Rivers Community School		X	X		X	X	X	X
St. Peter’s Catholic School		X	X		X	X	X	X
Treasure Valley Christian		X	X		X	X	X	X
Treasure Valley Community College		X	X		X	X	X	X
Arock Community Center		X	X		X	X	X	X
Jordan Valley Lion’s Hall		X	X		X	X	X	X
Juntura Community Center		X	X		X	X	X	X

Malheur County Asset Identification	Drought	Earthquake	Flood	Landslide	Severe Weather	Wildfire	Snow/ winter storm	Volcanic Event
State Highways: US 30, US 20/26, US 20, US 26 US 95, US 78 US 52, US 95 SPUR, I-84, and OR 201		X	X	X	X		X	X
Malheur County Fairgrounds		X	X		X	X	X	X
Four Rivers Cultural Center		X	X		X	X	X	X
First Church of the Nazarene		X	X		X	X	X	X
The Church of Jesus Christ of Latter-Day Saints (LDS) Church		X	X		X	X	X	X
Owyhee Dam		X	X			X	X	
Owyhee Irrigation District facilities		X					X	
City of Nyssa								
Water Treatment Plant (all the assets associated with the production of clean and safe drinking water)		x	x	x	x	x	x	x
Water distribution systems including pumping stations and tankage.		x	x	x	x	x	x	x
Wastewater Treatment Plant (all treatment trains in used to address and maintain discharge permit parameters)		x	x	x	x	x	x	x
Lift stations for collection of wastewater from the City to the treatment plant.		x	x		x		x	x
EMS facilities, including all equipment with the structures		x	x		x		x	x
Critical road infrastructure to provide access to hospitals, police and fire service. Primary and secondary road system identified in snow removal plan.	x	x	x	x	x	x	x	x
City Hall		x	x		x		x	x
Water distribution line under Snake River Bridge		x	x		x		x	x
Water Tank 100,000 gallon		x	x		x		x	x
City of Ontario								
Water Treatment Plant (all the assets associated with the production of clean and safe drinking water)	x	x	x		x		x	x
Water distribution systems including pumping stations and tankage (water storage tanks).								
Bench Reservoir	x	x	x		x		x	x
Sunset Reservoir	x	x	x		x		x	x

Malheur County Asset Identification	Drought	Earthquake	Flood	Landslide	Severe Weather	Wildfire	Snow/ winter storm	Volcanic Event
Eastside Reservoir	x	x	x		x		x	x
Canyon Two Booster Station	x	x	x		x		x	x
Ontario Wastewater Treatment Plant (all treatment trains in use to address and maintain discharge permit parameters)		x		x	x		x	x
Lift stations (for collection of wastewater from the City to the treatment plant).								
W. Idaho Lift Station		x	x	x	x		x	x
Malheur Lift Station		x	x	x	x		x	x
Regional Lift Station		x	x	x	x		x	x
8th Ave Lift Station		x	x	x	x		x	x
East Side Lift Station		x	x	x	x		x	x
Murakami Lift Station		x	x	x	x		x	x
Malheur Lift Station		x	x	x	x		x	x
Lower Lift Station		x	x	x	x		x	x
Tapadera Lift Station		x	x	x	x		x	x
LID 44 Lift Station		x	x	x	x		x	x
Critical road infrastructure to provide access to hospitals, police and fire service. Primary and secondary road system identified in the City of Ontario Snow and Ice Control Plan.		x	x	x	x		x	x
City Hall and Fire & Rescue		x			x		x	x
Airport (city owned /BLM base there)		x			x	x	x	x
City of Vale								
Water Treatment Plant (all the assets associated with the production of clean and safe drinking water).		X	X		X	X	X	X
Water distribution systems including pumping stations and tankage.		X	X	X	X	X	X	X
Vale Wastewater Treatment Plant (all treatment trains in used to address and maintain discharge permit parameters).		X	X		X		X	X
Lift stations (for collection of wastewater from the City to the treatment plant).		X	X		X		X	X
EMS facilities including all equipment with the structures.		X	X		X		X	X

Malheur County Asset Identification	**Drought**	**Earthquake**	**Flood**	**Landslide**	**Severe Weather**	**Wildfire**	**Snow/ winter storm**	**Volcanic Event**
Critical road infrastructure to provide access to hospitals, police and fire service. Primary and secondary road system identified in the City of Vale Snow Removal Plan.	X	X	X	X	X	X	X	X
City Hall		X	X		X		X	X
City Maintenance Shops		x	x		x		x	x
Miller Memorial Airpark Airport		x	x		x	x	x	x

Source: Malheur County Emergency Manager and NHMP Steering Committee, Tricia Sears, DLCD, November 2018

Critical Facilities and Infrastructure Vulnerabilities

- It is critical to maintain the quality of built capacity (transportation networks, critical facilities, utility transmission, etc.) throughout the area, as poor infrastructure can negatively affect Malheur County's ability to cope, respond and recover from a natural disaster.
- Based on U.S. Census data, 32.3% of the residential housing throughout Malheur County was built from 1960 to 1979. From 1980 to 1999 in Malheur County, 26.7% of the housing units were constructed. The local implementation of the flood elevation requirements was in the 1970's (Malheur County FIRMs were not completed until the 1980s). The current seismic building standards were implemented in 1990. Implementation of the flood and seismic provisions greatly reduced impacts.[33]
- Malheur County has 11,640 total housing units with 4,194 or 40.7% occupied by renters and 6,100 or 59.3% owner occupied.[34] Studies have shown that renters, for a variety of reasons, are less likely than homeowners to prepare for natural hazard events.
- Mobile homes account for 17.3% of the housing in Malheur County. In Jordan Valley it is 46.9%, in Adrian it is 26.5%, in Vale it is 18.8%, in Nyssa it is 14%, and in Ontario it is 10.1% of the housing units are mobile homes. These structures are particularly vulnerable to certain natural hazards, such as windstorms and heavy flooding events. [35]
- Some roads and bridges in Malheur County are highly vulnerable to hazards, specifically earthquakes. Because bridges vary in size, materials, siting, and design, any given hazard will affect them differently. The County and Cities should also pay considerable attention to roads and bridges that may become obstructed that serve as primary interstate travel routes (Interstate 5, Highways 20 and 26), as this will likely have significant impacts on access in and out of Malheur County and the region. ODOT has jurisdiction over the interstate and highways, but the Cities and County usually control maintenance in and around the communities.

[33] U.S. Census Bureau, 2006-2010 American Community Survey, Table S2504, *Physical Housing Characteristics for Occupied Housing*, http://factfinder2.census.gov

[34] U.S. Census Bureau, Table DP-04*, Selected Housing Characteristics: 2016*, accessed November 19, 2018, http://factfinder2.census.gov

[35] U.S. Census Bureau, Table DP-04, *Selected Housing Characteristics: 2016*, accessed November 19, 2018, http://factfinder2.census.gov

SECTION 3: MITIGATION STRATEGY

Section 3 outlines Malheur County's strategy to reduce or avoid long-term vulnerabilities to the identified hazards. This section presents a mission, goals, and mitigation actions thereby addressing the mitigation strategy requirements contained in 44 CFR 201.6(c). The Malheur County Natural Hazards Mitigation Plan (NHMP) Steering Committee reviewed and retained the mission and goals, and reviewed and updated the mitigation actions. Additional planning process documentation is in Appendix B Planning and Public Process.

Mitigation Plan Mission

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

The mission of the Malheur County NHMP is:

> To create a disaster-resilient Malheur County by building partnerships, reducing risk, preventing loss, and protecting life, property, and the environment from future natural hazard events.

The Malheur County NHMP Steering Committee reviewed the existing NHMP mission statement and agreed it accurately describes the overall purpose and intent of this NHMP; therefore the mission statement was retained as is. The Steering Committee believes the concise nature of the mission statement allows for a comprehensive approach to mitigation planning.

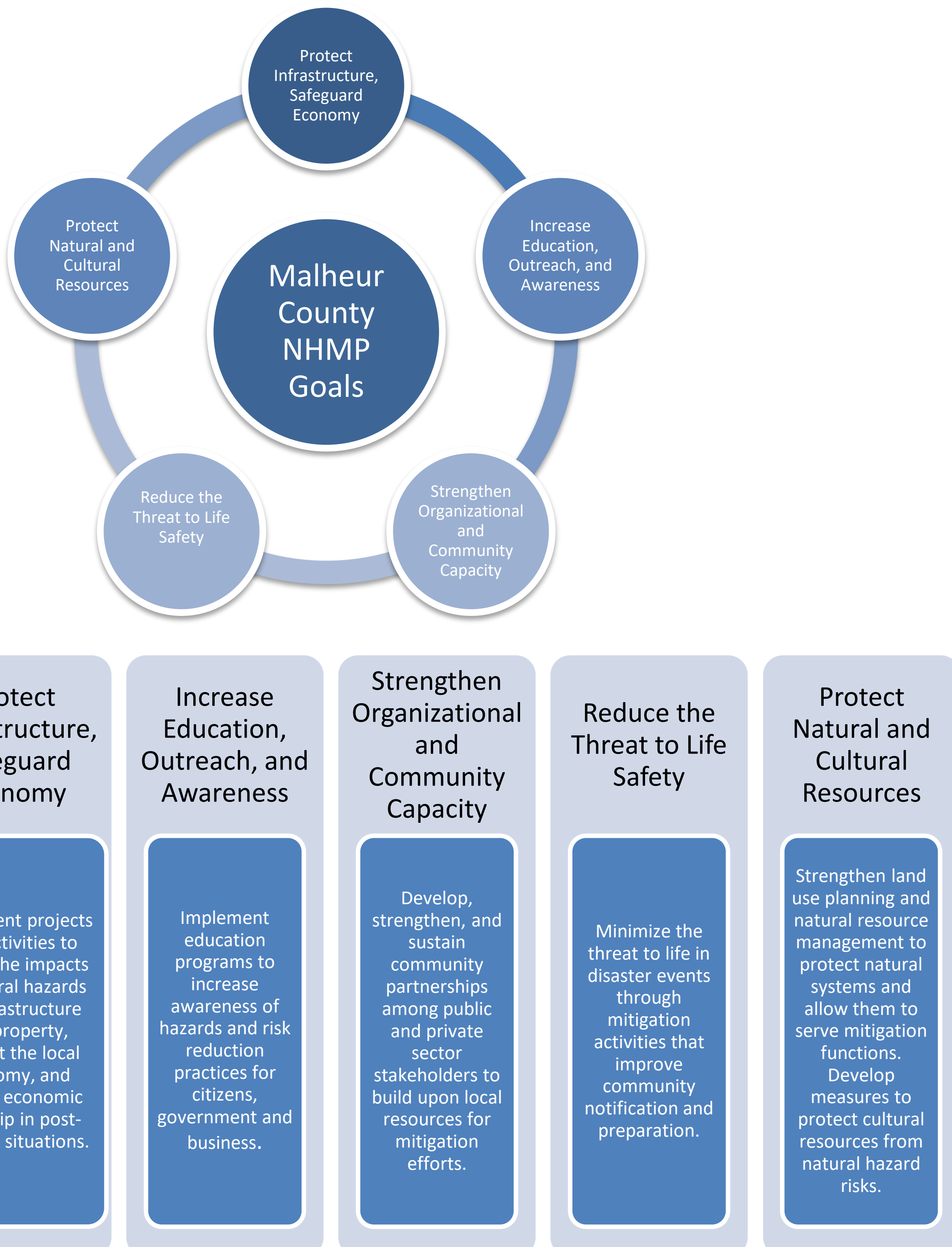
Mitigation Plan Goals

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

Public participation was a key aspect in developing the NHMP goals in previous plans. Meetings with the Steering Committee, stakeholder interviews, surveys, and public workshops all served as methods to obtain input and priorities in developing goals for reducing risk and preventing loss for natural hazards in Malheur County.

Public participation was also a key aspect in this update to the NHMP. The Malheur County NHMP Steering Committee reviewed the existing NHMP goals and determined they would keep the same goals for the *2019 Malheur County NHMP*. The two graphics in Figure 3-1 illustrate the equal importance of the goals and their statements.

Figure 3-1 Malheur County 2018 NHMP Goals and Statements



Source: Tricia Sears, DLCD, created August 8, 2018

Existing Mitigation Activities

Existing mitigation actions include current mitigation programs and activities that are being implemented by Malheur County in an effort to reduce the community's overall risk to natural hazards. Documenting these efforts can assist the jurisdiction to better understand risk and identifying successes. See Mitigation Actions Table – Status of 2014 NHMP, Table 3-2, and Mitigation Actions 2019 NHMP, Table 3-3. For details on each hazard see Volume II, Hazard Annexes.

Government Structure

In addition to the Emergency Management Department, most departments within the County and City governance structures have some degree of responsibility in building overall community resilience. Each plays a role in ensuring that jurisdiction functions and normal operations resume after an incident, and the needs of the population are met. For further explanation regarding how these departments influence hazard resilience, see Appendix C, Community Profile.

Existing Plans and Policies

Communities often have existing plans and policies that guide and influence land use, land development, and population growth. Linking existing plans and policies to the NHMP helps identify what resources already exist that can be used to implement the action items identified in the Plan. Plans and policies already in existence have support from local residents, businesses and policy makers.[1] A list documenting plans and policies already in place in Malheur County and the Cities can be found in Section 4 Implementation Table 4-1 and Appendix C Community Profile in Table C-24.

Community Organizations and Programs

In natural hazard mitigation planning, it is important to know what social systems exist within the community because of their existing connections to the public. Malheur County and Cities can use existing social systems as resources for implementing communication-related activities because these service providers already work directly with the public, one focus could be natural hazard preparedness and mitigation. Appendix C, Community Profile, provides a comprehensive list of community organizations and programs, and offers a more thorough explanation of how existing community organizations and programs can be utilized for hazard mitigation.

NHMP Mitigation Actions

Mitigation actions identified through the planning process are an important part of the mitigation plan. Mitigation actions are detailed recommendations for activities that local departments, citizens, and others could engage in to reduce risk. They address both multi-hazard (MH) and hazard-specific issues. Mitigation actions can be developed through a number of sources. A description of how the *2019 Malheur County NHMP* mitigation actions were developed is provided

[1] Raymond J. Burby, *Cooperating with Nature: Confronting Natural Hazards with Land-Use Planning for Sustainable Communities*, (1998), https://www.nap.edu/catalog/5785/cooperating-with-nature-confronting-natural-hazards-with-land-use-planning

below in the "Mitigation Action Development Process" section. The process resulted in the creation of two mitigation actions tables.

- The Mitigation Actions Table – Status of 2014 NHMP is included in Table 3-2 and provides an update on the status of each mitigation action from the 2014 NHMP.
- Table 3-3 Mitigation Actions 2019 NHMP includes the mitigation actions that the Steering Committee supports for the *2019 Malheur County NHMP*.

Mitigation Action Item Worksheets

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

Mitigation Action Title

Each mitigation action item includes a title and a brief description of the proposed action.

Alignment with Plan Goals

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

Affected Jurisdiction

Many of the mitigation actions within this plan apply to all of the participating Cities and Malheur County; however, some actions are specific. The list of affected jurisdictions is provided on the right side of the matrix. The action item form in Appendix A provides more detailed information.

Alignment with Existing Plans / Policies

Identify any existing community plans and policies where the mitigation action can be incorporated. Incorporating the mitigation action into existing plans and policies, such as comprehensive plans, will increase the likelihood that it will be implemented.

Rationale or Key Issues Addressed

Mitigation actions should be fact-based and tied directly to issues or needs identified throughout the planning process. Mitigation actions can be developed at any time during the planning process and can come from a number of sources, including participants in the planning process, noted deficiencies in local capability, or issues identified through the risk assessment. The rationale for proposed mitigation actions is based on the information documented in Section 2 Risk Assessment and Volume II Hazard Annexes.

Implementation through Existing Programs

For each mitigation action, the Mitigation Action Item form asks for some ideas for implementation, which serve as the starting point for taking action. This information offers a transition from theory to practice. Ideas for implementation could include: (1) collaboration with relevant organizations, (2) alignment with the community priority areas, and (3) applications to new grant programs.

The ideas for implementation offer a transition from theory to practice and serve as a starting point for this plan. This component of the mitigation action is dynamic, since some ideas may prove to not be feasible, and new ideas may be added during the plan maintenance process. Ideas for implementation include such things as: collaboration with relevant organizations, grant programs, tax incentives, human resources, education and outreach, research, and physical manipulation of buildings and infrastructure. When an action is implemented, more work may be needed to determine the exact course of action.

The *2019 Malheur County NHMP* includes a range of mitigation actions that, when implemented, will reduce loss from hazard events in the County. Within the NHMP, FEMA requires the identification of existing programs that might be used to implement these action items. Malheur County and the participating cities currently address statewide planning goals and legislative requirements through their comprehensive land use plans, capital improvements plans, mandated standards and building codes. Plans and policies already in existence have support from local residents, businesses, and policy makers. Many land use, comprehensive, and strategic plans are updated regularly, and can adapt easily to changing conditions and needs.[2] Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. The jurisdictions will work to incorporate the mitigation actions into existing programs and procedures.

Coordinating Organization

The coordinating organization is the public agency with the regulatory responsibility to address natural hazards, or that is willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring and evaluation.

The Coordinating Organization and main contact for the Malheur County NHMP is the Malheur County Emergency Manager, Rich Harriman, and the Emergency Management Team (EMT) which is also known as Local Emergency Planning Committee (LEPC). The EMT/LEPC members doubled as the NHMP Steering Committee for the *2019 Malheur County NHMP*.

Internal and External Partners

The internal and external partner organizations listed in the Mitigation Actions Table 2018 NHMP included below and in the Action Item Worksheets, located in Appendix A, are potential partners recommended by the Steering Committee but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and/or resources toward completion of the action items.

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

[2] Ibid

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

Potential Funding Sources

Where possible, identify potential funding sources for the mitigation action. Example funding sources can include: the federal Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM) and Flood Mitigation Assistance (FMA) Programs; state funding sources such as the Oregon Seismic Rehabilitation Grant Program; or local funding sources such as capital improvement or general funds. A mitigation action may have multiple funding sources. The funding sources are identified general as short- or long-term (see below) and includes an element of funding capacity of the jurisdiction for that action. Appendix A Action Item Forms includes the more detailed description of each mitigation action; funding sources are included there. See Appendix E Grant Programs and Resources for additional information on funding opportunities.

Estimated Cost

Where possible, an estimate of the cost for implementing the mitigation action is included.

Timeline

Action items include both short- and long-term activities. Each action item includes an estimate of the timeline for implementation.

- *Short-term action items* (ST) are activities that may be implemented with existing resources and authorities in one to two years.
- *Long-term action items* (LT) may require new or additional resources and/or authorities, and may take from one to five years to implement.
- *Ongoing* action items signify that work has begun and will either exist over an indefinite timeline, or an extended timeline. These are successful mitigation actions that have often been well integrated into the practices of the jurisdiction. These on-going activities are ones the community continues to prioritize each year. This is a very good accomplishment to have mitigation integrated as a priority.

Status

As mitigation actions are implemented or new ones are created, it is important to indicate the status of the action item—whether it is ongoing, complete, no longer included – and to create new actions. Documenting the status of the action will make reviewing and updating mitigation plan easier during the plan's five-year update, and can be used as a benchmark for progress.

Priority

The priority designations for the mitigation actions are described below in the Mitigation Actions Tables section to clarify the importance of these mitigation actions for the affected jurisdictions.

Mitigation Action Development Process

Development of mitigation actions was a multi-step, iterative process that involved brainstorming, discussion, review, and revisions. The bulk of this work occurred during the second and third Steering Committee meetings which were held on June 14, 2018 and August 9, 2018. Additional conversation occurred at the November 8, 2018 Emergency Management Team (EMT)/ Local Emergency Preparedness Committee (LEPC) with DLCD's Natural Hazards Planner and project lead calling in for discussion. DLCD's project lead also called in for discussion of the entire NHMP at the January 10, February 14, and April 11, 2019 EMT/LEPC/NHMP meetings.

One of the first steps was to discuss the status of the mitigation actions from the *2014 Malheur County NHMP*. The Steering Committee went through each mitigation action and ascertained if the action was completed or in progress.

- *Completed mitigation actions* were deemed a successful accomplishment and removed from the table.
- *No longer included mitigation actions* were removed from the table due to resource constraints or other factors.
- *Mitigation actions that were retained* were retained in full or modified to more accurately reflect the current situation.
- During this process, *new mitigation actions* were also identified.

The Mitigation Actions Table – Status of the 2014 NHMP is included in Table 3-2 and provides an update on the status of each mitigation action from the 2014 NHMP.

With the new mitigation actions and the retained existing mitigation actions (some of which were modified), a table was created to include all the mitigation actions that would be moved forward for the 2019 NHMP. Table 3-3 Mitigation Actions 2019 NHMP includes the mitigation actions that the Steering Committee supports for the *2019 Malheur County NHMP*.

Mitigation Actions Tables

The Mitigation Actions Tables portray the overall action plan framework and identify links between the plan goals, partnerships (coordination and partner organizations), and actions. The tables document a description of the action, the level of priority, the coordinating organization, partner organizations, timeline, and the plan goals addressed. The County and the Cities are included in these table; there is an x marked for each jurisdiction the mitigation action applies to. Refer to Appendix A Action Item Forms for detailed information about each mitigation action.

Table 3-2 Mitigation Actions Table – Status of 2014 NHMP includes the status and explanation of the *2014 Malheur County NHMP* mitigation actions as provided by the Malheur County NHMP Steering Committee (SC) at NHMP meetings in 2018. The decisions to retain, modify, or delete the mitigation actions were also discussed at the meetings. Follow up discussions occurred with SC members by email and phone calls. This table has been refined so as to include an overall summary from the discussions. While there is a column entitled "Priority" none of the mitigation actions in the *2014 Malheur County NHMP* were listed with a priority rating or ranking except Flood (FL) #6. It was listed as a high priority and highlighted in green.

The NHMP Steering Committee finalized the mitigation actions for the *2019 Malheur County NHMP* and determined the factors to consider for prioritizing them. At the August 9, 2018 Steering

Committee meeting, it was agreed that the risk level rankings from the Hazard Vulnerability Assessment (HVA) would be used as a way to prioritize the multi-hazard and hazard-specific mitigation actions. The “Priority” column lists the priority. All the multi-hazard (MH) actions are high priority. The hazard-specific actions are high, high-medium, and low. The risk level rankings are found in Section 2 Risk Assessment in Table 2-5 and the rankings are further described in the Risk Assessment section.

In Table 3-3, the Mitigation Actions Table 2019 NHMP, all the natural hazards - winter storms, wind storms, earthquakes, droughts, floods, volcanic events, wildfire, landslides, extreme temperature, dust storms, and severe weather - impacting Malheur County and the Cities have mitigation actions. The hazards of volcanic events, dust storm, landslides, and extreme temperature are included in the multi-hazards actions and do not have hazard specific actions.

Table 3-2 Malheur County Mitigation Actions – Status of 2014 NHMP

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals 1	2	3	4	5	Jurisdictions: Malheur County	Nyssa	Ontario	Vale	Status & Explanation	Retain, Modify or Delete
Multi-Hazard (MH)																
MH#1		Conduct Business Continuity Plan Development Workshops for small businesses and potentially local nonprofits, governments and human services organizations.	Emergency Management Coordinator	IBHS, Chambers of Commerce, Emergency Management Preparedness Team, Incorporated cities	Ongoing		X	X			X	X	X	X	Previous Emergency Services Manager met with safety committees of organizations like schools, DHS, and nursing homes and looked at emergency operations plans.	Retain and modify proposed action title. Presentation and information sharing about COOP is important. Suggestion to work with Chamber of Commerce more and to consider a Main Street COOP.
MH#2		Work with Southeast Oregon Regional Food Bank to develop a plan/system for stocking and distributing emergency food boxes at all county food pantry locations	Southeast Oregon Regional Food Bank	Four Rivers Hunger Awareness and Prevention Coalition, Emergency Management Preparedness Team	Ongoing		X	X			X	X	X	X	Previous Emergency Services Manager worked on SE Pantry Plan. Food comes from Portland. They have talked with Idaho about that and potential other.	Retain.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals 1	2	3	4	5	Jurisdictions Malheur County	Nyssa	Ontario	Vale	Status & Explanation	Retain, Modify or Delete
		for disaster situations.														
MH#3		Develop an education program for Malheur County to raise awareness of natural hazards and potential mitigation activities.	Emergency Management Preparedness Team	County, Incorporated cities, Snake River Fire Chiefs Association, local public safety committee (law enforcement)	Ongoing		X				X	X	X	X	The Emergency Coordinator and the Emergency Services Manager do education. Outreach is made through in person presentations, Facebook, and the website.	Retain it. Modify the lead agency information.
MH#4		Update the mission of the Malheur County Emergency Management Preparedness Team to include the maintenance and review of the Natural Hazard Mitigation Plan	Emergency Management Preparedness Team	County Court, Incorporated cities, FEMA	Short Term			X			X				The Malheur County NHMP has a mission statement. A mission statement will be prepared, and existing draft bylaws for the EMT will be reviewed at the July 2018 EMT meeting.	Retain. Mission and bylaws are in process for the EMT and will include the maintenance and review of the NHMP.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions				Status & Explanation	Retain, Modify or Delete
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale		
MH#5		Identify historic structures that represent a significant cultural resource for the community, and identify mitigation to protect them from natural hazards.	Malheur County Planning Department	Oregon State Historic Preservation Office	Long Term	X			X	X	X	X	X	X	SC wants to protect historic and cultural resources from natural hazards impacts. Malheur County Planning notes there is no historic structures list for the County or the Cities. Could use the State Historic Preservation Office (SHPO) information.	Modify. Start by identifying the historic structures based on the SHPO and National Register of Historic Places.
MH#6		Incorporate the Natural Hazards Mitigation Plan into the comprehensive Plan (in particular Goal 7).	County/ City Planning Departments	Department of Land Conservation and Development, Oregon Office of Emergency Management, Federal Emergency Management Agency	Long Term				X	X	X	X	X	X	The Comprehensive Plan is from 1985. The NHMP information has not been integrated to it.	Retain and modify slightly.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals 1	2	3	4	5	Jurisdictions Malheur County	Nyssa	Ontario	Vale	Status & Explanation	Retain, Modify or Delete
MH#7		Install arsenic removal equipment on municipal wells #7 and #9 to provide backup drinking water supply out of the floodplain.	City of Nyssa Public Works Department	City of Nyssa, FEMA	Long Term	X		X	X	X		X			The City of Nyssa will finish construction on the water treatment plan in August 2018; it will remove arsenic from the water. There is no way to remove arsenic from the water in wells #7 and #9. Nyssa has received approval from DEQ to use the water from these two wells for drinking and fire-fighting only in an emergency.	Action accomplished. It can be deleted.
Drought (DR)																
DR #1		Support the Malheur County Soil and Water Conservation District (SWCD) in its	Malheur Co. SWCD	Irrigation Districts, Malheur Watershed Council, Owyhee Watershed	Ongoing	X		X		X	X				The SC noted that the lead agency should change and that support could take many forms.	Retain and modify the proposed action title and the lead agency. SC said to add the cities

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions				Status & Explanation	Retain, Modify or Delete
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale		
		countywide water assessment project.		Council, FEMA, USDA-Farm Services Division												in addition to the County.
DR #2		Support the Malheur, Owyhee and Vale Irrigation Districts' ongoing efforts to convert dirt irrigation canals into pipes.	Malheur Watershed Council	Irrigation Districts, Soil and Water Conservation District, Owyhee Watershed Council, FEMA	Ongoing	X		X		X	X				The SC noted that the lead agency should change.	Retain and modify the lead agency. SC said to add the cities in addition to the County.
Earthquake (ER)																
EQ #1		Research opportunities for a seismic study of Antelope Reservoir.	Jordan Valley Irrigation District	Malheur County, DOGAMI, Idaho Geology, FEMA	Long Term	X				X	X				Nothing happened. SC agreed to strike this action.	Delete
EQ #2		Perform an earthquake risk evaluation, and retrofit, for buildings not listed in the DOGAMI RVS report. Consider both	Emergency Management	County/ City Building and Public Works, DOGAMI, OEM, Business Oregon, SHPO	Long Term	X			X		X	X	X	X	Nothing happened. SC agreed to strike this action.	Delete

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals 1	2	3	4	5	Jurisdictions Malheur County	Nyssa	Ontario	Vale	Status & Explanation	Retain, Modify or Delete
		structural and non-structural retrofit options.														
EQ #3		Seismically retrofit Adrian RFPD to reduce the facility's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.	Adrian RFPD	Malheur County, Adrian, DOGAMI, OEM, Business Oregon	Long Term	X			X		X				The listed buildings in EQ #3 through #14 have not been seismically upgraded. The SC determined a new approach is needed now	Retain and modify the proposed action title. Refer to the Critical Infrastructure List. The SC would evaluate the list and determine the priorities for which buildings would be identified for seismic upgrades. Connect this list and seismic upgrade priorities to the County and cities strategic plans. This would elevate the awareness of the buildings that are a priority for seismic upgrades and

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions				Status & Explanation	Retain, Modify or Delete
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale		
																replacements, and the need for those to happen.
EQ #4		Seismically retrofit Nyssa High School to reduce the facility's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.	Nyssa School District #26	Malheur County, Nyssa, DOGAMI, OEM, Business Oregon	Long Term	X			X		X	X			See EQ #3 for status and explanation	Delete.
EQ #5		Seismically retrofit Nyssa Middle School to reduce the facility's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.	Nyssa School District #26	Malheur County, Nyssa, DOGAMI, OEM, Business Oregon	Long Term	X			X		X	X			See EQ #3 for status and explanation	Delete.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals 1	2	3	4	5	Jurisdictions Malheur County	Nyssa	Ontario	Vale	Status & Explanation	Retain, Modify or Delete
EQ #6		Seismically retrofit Nyssa Police Department to reduce the facility's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.	Nyssa Police Department	Malheur County, DOGAMI, OEM, Business Oregon	Long Term	X				X	X	X			See EQ #3 for status and explanation	Delete.
EQ #7		Seismically retrofit Alameda Elementary School to reduce the facility's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.	Ontario School District #8C	Malheur County, Ontario, DOGAMI, OEM, Business Oregon	Long Term	X				X	X		X		See EQ #3 for status and explanation	Delete.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organizati on(s)	Timeline	Plan Goals					Jurisdictions				Status & Explanation	Retain, Modify or Delete
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale		
EQ #8		Seismically retrofit May Roberts Elementary School to reduce the facility's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.	Ontario School District #8C	Malheur County, Ontario, DOGAMI, OEM, Business Oregon	Long Term	X				X	X		X		See EQ #3 for status and explanation	Delete.
EQ #9		Seismically retrofit Ontario High School to reduce the facility's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.	Ontario School District #8C	Malheur County, Ontario, DOGAMI, OEM, Business Oregon	Long Term	X				X	X		X		See EQ #3 for status and explanation	Delete.
EQ #10		Seismically retrofit Pioneer Elementary School to reduce the facility's	Ontario School District #8C	Malheur County, Ontario, DOGAMI, OEM,	Long Term	X				X	X		X		See EQ #3 for status and explanation	Delete.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organizati on(s)	Timeline	Plan Goals 1	2	3	4	5	Jurisdictions Malheur County	Nyssa	Ontario	Vale	Status & Explanation	Retain, Modify or Delete
		vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.		Business Oregon												
EQ #11		Seismically retrofit Ontario Fire and Police Departments to reduce the facilities' vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.	Ontario Fire and Police Departmen ts	Malheur County, DOGAMI, OEM, Business Oregon	Long Term	X				X	X		X		See EQ #3 for status and explanation	Delete.
EQ #12		Seismically retrofit Treasure Valley Community College to reduce the facility's vulnerability to seismic hazards. Consider both structural and	Treasure Valley Community College	Malheur County, Ontario, DOGAMI, OEM, Business Oregon	Long Term	X				X	X		X		See EQ #3 for status and explanation	Delete.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organizati on(s)	Timeline	Plan Goals 1	2	3	4	5	Jurisdictions Malheur County	Nyssa	Ontario	Vale	Status & Explanation	Retain, Modify or Delete
		non-structural retrofit options.														
EQ #13		Seismically retrofit Vale Middle School to reduce the facility's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.	Vale School District #84	Malheur County, Vale, DOGAMI, OEM, Business Oregon	Long Term	X				X	X			X	See EQ #3 for status and explanation	Delete.
EQ #14		Seismically retrofit Vale High School to reduce the facility's vulnerability to seismic hazards. Consider both structural and non-structural retrofit options.	Vale School District #84	Malheur County, Vale, DOGAMI, OEM, Business Oregon	Long Term	X				X	X			X	See EQ #3 for status and explanation	Delete.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions				Status & Explanation	Retain, Modify or Delete
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale		
Flood (FL)																
FL #1		Update County and City floodplain ordinances	Malheur Co. Planning Department	Ontario, Nyssa, Vale, Adrian, Jordan Valley, DLCD, FEMA	Short Term	X			X		X	X	X	X	Previous Emergency Services Manager worked with the National Weather Service on flood stage level information. A few years ago FEMA showed maps which would change the existing floodplain areas. The levee was built in Vale after the 1957 flood.	Retain.
FL #2		Explore the potential for Malheur County to participate in the Community Rating System	Malheur County Planning Department	Incorporated Cities, Chambers of Commerce, DLCD, FEMA	Long Term	X	X	X	X	X	X	X	X	X	It has not been done.	Retain.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions				Status & Explanation	Retain, Modify or Delete
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale		
		(CRS) of the National Flood Insurance Program (NFIP)														
FL #3		Implement storm water improvement measures as identified in the 2003 City of Ontario Storm water Master Plan	City of Ontario Public Works	City of Ontario, Ontario Planning Department, FEMA, DLCD	Long Term	X							X		Not done.	Retain.
FL #4		Update the FEMA Flood Insurance Rate Maps (FIRMs) for the county and cities	Malheur County Planning Department	Incorporated cities, Malheur County GIS staff, FEMA, DLCD, DOGAMI, Silver Jackets	Long Term		X	X			X	X	X	X	The update was in process in 2016 but the process of reviewing revised maps stopped.	Retain.
FL #5		Replace faulty flapper valve and head gate valve in storm drain near the	Vale Department of Public Works	City of Vale, FEMA, ACOE, Silver Jackets	Short Term	X								X	The flapper and head gate valves have been replaced; also there is a manual gate	Action accomplished. Delete.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions				Status & Explanation	Retain, Modify or Delete
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale		
		city school bus shed													that can be closed between the flapper valve and the river.	
FL #6	High	Develop a maintenance plan and restore the Bully Creek Levee System (in particular systems Q and R).	Vale Department of Public Works	City of Vale, Malheur County, FEMA, ACOE, Silver Jackets	Long Term	X			X		X			X	The maintenance plan is not written. In June 2018 the Bully Creek Levee System was inspected by USACE.	Modify language after we read the inspection report from USACE and ascertain the appropriate actions to take.
Landslide (LS)																
LS #1		Reinforce the hillside underneath Nyssa's water storage tank to prevent erosion and a possible	City of Nyssa Public Works Department	City of Nyssa, Local Landowners, FEMA	Long Term	X			X			X			Nyssa City Manager says there are no issues with that hillside and is not sure why this action was established.	Delete.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions				Status & Explanation	Retain, Modify or Delete
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale		
		landslide and tank collapse														
Severe Weather/Winter Storms/ Wind Storms (SW)																
SW #1		Convert primary electrical overhead lines to mountaintop communication services with underground lines.	Southeast Oregon Electric Cooperatives	Malheur County, Companies which are served by the utility and the utility company	Ongoing	X					X				Southeast Oregon Electric Cooperatives does not exist. The Oregon Rural Electric Cooperative Association (ORECA) Executive Director says the Harney Electric Cooperative serves Malheur and Harney County. Blue Mountain in Malheur County has undergrounded lines. They apply for FEMA grants to do this.	Retain. Modify lead agency and partner agency.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions				Status & Explanation	Retain, Modify or Delete
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale		
SW #2		Shorten spans and anchor poles on utility lines in high wind or heavy icing areas.	Southeast Oregon Electric Cooperatives	Malheur County, Century Link	Ongoing	X					X				See SW #1. They apply for FEMA grants to do this.	Retain. Modify lead agency and partner agency.
SW #3		Obtain land along I-84 corridor to serve as emergency truck parking during winter storm events.	City of Ontario Economic Development	Chamber of commerce, local businesses, police, public works, Malheur County, ODOT	Long Term	X		X	X		X		X		The SC notes that some work has been done to increase the land along I-84 for emergency truck parking. There are number of issues that make this complicated. More work to be done.	Retain and modify.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals 1	2	3	4	5	Jurisdictions Malheur County	Nyssa	Ontario	Vale	Status & Explanation	Retain, Modify or Delete
Volcanic Event (VE)																
VE#1		No actions identified. This hazard is rated as low probability and low vulnerability.														
Wildfire (WF)																
WF #1		Coordinate wildfire mitigation action items through the Malheur County Community Wildfire Protection Plan.	Emergency Management Preparedness Team	Malheur County Emergency Services, BLM, County Court, Oregon Department of Forestry, FEMA	Ongoing		X	X			X	X	X	X	The mitigation actions are coordinated through the CWPP. SC said that the CWPP is about to be updated.	Done but retain it so that mitigation actions continue to be coordinated between the NHMP and CWPP.
WF #2		Construct barriers on pole power transformers to prevent birds from building nests on them,	Southeast Oregon Electric Cooperatives	Malheur County, Harney County, Audubon	Ongoing		X	X			X				See SW #1. They use their own money to do this, it is a budgeted activity.	Retain. Modify lead agency and partner agency.

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organizati on(s)	Timeline	Plan Goals					Jurisdictions				Status & Explanation	Retain, Modify or Delete
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale		
		thereby reducing the chance of wildfires from transformer shorts.		Society, Century Link												
WF #3		Manage weeds and vegetation growth at base of poles in fire prone regions.	Southeast Oregon Electric Cooperatives	Malheur County, Harney County, BLM, USFW	Ongoing		X	X			X				See SW #1. They use their own money to do this, it is a budgeted activity.	Retain. Modify lead agency and partner agency.

Source Malheur County NHMP Steering Committee, 2018

Table 3-3 Malheur County Mitigation Actions 2019 NHMP

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions			
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale
Multi-Hazard (MH)														
MH #1	High	Conduct Business Continuity Plan Development information sharing through presentations, workshops, and other methods for small businesses, local nonprofits, governments, and human services organizations.	Malheur County Emergency Services Manager	Chambers of Commerce, Emergency Management Preparedness Team, Incorporated cities	Ongoing	x	X	X			X	X	X	X
MH #2	High	Work with Southeast Oregon Regional Food Bank to develop a plan/system for stocking and distributing emergency food boxes at all county food pantry locations for disaster situations.	Southeast Oregon Regional Food Bank	Four Rivers Hunger Awareness and Prevention Coalition, Emergency Management Preparedness Team	Ongoing		X	X			X	X	X	X

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions			
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale
MH #3	High	Develop an education program for Malheur County to raise awareness of natural hazards and potential mitigation activities.	Malheur County Emergency Services Manager, Malheur County Health Department Emergency Coordinator	Malheur County, Incorporated cities, Snake River Fire Chiefs Association, local public safety committee (law enforcement)	Ongoing		X	x			X	X	X	X
MH #4	High	Update the mission of the Malheur County Emergency Management Preparedness Team to include the maintenance and review of the Natural Hazards Mitigation Plan.	Emergency Management Team (EMT)	Malheur County Court, City of Ontario, City of Nyssa, City of Vale, FEMA	Short Term			X			X			
MH #5	High	Identify historic structures that represent a significant cultural resource for the community. Use information from the Oregon State Historic Preservation Office and the National	Malheur County Planning Department	Oregon State Historic Preservation Office	Long Term	X			X	X	X	X	X	X

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions			
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale
		Register of Historic Places.												
MH #6	High	Incorporate the Natural Hazards Mitigation Plan information into the Comprehensive Plan (in particular Goal 7).	Malheur County and City Planning Departments	Department of Land Conservation and Development, Oregon Office of Emergency Management, Federal Emergency Management Agency	Long Term	x			X	X	X	X	X	X
MH #7	High	Continue to work on the Malheur County Continuity of Operations Plan (COOP).	Malheur County Emergency Manager	Emergency Management Team (EMT), all Malheur County departments	Short Term	x	x	x	x		x	x	x	x
Drought (DR)														
DR #1	High	Cooperate and help the Malheur County Soil and Water Conservation District (SWCD) maintain and continue in its countywide water assessment project.	Emergency Management Team	Irrigation Districts, Malheur County SWCD, Malheur Watershed Council, Owyhee Watershed Council, FEMA, USDA-Farm Services Division	Ongoing	X		X		X	X	x	x	x

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions			
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale
DR #2	High	Support the Malheur, Owyhee and Vale Irrigation Districts' ongoing efforts to convert dirt irrigation canals into pipes.	Emergency Management Team	Irrigation Districts, Malheur Watershed Council, Soil and Water Conservation District, Owyhee Watershed Council, FEMA	Ongoing	X		X		X	X	x	x	x
Earthquake (EQ)														
EQ #1	Low	Review Critical Infrastructure List prepared for the 2019 NHMP. Evaluate the list and determine the priority buildings for seismic retrofits or replacements. Include the Critical Infrastructure List in the strategic plans for the County and the Cities.	Emergency Management Team/ SC NHMP	Malheur County, Cities of Nyssa, Vale, and Ontario, DOGAMI, OEM, Business Oregon,	Long Term	X			X		X	x	x	x

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions			
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale
Flood (FL)														
FL #1	High-Medium	Update County and City floodplain ordinances.	Malheur County Planning Department and Cities Planning Departments	Ontario, Nyssa, Vale, Adrian, Jordan Valley, DLCD, FEMA	Short Term	X			X	x	X	X	X	X
FL #2	High-Medium	Explore the potential for Malheur County to participate in the Community Rating System (CRS) of the National Flood Insurance Program (NFIP).	Malheur County Planning Department	Incorporated Cities, Chambers of Commerce, DLCD, FEMA	Long Term	X	X	X	X	X	X	X	X	X
FL #3	High-Medium	Implement stormwater improvement measures as identified in the 2003 City of Ontario Stormwater Master Plan (see Section 7.0). Evaluate	City of Ontario Public Works	City of Ontario, Ontario Planning Department, FEMA, DLCD	Long Term	X		x					X	

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions			
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale
		implementation progress each year.												
FL #4	High-Medium	Update the FEMA Flood Insurance Rate Maps (FIRMs) for the County and Cities.	Malheur County Planning Department	Incorporated cities, Malheur County GIS staff, FEMA, DLCD, DOGAMI, Silver Jackets	Long Term		X	X			X	X	X	X
FL #5	High-Medium	Develop a maintenance plan and restore the Bully Creek Levee System. Include vegetation and debris removal as part of maintenance efforts. Prioritize actions that are identified in the inspection report when it is available from USACE (inspection done in June 2018).	Malheur County Emergency Services Manager, Vale Department of Public Works, Vale Irrigation District	City of Vale, Malheur County, FEMA, USACE, Silver Jackets	Long Term	X	x	x	X		X			X
FL #6	High-Medium	Explore funding opportunities with Business Oregon for the maintenance, repairs, and other	Malheur County Emergency Manager, City of Vale	Business Oregon, Regional Solutions office, USACE, Silver Jackets, OEM, DLCD	Short Term	x		x	x		x			x

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions			
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale
		work related to Bully Creek Levee System.												
FL #7	High-Medium	Evaluate status of the water treatment plant (1900 SE 5th Ave) and the wastewater treatment plant (2405 Malheur Drive) in Ontario in regards to preparing for and mitigating flood issues. Portions of these sites are within the floodplain.	Malheur County Emergency Manager, City of Ontario	FEMA, USACE, Silver Jackets, OEM, DLCD	Long-term	x		x	x		x		x	
FL #8	High-Medium	Ice jam and weather event flooding occur along the rivers due to flow levels. When water is released from storage facilities, it may cause or contribute to flood events. Malheur County cannot manage these releases of water. Notification, communication, and a	Malheur County Emergency Manager, Owyhee Irrigation District	Malheur County, Bureau of Reclamation, Oregon Department of State Lands (DSL), Army Corps of Engineers, Cities of Nyssa, Vale, and Ontario	Long-term	x	x	x	x	x	x	x	x	x

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions			
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale
		memorandum of understanding between regulating agencies is needed.												
Severe Weather/Winter Storms/Winds Storms (SW)														
SW #1	High	Convert primary electrical overhead lines to mountaintop communication services with underground lines.	Oregon Rural Electric Cooperative Association and Harney Electric Cooperative	Malheur County, Harney Electric Cooperative (serves Malheur, Lake, and Harney Counties), Companies which are served by the utility and the utility company	Ongoing	X					X			
SW #2	High	Shorten spans and anchor poles on utility lines in high wind or heavy icing areas.	Oregon Rural Electric Cooperative Association and Harney Electric Cooperative	Malheur County, Harney Electric Cooperative (serves Malheur, Lake, and Harney Counties), Century Link	Ongoing	X					X			

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions			
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale
SW #3	High	Work on obtaining land along I-84 corridor to serve as emergency truck parking during winter storm events.	City of Ontario Economic Development	Chamber of commerce, local businesses, police, public works, Malheur County, ODOT	Long Term	X		X	X		X		X	
SW #4	High	Severe weather events occur with debris or snow removal beyond the resources available to the County, the Cities, and the Special Districts affected. A list of available local resources, contacts, and a memorandum of understanding between contributing agencies and organizations is needed.	Malheur County Emergency Manager, Owyhee Irrigation District	Malheur County, Cities of Ontario, Vale, and Nyssa, Nyssa Rural Road District, Ontario Rural Road Assessment District #3, ODOT	Long-term	x	x	x	x	x	x	x	x	
Wildfire (WF)														
WF #1	High Medium	Coordinate the wildfire mitigation action items in the NHMP with those in	Emergency Management	Malheur County Emergency Services, BLM, County Court,	Ongoing		X	X			X	X	X	X

Hazard Action Item	Priority	Proposed Action Title	Lead Agency	Partner Organization(s)	Timeline	Plan Goals					Jurisdictions			
						1	2	3	4	5	Malheur County	Nyssa	Ontario	Vale
		the Malheur County Community Wildfire Protection Plan (CWPP).	Preparedness Team	Oregon Department of Forestry, FEMA										
WF #2	High Medium	Construct barriers on pole power transformers to prevent birds from building nests on them, thereby reducing the chance of wildfires from transformer shorts.	Oregon Rural Electric Cooperative Association and Harney Electric Cooperative	Malheur County, Harney Electric Cooperative (serves Malheur, Lake, and Harney Counties), Harney County, Audubon Society, Century Link, Idaho Power	Ongoing		X	X			X			
WF #3	High Medium	Manage weeds and vegetation growth at base of poles in fire prone regions.	Oregon Rural Electric Cooperative Association and Harney Electric Cooperative	Malheur County, Harney Electric Cooperative (serves Malheur, Lake, and Harney Counties), Harney County, BLM, USFW, Idaho Power	Ongoing		X	X			X			

Source: Malheur County NHMP Steering Committee, 2018.

SECTION 4:
PLAN IMPLEMENTATION AND MAINTENANCE

The Plan Implementation and Maintenance section details the formal process that will ensure that the Malheur County Multi-Jurisdictional Natural Hazards Mitigation Plan (NHMP) remains an active and relevant document. The plan implementation and maintenance process includes a schedule for monitoring and evaluating the plan semi-annually, as well as producing an updated plan every five years. This section also describes how the Malheur County and the Cities of Ontario, Nyssa, and Vale will integrate public participation throughout the plan maintenance and implementation process.

Implementing the Plan

The success of the *2019 Malheur County NHMP* depends on how well the mitigation actions in Table 3-3 are implemented. In an effort to ensure that the mitigation actions are implemented, the following steps will be taken. The plan will be formally adopted, a coordinating body will be assigned, a convener shall be designated, the identified activities will be prioritized and evaluated, and finally, the plan will be implemented through existing plans, programs, procedures, and policies.

Plan Adoption

Once the NHMP is locally reviewed and ready, the Plan Convener and DLCD submit it to the State Hazard Mitigation Officer at Oregon's Office of Emergency Management (OEM). OEM reviews the plan and submits it to the Federal Emergency Management Agency (FEMA) Region X for review. This review addresses the federal criteria outlined in FEMA Interim Final Rule 44 CFR Part 201.6.

Upon pre-approval by FEMA, indicated by a letter provided from FEMA to Malheur County called the "Approval Pending Adoption" (APA) the County will then adopt the NHMP via resolution. Following County adoption, the other participating jurisdictions – the Cities of Ontario, Nyssa, and Vale - will need to adopt it. Once FEMA is provided with final resolution documentation, they will formally approve the Malheur County multi-jurisdictional NHMP. At that point Malheur County will maintain their eligibility for the Hazard Mitigation Assistance (HMA) pre- and post- disaster funds. These funds are distributed through the Pre-Disaster Mitigation (PDM) program, the Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) program.

The accomplishment of the NHMP goals and actions depends upon regular Steering Committee participation and support from County and City leadership. Thorough familiarity with this NHMP will result in the efficient and effective implementation of mitigation actions and a reduction in the risk and the potential for loss from future natural hazard events.

Copies of the resolutions of approval from Malheur County and the Cities of Ontario, Nyssa, and Vale will be included in this NHMP once they are received. Copies of the FEMA APA and final approval letters will also be included in the *2019 Malheur County NHMP* when they are received.

Convener

The Malheur County Emergency Manager will take responsibility for plan implementation and will facilitate the Natural Hazards Mitigation Plan coordinating body meetings. The Emergency Manager will assign tasks as needed. Plan implementation and evaluation will be a shared responsibility among all of the coordinating body members. The convener's responsibilities include:

- Coordinate NHMP Steering Committee/ Emergency Management Team/ Local Emergency Preparedness meeting dates, times, locations, agendas, and member notification;
- Documenting the discussions and outcomes of committee meetings;
- Serving as a communication conduit between the steering committee and the public/stakeholders;
- Identifying emergency management-related funding sources for natural hazard mitigation projects; and
- Utilizing the Risk Assessment as a tool for prioritizing proposed natural hazard risk reduction projects.

Coordinating Body

The Malheur County NHMP convener is the Emergency Manager; this person will facilitate a Steering Committee for maintaining, updating, and implementing the NHMP. The coordinating body is composed of members of the NHMP Steering Committee, the Emergency Management Preparedness Team (EMT), and the Local Emergency Preparedness Committee (LEPC). The coordinating body responsibilities include:

- Attending future plan maintenance and plan update meetings (or designating a representative to serve in your place);
- Serving as the local evaluation committee for funding programs such as the Pre-Disaster Mitigation Grant Program (PDM), the Hazard Mitigation Grant Program (HMGP) funds, and Flood Mitigation Assistance (FMA) program funds;
- Prioritizing and recommending funding for natural hazard risk reduction projects;
- Evaluating and updating the Natural Hazards Mitigation Plan in accordance with the prescribed maintenance schedule;
- Developing and coordinating ad hoc and/or standing subcommittees as needed; and
- Coordinating public involvement activities.

Members

The NHMP update was developed by the Malheur County Natural Hazards Mitigation Plan Steering Committee which includes Malheur County, the Cities of Nyssa, Ontario and Vale, and many other organizations and agencies. A roster of the Steering Committee is included in the Acknowledgements section of this NHMP. The Malheur County Steering Committee also serves as the Emergency Management Team (EMT) and the Local Emergency Planning Committee (LEPC); there are meetings each month for this triple duty high energy group.

As part of this NHMP process, the group has established LEPC bylaws and within the bylaws set the requirement that the NHMP will be reviewed and discussed twice per year as part of the meetings. This will help ensure that the NHMP is a living document that is used and stays connected to the plans, policies, and programs of the involved jurisdictions and other Steering Committee members. In addition, the EMPG grant requires review of the NHMP twice per year.

To make the coordination and review of the *2019 Malheur County NHMP* as broad and useful as possible, the Malheur County Emergency Manager will engage the stakeholders to implement the identified mitigation actions. Specific organizations have been identified as either internal or external partners for the mitigation actions listed for the *2019 Malheur County NHMP*; these are identified in Table 3-3 and described in the more detailed Mitigation Action Item Forms found in Appendix A.

Implementation through Existing Programs

The NHMP includes mitigation actions that, when implemented, will reduce loss from hazard events throughout Malheur County. Within the NHMP, FEMA requires the identification of existing plans, programs, and policies that might be used to implement these mitigation actions.

Malheur County and the participating Cities currently address Oregon's Statewide Planning Goals and legislative requirements through their comprehensive land use plans, capital improvement plans, mandated standards, and building codes. Malheur County and participating Cities will incorporate the mitigation actions from this NHMP into existing programs, procedures, plans, and policies. Plans, programs, procedures, and policies already in existence often have support from local residents, businesses, and policy-makers. Many land use, comprehensive, and strategic plans are updated regularly, and can adapt easily to changing conditions and needs. Implementing the mitigation actions from the NHMP through such plans and policies increases their likelihood of being supported and implemented.

Examples of plans, programs or agencies that may be used to implement mitigation actions:

- City and County Budgets
- Community Wildfire Protection Plans
- Comprehensive Land Use Plans
- Economic Development Action Plans
- Zoning Ordinances & Building Codes
- Emergency Operations Plans and Continuity of Operations Plans (COOP)

The specific plans that presently exist relate to this NHMP and the FEMA requirement are listed in Table 4-1 and are the same plans listed in Table C-24 in Appendix C Community Profile. For additional examples of plans, programs, policies, procedures and agencies that may be used to implement mitigation actions, refer to the sections entitled "Government Structure" and "Existing Plans & Policies" in Appendix C Community Profile, the Mitigation Action Table 2019 NHMP, and the Appendix A Action Item Forms.

Table 4-1 Existing Plans

Jurisdiction	Document	Year
Malheur County	Community Wildfire Protection Plan	2009
Malheur County	Comprehensive	1982
Malheur County	Emergency Operations Plan	2017
Malheur County	Natural Hazards Mitigation Plan	2014

Jurisdiction	Document	Year
Malheur County	Transportation Systems Plan	1998
City of Ontario	Comprehensive Plan	1992
City of Ontario	Public Safety Master Plan	2002
City of Ontario	Stormwater Master Plan	2003
City of Ontario	Transportation Systems Plan	2006
City of Nyssa	Comprehensive Plan	1982
City of Nyssa	Development Code	2006
City of Nyssa	Main Street Revitalization Plan	1987
City of Nyssa	Transportation System Plan	1998
City of Nyssa	Snow Removal Plan	2018
City of Nyssa	Flood Control Ordinance	1962
City of Nyssa	Water Management and Conservation Plan	2009
City of Nyssa	Water System Master Plan	2010
City of Vale	Comprehensive Plan	2003
City of Vale	Development Code	2003
City of Vale	Downtown Plan	2001
City of Vale	Transportation System Plan	1998
City of Vale	Snow Removal Plan	2003
City of Vale	Water Management and Conservation Plan	2015
Natural Resource Conservation Service	Natural Resources Long Range Strategy in Malheur County, Oregon	2010
Greater Eastern Oregon Development Corporation	Comprehensive Economic Development Strategy	2014
City of Adrian	Comprehensive Plan	1978
City of Adrian	Transportation Systems Plan	2001
City of Jordan Valley	Comprehensive Plan	1981
City of Jordan Valley	Zoning Ordinance	1981
City of Jordan Valley	Flood Damage Prevention Ordinance	1980

Source: 2014 Malheur County NHMP; City of Ontario, http://www.ontariooregon.org/CityServices.cfm; City of Nyssa, https://www.nyssacity.org/; City of Vale, https://www.cityofvale.com/, accessed March 13, 2019.

Plan Maintenance

Plan maintenance is a critical component of the NHMP. Proper maintenance ensures that this plan will maximize Malheur County and participating City's efforts to reduce the risks posed by natural hazards. The coordinating body and local staff are responsible for implementing this process, in addition to maintaining and updating the plan through a series of meetings outlined in the maintenance schedule below.

Meetings

The coordinating body is composed of members of the NHMP Steering Committee which is also the Emergency Management Preparedness Team (EMT) and the Local Emergency Preparedness Committee (LEPC). The coordinating body will meet twice per year to complete the following tasks.

During the first meeting, the NHMP Steering Committee/EMT/LEPC will:

- Review existing action items to determine appropriateness for funding;
- Educate and train new members on the plan and mitigation in general;
- Identify issues that may not have been identified when the plan was developed; and
- Prioritize potential mitigation projects using the methodology described below.

During the second meeting the NHMP Steering Committee/EMT/LEPC will:

- Review status and progress of the mitigation actions;
- Document the status of the mitigation actions;
- Review existing and new risk assessment data;
- Discuss already held and upcoming continued public involvement events; and
- Document successes and lessons learned during the year.

These meetings are an opportunity for each jurisdiction and organization to report back to Malheur County and the NHMP Steering Committee/EMT/LEPC on progress that has been made towards their components and mitigation actions of the NHMP.

The convener is the Malheur County Emergency Manager and he/she will be responsible for documenting the outcome of the semi-annual meetings. The process the coordinating body, which is the NHMP Steering Committee/EMT/LEPC, will use to prioritize mitigation projects is described in Section 3 Mitigation Strategy and briefly below in the "Project Prioritization Process" section.

The NHMP format allows Malheur County and participating jurisdictions and organizations to review and update sections when new data becomes available. New data can be easily incorporated, and discussed with the Steering Committee, resulting in a NHMP that remains current and relevant to the participating jurisdictions and organizations. The regularly scheduled monthly meetings of the NHMP Steering Committee/EMT/LEPC provide an excellent forum for discussions such as those on the status of mitigation actions, new data, and opportunities for funding.

Project Prioritization Process

The Disaster Mitigation Act of 2000 requires that jurisdictions identify a process for prioritizing potential mitigation actions. Potential mitigation actions often come from a variety of sources; therefore the project prioritization process needs to be flexible and shaped to the community's needs. Projects may be identified by Steering Committee members, local government staff, other planning documents, or the risk assessment.

In brief, the selected prioritization format used in the Malheur County NHMP is that the risk level rankings from the Hazard Vulnerability Assessment will be used. All the multi-hazard mitigation actions are a high priority. The hazard-specific mitigation actions that are a high priority are the drought and severe weather mitigation actions. See Table 3-3 Mitigation Action Table 2019 NHMP.

Resource availability, including such factors as staff time and funding, are part of the categorization of whether the action is short- or long-term.

- *Short-term actions* are activities that may be implement with existing resources and authorities in one to two years.
- *Long-term actions* are those that may require new or additional resources and/or authorities.
- *Ongoing activities* are those that are currently in process and will continue to be implemented during the next planning period.

Below, the project prioritization process that was written by the Oregon Partnership for Disaster Resilience (OPDR) and included in the *2014 Malheur County NHMP*. The process includes four steps and is a more general description of the process. It has been slightly modified for inclusion in this *2019 Malheur County NHMP*. It is not the process that Malheur County used to establish priorities for the mitigation actions. In Appendix D Economic Analysis of Natural Hazard Mitigation Projects, there is a detailed description of the three potential approaches of economic analysis that a jurisdiction could take to prioritize the mitigation actions: benefit/cost analysis, cost-effectiveness analysis, and the STAPLE/E approach.

Four General Steps for Project Prioritization

Step 1: Examine funding requirements

The first step in prioritizing the plan's mitigation actions is to determine which funding sources are open for application. Several funding sources may be appropriate for a county's proposed mitigation projects. Examples of mitigation funding sources include but are not limited to: FEMA's Pre-Disaster Mitigation program (PDM), Flood Mitigation Assistance (FMA) program, Hazard Mitigation Grant Program (HMGP), National Fire Plan (NFP), Community Development Block Grants (CDBG), local general funds, and private foundations, among others. Please see Appendix E Grant Programs and Resources for a more comprehensive list of potential grant programs.

Because grant programs open and close on differing schedules, the coordinating body will examine upcoming funding streams' requirements to determine which mitigation activities would be eligible. The coordinating body may consult with the funding entity, Oregon's Office of Emergency Management (OEM), or other appropriate state or regional organizations about project eligibility requirements. This examination of funding sources and requirements will happen during the coordinating body's twice yearly maintenance meetings.

Step 2: Complete risk assessment evaluation

The second step in prioritizing the plan's mitigation actions is to examine which hazards the selected actions are associated with and where these hazards rank in terms of community risk. The coordinating body will determine whether or not the plan's risk assessment supports the implementation of eligible mitigation activities. This determination will be based on the location of the potential activities, their proximity to known hazard areas, and whether community assets are at risk. The coordinating body will additionally consider whether the selected actions mitigate hazards that are likely to occur in the future, or are likely to result in severe / catastrophic damages.

Step 3: Committee Recommendation

Based on the steps above, the coordinating body will recommend which mitigation actions should be moved forward. If the coordinating body decides to move forward with an action, the coordinating organization designated on the mitigation action item form will be responsible for taking further action and documenting success upon project completion. The coordinating body will convene a meeting to review the issues surrounding grant applications and to share knowledge and/or resources. This process will afford greater coordination and less competition for limited funds.

Step 4: Complete quantitative and qualitative assessment, and economic analysis

The fourth step is to identify the costs and benefits associated with the selected natural hazard mitigation actions which may include measures or projects. This is discussed in more detail for three potential approaches to economic analysis- benefit/cost analysis, cost-effectiveness analysis, and the STAPLE/E approach - in Appendix Economic Analysis of Natural Hazard Mitigation Projects.

The recommended approaches are benefit/cost for structural projects and either cost-effectiveness or STAPLE/E for the non-structural projects.

If the activity requires federal funding for a structural project, the Committee will use a FEMA-approved cost-benefit analysis tool to evaluate the appropriateness of the activity. A project must have a benefit/cost ratio of greater than one in order to be eligible for FEMA grant funding.

For non-federally funded or nonstructural projects, a qualitative assessment will be completed to determine the project's cost effectiveness. The committee could use a multivariable assessment technique called STAPLE/E to prioritize these actions. STAPLE/E stands for Social, Technical, Administrative, Political, Legal, Economic, and Environmental. Assessing projects based upon these seven variables can help define a project's qualitative cost effectiveness. ODPR has tailored the STAPLE/E technique for use in natural hazard mitigation action prioritization.

Appendix D includes a diagram, Economic Analysis Flowchart, to illustrate the process.

Continued Public Involvement & Participation

The participating jurisdictions are dedicated to involving the public directly in the continual reshaping and updating of the Malheur County NHMP. In addition to the members of the Coordinating Body, also known as the NHMP Steering Committee/ EMT/LEPC, the public will also have the opportunity to continue to provide feedback about the NHMP.

To ensure that these opportunities will continue, the County and the Cities of Ontario, Nyssa, and Vale will:

- Post copies of their plans on corresponding websites;

- Place articles in the local newspaper directing the public where to view and provide feedback; and
- Use existing newsletters such as schools and utility bills to inform the public where to view and provide feedback.

The *2019 Malheur County NHMP* is on the County's website at: http://www.malheurco.org/.

The NHMP will also be archived and posted on the University of Oregon Libraries' Scholar's Bank Digital Archive at https://scholarsbank.uoregon.edu and on the Oregon Department of Land Conservation and Development's website at https://www.oregon.gov/lcd/Pages/index.aspx.

Five-Year Review of Plan

This plan will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. **With FEMA approval granted in 2019, the Malheur County NHMP would be due to be updated in 2024.** The convener, who is the Malheur County Emergency Manager, will be responsible for organizing the coordinating body, which is the NHMP Steering Committee/ EMT/LEPC, to address plan update needs. The coordinating body will be responsible for updating any deficiencies found in the plan, and for ultimately meeting the Disaster Mitigation Act of 2000's plan update requirements.

The following 'toolkit' can assist the convener in determining which plan update activities can be discussed during regularly-scheduled plan maintenance meetings, and which activities require additional meeting time and/or the formation of sub-committees.

Table 4-1 Natural Hazards Mitigation Plan Update Toolkit

Question	Yes	No	Plan Update Action
Is the planning process description still relevant?			Modify this section to include a description of the plan update process. Document how the planning team reviewed and analyzed each section of the plan, and whether each section was revised as part of the update process. (This toolkit will help you do that).
Do you have a public involvement strategy for the plan update process?			Decide how the public will be involved in the plan update process. Allow the public an opportunity to comment on the plan process and prior to plan approval.
Have public involvement activities taken place since the plan was adopted?			Document activities in the "planning process" section of the plan update
Are there new hazards that should be addressed?			Add new hazards to the risk assessment section
Have there been hazard events in the community since the plan was adopted?			Document hazard history in the risk assessment section
Have new studies or previous events identified changes in any hazard's location or extent?			Document changes in location and extent in the risk assessment section
Has vulnerability to any hazard changed?			Document changes in vulnerability in the risk assessment section
Have development patterns changed? Is there more development in hazard prone areas?			Document changes in vulnerability in the risk assessment section
Do future annexations include hazard prone areas?			Document changes in vulnerability in the risk assessment section
Are there new high risk populations?			Document changes in vulnerability in the risk assessment section
Are there completed mitigation actions that have decreased overall vulnerability?			Document changes in vulnerability in the risk assessment section
Did the plan document and/or address National Flood Insurance Program repetitive flood loss properties?			Document any changes to flood loss property status
Did the plan identify the number and type of existing and future buildings, infrastructure, and critical facilities in hazards areas?			1) Update existing data in risk assessment section, or 2) determine whether adequate data exists. If so, add information to plan. If not, describe why this could not be done at the time of the plan update
Did the plan identify data limitations?			If yes, the plan update must address them: either state how deficiencies were overcome or why they couldn't be addressed
Did the plan identify potential dollar losses for vulnerable structures?			1) Update existing data in risk assessment section, or 2) determine whether adequate data exists. If so, add information to plan. If not, describe why this could not be done at the time of the plan update
Are the plan goals still relevant?			Document any updates in the plan goal section
What is the status of each mitigation action?			Document whether each action is completed or pending. For those that remain pending explain why. For completed actions, provide a 'success' story.
Are there new actions that should be added?			Add new actions to the plan. Make sure that the mitigation plan includes actions that reduce the effects of hazards on both new and existing buildings.
Is there an action dealing with continued compliance with the National Flood Insurance Program?			If not, add this action to meet minimum NFIP planning requirements
Are changes to the action item prioritization, implementation, and/or administration processes needed?			Document these changes in the plan implementation and maintenance section
Do you need to make any changes to the plan maintenance schedule?			Document these changes in the plan implementation and maintenance section
Is mitigation being implemented through existing planning mechanisms (such as comprehensive plans, or capital improvement plans)?			If the community has not made progress on process of implementing mitigation into existing mechanisms, further refine the process and document in the plan.

Source: *2014 Malheur County NHMP*, Oregon Partnership for Disaster Resilience, 2010.

Volume II: Hazard Annexes

Source: Range fire and snow removal at Aiken Elementary photos, Lt. Rich Harriman, Malheur County, personal communication, February 7, 2019

Introduction

Malheur County identifies eleven natural hazards that could have an impact on the County and the Cities, as described in Section 2 Risk Assessment and within these Hazard Annexes. Table HA-1 below is the same as Table 2-5; it summarizes the hazards and their risk scores and risk level.

Each hazard has a Hazard Annex. Note that the Severe Weather is listed as a separate hazard, but in the description of that hazard in these Hazard Annexes it includes dust storms, tornadoes, extreme temperatures, wind storms, rain storms, and winter storms. As determined by the Steering Committee, severe weather, wind, winter, and dust storms as well as extreme temperature have separately listed risk scores and risk levels. Rain was not scored separately.

The natural hazard identification and risk levels were assessed and ascertained by the Steering Committee; they play into the establishment and prioritization of mitigation actions. It is useful to keep in mind that knowing your hazards is the key to reducing the risk. Without knowing them, the ability to reduce risk is lessoned and appropriate mitigation actions are difficult to establish. Mitigation actions for Malheur County and the Cities are in Section 3 Mitigation Strategy, Table 3.3.

Table HA-1 Natural Hazards, Risk Scores, and Risk Levels

HAZARD	RISK SCORE	RISK LEVEL (H-M-L)
Droughts	240	High
Winter Storms	226	High
Wind Storms	195	High-Medium
Floods	188	High-Medium
Wildfire	175	High-Medium
Severe Weather	165	High-Medium
Extreme Temperature	126	Medium
Volcanic Events	124	Medium
Dust Storms	116	Medium
Earthquakes	64	Low
Landslides	60	Low

Source: Malheur County (includes Nyssa, Vale and Ontario) NHMP Steering Committee, April 12, 2018.

These Hazard Annexes describe the characteristics, location, extent, history, and probability for each hazard addressed in the Malheur County NHMP. Probability and vulnerability are described and uses the OEM Methodology; see the full description of the OEM Methodology in Volume I, Section 2 Risk Assessment. The Risk Assessment and these Hazard Annexes comprise and provide a risk analysis and vulnerability assessment for the natural hazards identified by Malheur County. Additional information pertaining to the types and characteristics of each natural hazard is available in the appendices of this NHMP and in the *2015 Oregon Natural Hazards Mitigation Plan,* Region 8 Southeast Risk Assessment.

Notable changes from the *2014 Malheur County NHMP* to the *2019 Malheur County NHMP* for the Risk Assessment (see Volume I Section 2) and these Hazards Annexes include:

- The Hazard Annexes were significantly altered for clarity. Hazard identification, characteristics, history, probability, vulnerability, and hazard specific mitigation activities were updated. Extraneous information was removed and links to technical reports, studies, and data were added.
- Hazard Annexes include information for Malheur County and the Cities of Ontario, Nyssa, and Vale (previously the Cities were in separate addenda).
- All hazard subsections have been reformatted to emphasize characteristics, location and extent, history, probability, and vulnerability.
- The addition of new hazard history events in all hazards.
- The addition of more extensive climate change information.
- Maps depicting hazard location and local vulnerability were added.
- Previously included statistics and information were updated with the most current data.

Predicted Climate Variability

Temperatures increased across the Pacific Northwest by 1.3˚F in the period 1895–2011 (the observed record). In that same timeframe, Cascade Mountain snowpacks have declined, and higher temperatures are causing earlier spring snowmelt and spring peak streamflows. In Oregon's forested areas, large areas have been impacted by disturbances that include wildfire in recent years, and climate change is probably one major factor.

The state climate change information in the *2015 Oregon NHMP* indicates that hazards projected to be impacted by climate change in Malheur County include drought and wildfire. Climate models project warmer drier summers and a decline in mean summer precipitation for Oregon. Winter storms and wind storms also affect Malheur County. There is an increasing amount of research on how climate change influences these and other hazards in the Pacific Northwest.

As part of the PDM 16 grants, the Department of Land Conservation and Development (DLCD) contracted with the Oregon Climate Change Research Institute (OCCRI) to provide an analysis of climate change influences on natural hazards. The collaboration resulted in products which provide information regarding the influence and impacts of climate change on existing natural hazards events such as heavy rains, river flooding, droughts, heat waves, cold waves, wildfire, and air quality.

The products include:

- *Future Climate Projections: Malheur County (see Appendix F);*
- *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports (see Appendix F);*
- *Climate Change One-Pager;* and
- *Future Climate Change Projections to Support County Natural hazard Mitigation Planning in Oregon* (webinar).

All are available on the DLCD website: https://www.oregon.gov/lcd/CL/Pages/Climate-Change-Resources.aspx.

The basis of the research prepared by OCCRI uses future climate projections that are derived from 10–20 global climate models and have been "downscaled"—made locally relevant. Several climate metrics that relate to natural hazards are being calculated for historical and mid-21st century periods under two future emissions scenarios that result in varying future temperature increases for the State of Oregon.

Each county report describes county-specific projected changes in climate metrics related to the selected natural hazards. The reports present future climate projections for the 2020s (2010-2039 average) and the 2050s (2040-2069 average) compared to the 1971-2000 average historical baseline. Each hazard in the report has a box highlighting “key messages” that call out the main points of the research and analysis for that hazard.

Table HA-2 provides an overview of expected climate change impacts for Malheur County. The table shows the direction of change (increasing, decreasing, unchanging) and indicates the level of confidence in direction of change (high, medium, low).

According to the OCCRI reports:

- There is high confidence that heat waves will increase and that cold waves will decrease.
- There is medium confidence that heavy rains, river flooding, wildfire, droughts, prevalence of invasive species, and loss of wetland ecosystems will increase.
- There is low confidence that dust storms will decrease and poor air quality will increase.

The overview describes results for the natural hazards using climate metrics in summary and as a comparison. For more information see the OCCRI reports in Appendix F. Of note, the climate metrics used by OCCRI do not exactly match the natural hazards identified by Malheur County.

Table HA–2 Overview of Expected Climate Change Impacts for Malheur County

Heat Waves	↑↑	Heavy Rains	↑↑	Poor Air Quality	↑↑
Cold Waves	↓↓	River Flooding	↑↑	Dust Storms	↓↓
		Wildfire	↑↑	Wind Storms	==
		Droughts	↑↑		
		Increased Invasive Species	↑↑		
		Loss of Wetlands	↑↑		
Level of Confidence in Direction of Change			Expected Direction of Change		
	High Confidence		Risk Increasing		↑↑
	Medium Confidence		Risk Decreasing		↓↓
	Low Confidence		Risk Unchanging		=

Source: OCCRI, Climate Change Influence on Natural Hazards in Eight Oregon Counties, August 2018.

Risk Score: 240 Risk Level: High

DROUGHT HAZARD ANNEX

Causes and Characteristics of Drought

A drought is a period of drier than normal conditions that results in water-related problems.[1] In the most general sense, drought is defined as a deficiency of precipitation over an extended period of time (usually a season or more), resulting in a water shortage. The effects of this deficiency are often called drought impacts. Natural impacts of drought can be made worse by the demand that humans place on a water supply.[2] Drought is a temporary condition – it is seen in an interval of time, generally months or years, when moisture is consistently below normal.[3] It differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate. [4]

The National Drought Mitigation Center (NDMC) categorizes drought into types: meteorological, agricultural, hydrological, socioeconomic, and ecological. The descriptions included below are largely excerpted from the definitions on the NDMC's website.[5] Oregon's *Emergency Operations Plan* includes the *Incident Annex for Drought*; all the drought types except ecological are described in that document. The *2015 Oregon Natural Hazards Mitigation Plan* (*2015 Oregon NHMP*) also includes all the drought types except ecological.

Meteorological Droughts

Meteorological droughts are defined in terms of the departure from a normal precipitation pattern and the duration of the event. These are region specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region. This drought type may relate specific precipitation departures to average amounts on a monthly, seasonal, or yearly basis.

Agricultural Droughts

Agricultural drought links various characteristics of meteorological or hydrological drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, and reduced groundwater or reservoir levels. Plant water demand depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil. A good definition of

---

[1] Moreland, A. USGS, *Drought. Open File Report 93-642*, 1993, https://pubs.er.usgs.gov/publication/ofr93642.

[2] National Drought Mitigation Center, *Drought Basics.* https://drought.unl.edu/Education/DroughtBasics.aspx, accessed January 24, 2019.

[3] *2014 Malheur County NHMP.* https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf

[4] National Drought Mitigation Center, *Types of Drought,* https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx, accessed January 24, 2019.

[5] Ibid.

agricultural drought accounts for the variable susceptibility of crops during different stages of crop development, from emergence to maturity.

Hydrological Droughts

Hydrological droughts refer to deficiencies in surface water and sub-surface water supplies. It is measured as stream flow, and as lake, reservoir, and ground water levels. When precipitation is reduced or deficient over an extended period of time, the shortage will be reflected in declining surface and sub-surface water levels. Hydrological droughts are usually out of phase with the occurrence of meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, streamflow, and groundwater and reservoir levels. As a result, these impacts are out of phase with impacts in other economic sectors. Also, water in hydrologic storage systems (e.g., reservoirs, rivers) is often used for multiple and competing purposes (e.g., flood control, irrigation, recreation, navigation, hydropower, and wildlife habitat), further complicating the sequence and quantification of impacts. Competition for water in these storage systems escalates during drought and conflicts between water users increase significantly.

Socioeconomic Droughts

Socioeconomic definitions of drought associate the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought. It differs from the aforementioned types of drought because its occurrence depends on the time and space processes of supply and demand to identify or classify droughts. The supply of many economic goods, such as water, forage, food grains, fish, and hydroelectric power, depends on weather. Because of the natural variability of climate, water supply is ample in some years but unable to meet human and environmental needs in other years. Socioeconomic drought occurs when the demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply.

In most instances, the demand for economic goods is increasing as a result of increasing population and per capita consumption. Supply may also increase because of improved production efficiency, technology, or the construction of reservoirs that increase surface water storage capacity. If both supply and demand are increasing, the critical factor is the relative rate of change. Is demand increasing more rapidly than supply? If so, vulnerability and the incidence of drought may increase in the future as supply and demand trends converge.

Ecological Droughts

A more recent effort focuses on ecological drought, defined as "a prolonged and widespread deficit in naturally available water supplies — including changes in natural and managed hydrology — that create multiple stresses across ecosystems."

Oregon’s Drought Planning and Monitoring

The State of Oregon’s *Emergency Operations Plan* (EOP), dated April 2017, includes an *Incident Annex for Drought*, dated January 2016. The drought types included there are meteorological, agricultural, hydrological, and socioeconomic. The *Incident Annex for Drought* describes the way a drought is determined in Oregon. A brief description is included here.

"To trigger specific actions from the Water Resources Commission and the Governor, a "severe and continuing drought" must exist or be likely to exist. Oregon relies upon two inter-agency groups to evaluate water supply conditions, and to help assess and communicate potential drought-related impacts. The Water Supply Availability Committee (WSAC) is a technical committee chaired by the Water Resources Department. The other group—the Drought Readiness Council—is a coordinating body of state agencies co-chaired by the Water Resources Department and the Office of Emergency Management."[6]

The WSAC utilizes the Surface Water Supply Index (SWSI)[7]. The SWSI is an index of current water conditions throughout the state. The index utilizes parameters derived from snow, precipitation, reservoir and streamflow data. The data is gathered each month from key stations in each basin. The lowest SWSI value, -4.1, indicates extreme drought conditions. The highest SWSI value, +4.1, indicates extreme wet conditions. The mid-point is 0.0, which indicates a normal water supply.[8] Additional information can be found on the Natural Resource Conservation Service's website; https://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/snow/waterproducts/?cid=stelprdb1244919.

The following are indicators used by the WSAC for evaluating drought conditions:

- Snowpack
- Precipitation
- Temperature anomalies
- Long range temperature outlook
- Long range precipitation outlook
- Current stream flows and behavior
- Spring and summer streamflow forecasts
- Ocean surface temperature anomalies (El Nino, La Nina)
- Storage in key reservoirs
- Soil and fuel moisture conditions
- NRCS Surface Water Supply Index.[9]

In the *2015 Oregon Natural Hazards Mitigation Plan* (*2015 Oregon NHMP*), it states "Oregon has not undertaken a comprehensive statewide analysis to identify which communities are most vulnerable to drought. However, based on a review of drought declarations issued by the Governor, Malheur County could be considered one of the communities most vulnerable to drought and its related impacts."[10] Since 1992, Malheur County has been under an emergency drought declaration on ten occasions: 1992, 1994, 2002, 2003, 2004, 2007, 2013, 2014, 2015, and 2018.

---

[6] State of Oregon, *Emergency Operations Plan*, *Incident Annex for Drought*, April 2016, https://www.oregon.gov/oem/Documents/2015_OR_EOP_IA_01_drought.pdf.

[7] *2014 Malheur County NHMP,* https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf

[8] Barry Norris, Administrator, Technical Services Division, Water Resources Department, Planning for Drought, 2001.

[9] State of Oregon, *Emergency Operations Plan*, *Incident Annex for Drought*, April 2016, https://www.oregon.gov/oem/Documents/2015_OR_EOP_IA_01_drought.pdf.

[10] DLCD, *2015 Oregon Natural Hazards Mitigation Plan*, https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP.pdf

Ranching, farming, and other agricultural activities greatly contribute to the economy of Malheur County. "Malheur County ranks fourth in the state for agricultural sales, with $373 million in gross farm and ranch sales in 2012. Drought can have a significant impact on the agricultural community and associated businesses that rely on this industry."[11] Besides the economy, the *2015 Oregon NHMP* also describes impacts of droughts on the environment, population, infrastructure, critical/essential facilities, and state-owned and operated facilities.

See the History of Drought in Malheur County and Table DR-1 Significant Historic Drought Events for more details.

History of Drought in Malheur County and Oregon

Quantifying drought requires an objective criterion for defining the beginning and end of a drought period. The Palmer Drought Severity Index is most effective in determining long-term drought — e.g. several months — and is not as good with short-term forecasts, e.g. a matter of weeks.

As described in the *2015 Oregon NHMP*, "Most federal agencies use the Palmer Method which incorporates precipitation, runoff, evaporation, and soil moisture. However, the Palmer Method does not incorporate snowpack as a variable. Therefore, it is does not provide a very accurate indication of drought conditions in Oregon and the Pacific Northwest, although it can be very useful because of its long-term historical record of wet and dry conditions."[12]

The Palmer Method or Palmer Drought Severity Index (PDSI) indicates the prolonged and abnormal moisture deficiency or excess. It indicates general conditions and not local conditions caused by isolated rain. The PSDI is an important climatological tool for evaluating the scope, severity, and frequency of prolonged period of abnormally dry or wet weather. It can be used to delineate disaster areas and indicate the availability of irrigation water supplies, reservoir levels, range conditions, amount of stock water, and potential intensity of forest fires.[13]

The PDSI uses readily available temperature and precipitation data to estimate relative dryness. It is a standardized index that spans -10 (dry) to +10 (wet). As it uses temperature data and a physical water balance model, it can capture the basic effect of global warming on drought through changes in potential evapotranspiration. Monthly PDSI values do not capture droughts on time scales less than about 12 months;[14] The PDSI uses a zero (0) as normal, and drought is shown in terms of negative numbers; for example, negative two (-2.00) is moderate drought, negative three (-3.00) is severe drought, and negative four (-4.00) is extreme drought.[15] See Figure DR-1.

---

[11] DLCD, *2015 Oregon Natural Hazards Mitigation Plan*, https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP.pdf

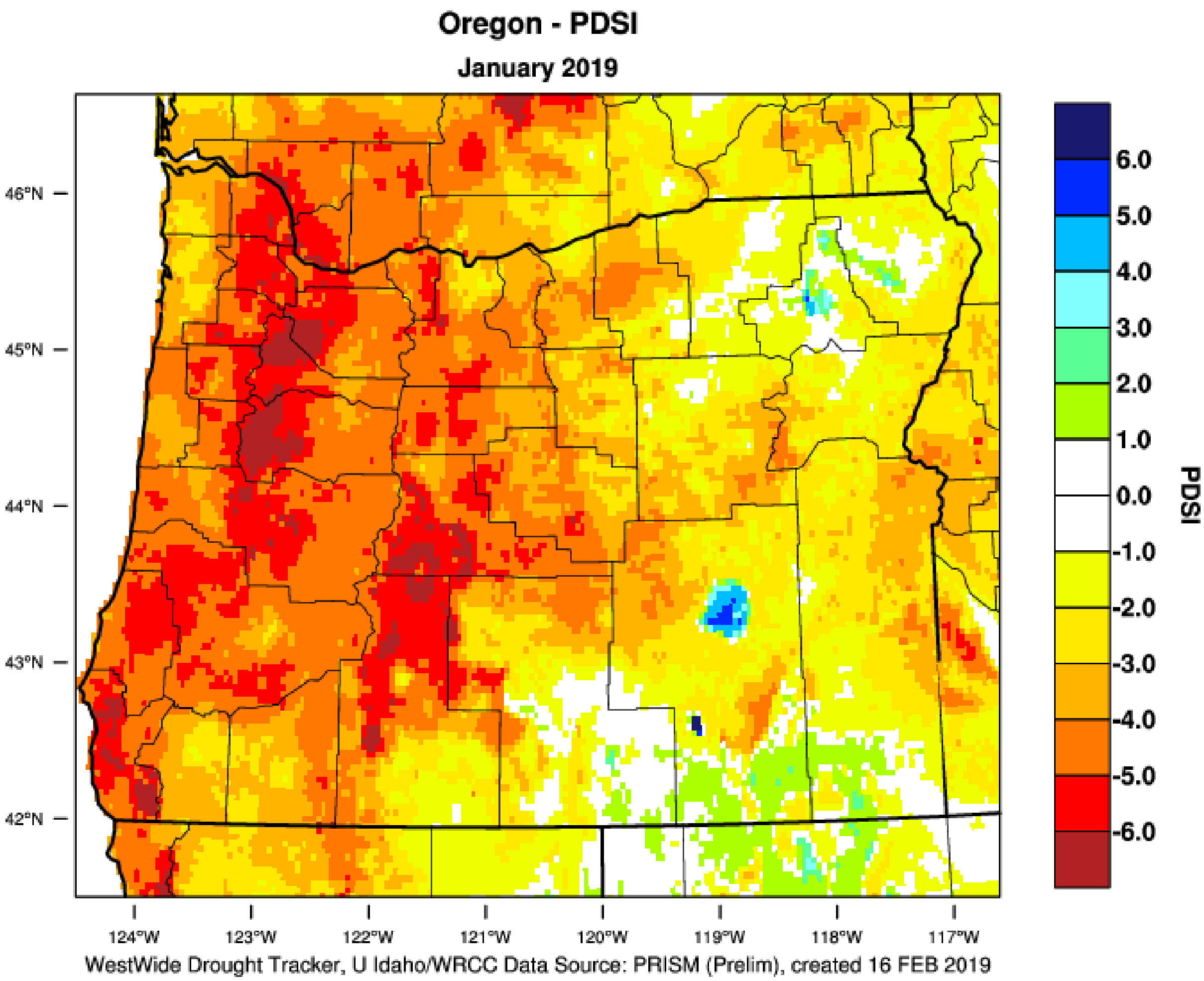
[12] Ibid.

[13] Oregon Drought Conditions Map – May 13, 2017, https://www.plantmaps.com/interactive-oregon-drought-conditions-map.php

[14] National Center for Atmospheric Research, *The Climate Data Guide: Palmer Drought Severity Index (PDSI),* https://climatedataguide.ucar.edu/climate-data/palmer-drought-severity-index-pdsi

[15] *2014 Malheur County NHMP,* https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf.

Figure DR-1 Oregon Counties Palmer Drought Severity Index Map for January 2019



Source: West Wide Drought Tracker, Oregon – PDSI, https://wrcc.dri.edu/wwdt/index.php?region=or

Some Oregon droughts were especially significant during the period of 1928 to 1994. The period from 1928 to 1941 was a prolonged drought that caused major problems for agriculture. The only area spared was the northern coast, which received abundant rains in 1930-33. The three Tillamook burns (1933, 1939, and 1945) were the most significant results of this very dry period.[16]

During 1959-1962 stream flows were low throughout Eastern Oregon, but areas west of the Cascades had few problems. The driest period in Western Oregon was the summer following the benchmark 1964 flood. Low stream flows prevailed in Western Oregon during the period from 1976-81, but the worst year, by far, was 1976-77, the single driest year of the century. The Portland airport received only 7.19 inches of precipitation between Oct. 1976 and Feb. 1977, only 31% of the average 23.16 inches for that period. The 1985-94 drought was not as severe as the 1976-77 drought in any single year, but the cumulative effect of ten consecutive years with mostly dry conditions caused statewide problems. The peak year of the drought was 1992, when a drought

[16] *2014 Malheur County NHMP*, https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf.

emergency was declared for all of Oregon. Forests throughout the state suffered from a lack of moisture. Fires were common and insect pests, which attacked the trees, flourished.[17]In 2001 and 2002 Oregon experienced drought conditions. These conditions were compounded by actions taken by the federal government in the Klamath Basin.

During the 2005 drought the Governor issued declarations for eight counties, all east of the Cascades, and the USDA issued three drought declarations, overlapping two of the Governor's. State declarations were made for Baker, Crook, Gilliam, Hood River, Klamath, Morrow, Sherman, and Umatilla counties. Federal declarations were made in Coos, Klamath, and Umatilla counties. Wheeler County made a county declaration. The USDA declarations provided access to emergency loans for crop losses.[18]

State declaration of drought conditions were made in several counties, including Malheur, throughout Oregon during 1988, 1991-1995, 1999, 2001, 2002-2005, 2007, 2013, 2014, 2015, and 2018.

Table DR-1 Significant Historic Drought Events

Date	Location	Description
1094-05	Statewide	Drought period of about 18 months.
1917-31	Statewide	Very dry period punctuated by brief wet spells (1920, 1927). The 1920s and 30s were commonly known as the Dust Bowl.
1939-41	Statewide	Three-year intense drought.
1959-1964	Eastern Oregon	Stream flows were low throughout eastern Oregon.
1965-68	Statewide	Three-year drought following the big regional floods of 1964-65.
1976-77	Statewide	EM-3039. Oregon Drought. Declared April 29, 1977. Brief very intense statewide drought. There were significant impacts to agriculture. Affected Lake County.
1988	Regions 7 and 8	Extreme drought for Malheur County.
1991	Statewide	Governor declared drought in 10 counties via several Executive Orders, including Harney (Executive Order 91-06).
1992	Statewide	Governor declared drought (Executive Order 92-21) in many counties, including Harney, Lake and Malheur, for the period of September through October.
1993	Lake County	Disaster loans made available for drought in Lake County.
1985-94	Statewide	Generally dry period, capped by statewide droughts in 1992 and 1994. In 1994, the Governor declared drought in 11 counties within regions 4, 5, 6, 7, and 8.
2001-2003	Statewide	Governor declared drought (Executive Order 01-12) from May 2001 through June 2003 (additional Executive Orders such as 01-05, 02-21, 04-03 and 03-05) in 18 counties including: Malheur, Harney, Lake, Hood River, Wasco, Sherman, and Gilliam.
2004	Eastern Oregon	Governor declared drought (Executive Orders) for Morrow, Baker, Klamath, and Malheur Counties.
2005	Several counties	Governor declared drought (Executive Orders) for Baker, Crook, Deschutes, Gilliam, Hood River, Klamath, Lake, Morrow, Sherman, Umatilla, Wallowa, Wasco, and Wheeler Counties. Stream and river levels were low. Malheur County did not have a drought declaration in 2005.
2007	Several counties	Governor declared drought for Harney (Executive Order 07-10), Malheur (Executive Order 07-11), and Lake (07-16) County and three other counties (other Executive Orders).

[17] Ibid.

[18] Ibid.

Date	Location	Description
2010	Region 6	Governor declared drought (Executive Order 10-03) for Klamath County and contiguous counties.
2012	Region 6	Governor declared drought (Executive Order 12-15) for Lake and Klamath Counties, specific to the Lost River Basin. Malheur County was included in the Federal Secretary of Agriculture Drought Declaration.
2013	Eastern Oregon	Five counties affected by drought declarations (Executive Orders 13-05, 13-06, 13-09): Gilliam, Morrow, Klamath, Baker, and Malheur.
2014	Regions 4, 6-8	Governor declared drought in 10 counties (via several Executive Orders). This was the third driest Nov.-Jan. period since 1895. State drought declarations: Baker, Crook, Grant, Harney, Jackson, Josephine, Klamath, Lake, Malheur and Wheeler counties. USDA drought disaster declarations: Baker, Benton, Coos, Crook, Curry, Deschutes, Douglas, Grant, Harney, Jackson, Jefferson, Josephine, Klamath, Lake (Ex Order 14-01), Lane, Lincoln, Linn, Malheur (Ex Order 14-01), Morrow, Umatilla, Union, Wallowa and Wheeler counties.
2015	Statewide	Governor declared drought for Harney County (Executive Order 15-03), Lake and Malheur Counties (Executive Order 15-02), and others (via other Executive Orders) in 2015.
2018	Malheur County	Governor declared drought in Malheur County (Executive Order 18-26).

Sources: University of Oregon, Malheur County NHMP, May 2014; DLCD, Oregon NHMP, 2015; FEMA, Disaster Declarations for Oregon, retrieved 2017. The Oregonian, http://www.oregonlive.com/weather/index.ssf/2014/09/oregon_drought_not_much_relief.html; Oregon Water Resources Department Public Declaration Report http://apps.wrd.state.or.us/apps/wr/wr_drought/declaration_status_report.aspx, Haberman, Margaret (September 15, 2014). The Oregonian. http://www.oregonlive.com/weather/index.ssf/2014/09/oregon_drought_not_much_relief.html; Taylor and Hatton, 1999.

Risk Assessment

How are Hazards Identified?

The extent of the drought depends upon the degree of moisture deficiency, and the duration and size of the affected area. Typically, and as indicated in the History of Malheur County and Oregon, droughts occur as regional events and often affect more than one city and county. In severe droughts, environmental, infrastructure, critical/essential facilities, state-owned and operated facilities, population, and economic consequences can be significant.

Hazard Risk Analysis

The Malheur County NHMP Steering Committee completed a Hazard Vulnerability Assessment/Analysis (HVA) during this NHMP update. It occurred on April 18, 2018. This was described in Section 2 Risk Assessment. The method used for the HVA was developed from a Federal Emergency Management Agency (FEMA) tool that has been refined by the Oregon Office of Emergency Management (OEM). It addresses and weights (shown as percent within parentheses) probability (29%), vulnerability (21%), maximum threat (42%) and the history (8%) of each natural hazard and attributes a final hazard analysis score. The methodology produces scores that range from 24 to 240.

For local governments, conducting the HVA is a useful step in planning for hazard mitigation. The method provides the jurisdiction with a relative ranking from which to prioritize mitigation actions, but does not predict the occurrence of a particular hazard.

In 2013 drought hazards had a risk score of 190 and a rank of 3 out of 11 natural hazards. In 2018 drought hazards had a risk score of 240 and a rank of 1 out of 11 natural hazards. In the methodology used to determine the risk score, there are 240 points possible. So drought scored every point available, in the Malheur County NHMP Steering Committee's evaluation.

For more information on all the risk scores and ranks of the natural hazards, see Volume I Basic Plan, Section 2 Risk Assessment of this NHMP.

Probability Assessment

Oregon's drought history reveals many short-term and a few long-term events. The average recurrence interval for severe droughts in Oregon is somewhere between 8-12 years.[19] According to the Probability section for drought that is within the *2015 Oregon NHMP*, "Drought is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. It is a temporary condition and differs from aridity because the latter is restricted to low rainfall regions and is a permanent feature of climate. It is rare for drought not to occur somewhere in North America each year. Despite impressive achievements in the science of climatology, estimating drought probability and frequency continues to be difficult. This is because of the many variables that contribute to weather behavior, climate change, and the absence of historic information."[20]

Vulnerability Assessment

Droughts have effects on lake and river levels, which harms wildlife, farmers and ranchers. Its effect on forest is less obvious and can have a tremendous impact. For example, during extended periods of drought trees are weakened by water shortages and tree pests proliferate. Wildfires also often coincide with droughts. The severity of a drought occurrence poses a risk for agricultural and timber losses, property damage, and disruption of water supplies and availability in urban and rural areas. Factors used to assess drought risk include agricultural practices, such as crop types and varieties grown, soil types, topography, and water storage capacity (e.g. behind dams and in reservoirs).[21]

In droughts, environmental, infrastructure, critical/essential facilities, state-owned and operated facilities, population, and economic consequences can be significant. Dams and reservoirs are considered critical/essential facilities; these are discussed in the Flood Hazard Annex of this NHMP.

Community Hazard Issues

What is susceptible to damage during a hazard event?

Given the breadth of impacts identified in the Vulnerability Assessment as possibly resulting from drought, losses from a drought could be extensive and far-reaching. As described in Appendix F Future Climate Projections Reports, drought conditions represented by low spring snowpack are

[19] *2014 Malheur County NHMP*, https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf.

[20] DLCD, *2015 Oregon Natural Hazards Mitigation Plan*, https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP.pdf

[21]Water availability and precipitation are not always correlated; drought conditions affect regions differently than others due to available water supplies.

projected to become more frequent whereas drought conditions represented by low summer soil moisture and low summer runoff may become less frequent in Malheur County by the 2050s as compared to the historical baseline. Fiscal impacts to Malheur County were not available.

Drought is a normal, recurrent feature of climate, one experienced frequently in the arid high desert of southeastern Oregon. It is a temporary condition, but its effects can accumulate slowly and last from several months to several years, even well after the termination of the drought itself. Because of this characteristic of drought, it can be difficult to fully quantify the impact of drought upon communities. Additionally, estimating drought probability and frequency is difficult. Oregon lacks long historic databases for drought, many variables contribute to the weather behavior that causes drought, and different regions are affected to varying degrees of severity based on natural features and human infrastructure. Droughts can happen at any time of the year.

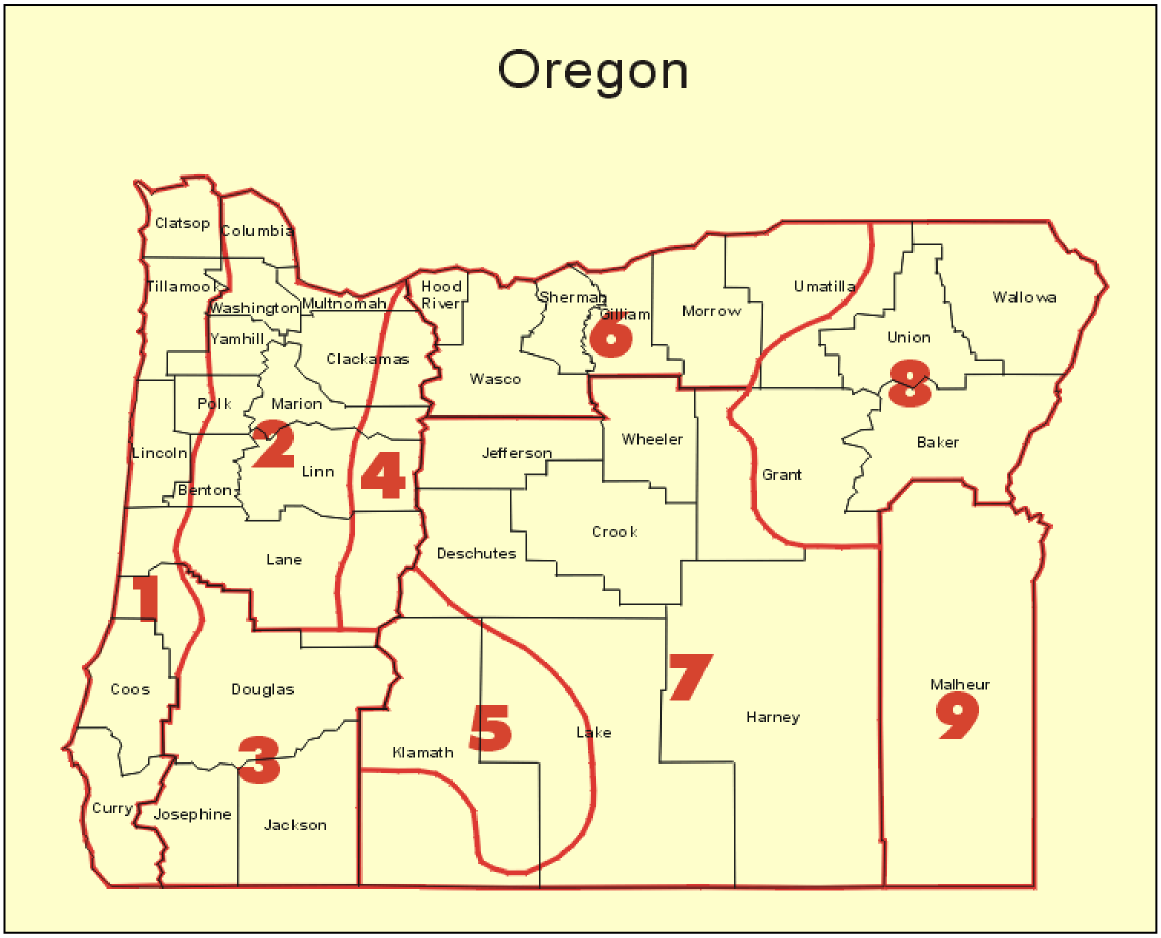
Winter droughts can have a profound impact on agriculture, particularly east of the Cascade Mountains. Also, below average snowfall in higher elevations has a far-reaching effect, especially in terms of hydroelectric power, irrigation, recreational opportunities and a variety of industrial uses. Drought is a particularly significant risk in Malheur County due to its limited annual rainfall and economic reliance on agriculture and ranching. Agriculture and ranching are heavily dependent on water supply and a complex network of irrigation systems and dams spread throughout the County. Malheur County is 9,926 square miles in size, with 94% of its land area in rangeland use. Rangeland, in addition to irrigated farmland, is susceptible to drought impacts.

Oregon climate Zone 9 occupies the southeast corner of the state and comprises the entirety of Malheur County. See Figure DR-1. With the exception of a few high-elevation mountain areas, Zone 9 receives low amounts of precipitation; the majority of the region averages less than 15 inches of precipitation per year. Valleys near the unincorporated communities of Rome and Burns Junction are the driest, averaging 7.62 and 8.04 inches per year, respectively.[22]

Drought can affect all segments of a jurisdiction's population, particularly those employed in water-dependent activities (e.g., agriculture, hydroelectric generation, recreation, etc.). Also, domestic water-users may be subject to stringent conservation measures (e.g., rationing) and could be faced with significant increases in electricity rates. Facilities affected by drought conditions include irrigation systems, storage systems for potable water, sewage treatment facilities, water storage for firefighting, and hydroelectric generating plants (there are none in Malheur County but several on the Snake River just to the north of the county, which affects the region's power and water supply).

[22] *2014 Malheur County NHMP*, https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf.

Figure DR-1 Map of Climatic Divisions



Source: NOAA, National Weather Service Climate Prediction Center, https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/CLIM_DIVS/oregon.gif

There also are environmental consequences. A prolonged drought in forests promotes an increase of insect pests, which in turn, damage trees already weakened by a lack of water. A moisture-deficient forest or grassland constitutes a significant fire hazard (see the Wildfire Hazard Annex). In addition, drought and water scarcity add another dimension of stress to species listed pursuant to the Endangered Species Act (ESA) of 1973.

Most agricultural land in the County is irrigated, and in drought conditions irrigation pumping can be restricted to manage low flow conditions. The Owyhee Reservoir, created by Owyhee Dam, serves as the largest source of irrigation water for agricultural lands in the county. Reservoir capacity information is available in the Flood Hazard Annex. Ranching land (mostly BLM-managed), which comprises the majority of the County's land use, is not irrigated, and livestock depend on water sources (e.g. natural waterways, built reservoirs, and wells) that can disappear in drought conditions. Drought conditions have a negative impact on cattle ranching, and tourism in Malheur County. Water-dependent activities, such as agriculture, are particularly vulnerable to droughts.

In addition to already described impacts, Malheur County may experience impacts such as:

- The County's irrigation system is generally functional, but much of its pumping equipment is old, and dirt canal walls are prone to collapse. Up to 30% of irrigation water is lost due to evaporation from open dirt canals. Several local organizations are working upgrade key dirt canals to enclosed pipeline to improve efficiency and reduce agricultural runoff into waterways.

- The County's irrigation system is divided into several irrigation districts and there is no one location for data on the entire system. The Malheur County Soil and Water Conservation District would like to comprehensively map the irrigation network; this would help districts work more closely together to prioritize improvements (http://malheurcoswcdorg.netfirms.com/swcd/).

- Current off-stream water storage for agricultural use (reservoirs, basins) is insufficient in drought years.

City Specific Damage

Ontario

Because of the predominance of ranching, farming and other agricultural activities as a major economic force in the City of Ontario, the economic impacts of drought are significant both for those individuals and for businesses, which support and are supported by the agricultural community. Countywide drought declarations apply to the County and the City of Ontario.

Nyssa

Because of the predominance of ranching, farming and other agricultural activities as a major economic force in the City of Nyssa, the economic impacts of drought are significant both for those individuals and for businesses, which support and are supported by the agricultural community. The City of Nyssa falls within the boundaries of Owyhee Irrigation District for irrigation water.

The City of Nyssa has had some municipal water shortages due to overuse in drought conditions, but water meters were installed in the early 1990s which allowed for more accurate usage billing and reduced overuse problems. The City also has two plans that include drought information: the Water Management and Conservation Plan from 2009 and the Water System Master Plan from 2010. Water curtailment measures have not been imposed since 1995. However, the City does have odd/even watering days and a system designed to accommodate water decreases to their wells. Countywide drought declarations apply to the County and the City of Nyssa.

Vale

Because of the predominance of ranching, farming and other agricultural activities as a major economic force in the City of Vale, the economic impacts of drought are significant both for those individuals and for businesses, which support and are supported by the agricultural community.

The City falls within the boundaries of Warm Springs and Vale Irrigation Districts for irrigation water, but most agricultural activity takes place outside city limits. Several Warm Springs irrigation canals pass through the City. Countywide drought declarations apply to the County and the City of Vale.

Government Assistance when Droughts Occur

Once drought conditions have been established, Oregon communities may request government assistance. The mechanism to trigger federal or state assistance is contained in ORS 536.710.

“1) The Legislative Assembly finds that an emergency may exist when a severe, continuing drought results in a lack of water resources, thereby threatening the availability of essential services and jeopardizing the peace, health, safety and welfare of the people of Oregon.

(2) The Legislative Assembly finds it necessary in the event of an emergency described in subsection (1) of this section, to promote water conservation and to provide an orderly procedure to assure equitable curtailment, adjustment, allocation or regulation in the domestic, municipal and industrial use of water resources where more than one user is dependent upon a single source of supply."[23]

Locally, farmers may apply for assistance only when the state has declared the County a disaster area. The process for such a declaration is as follows: local County Court has passes a resolution declaring the County to be in a “State of Drought Emergency,” which is sent to the Oregon Department of Agriculture for review. If the Department deems the County’s production losses sufficient, it will request that the Governor designate the County a disaster area, making local farmers eligible for emergency loans and other assistance from the USDA Farm Service Agency. To receive assistance, farmers must provide documentation of crop losses and typical yields; additionally, they are only eligible for funds if this documentation reveals a 35% or greater loss in production due to drought.[24]

Comprehensive cost estimates for droughts in Malheur County are not kept on record, but a county-wide drought declaration can incur $500,000 – 5,000,000 dollars in disaster assistance payments for farmers from the USDA. Most farmers in the county do not carry drought insurance, according to the USDA Farm Service Agency.[25]

Existing Hazard Mitigation Activities and Resources

Water Resources Commission, Water Supply Availability Committee, and the Drought Readiness Council

As described in the Oregon Drought Planning and Monitoring section, to trigger specific actions from the Water Resources Commission and the Governor, it must be likely that a severe and continuing drought will occur. There are two inter-agency groups that evaluate water supply conditions, and help assess and communicate potential drought-related impacts:

- The Water Supply Availability Committee (WSAC) is a technical committee chaired by the Oregon Water Resources Department (OWRD).
- The Drought Readiness Council is a coordinating body of state agencies co-chaired by the OWRD and the Office of Emergency Management (OEM).

See the State of Oregon’s *Emergency Operations Plan, Incident Annex for Drought*, https://www.oregon.gov/oem/Documents/2015_OR_EOP_IA_01_drought.pdf.

---

[23] State of Oregon, ORS 536.710, https://www.oregonlaws.org/ors/536.710.

[24] *2014 Malheur County NHMP*, https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf.

[25] Ibid.

Natural Resources Conservation Service (Malheur County)

Since 1935, the Natural Resources Conservation Service (NRCS) (previously the Soil Conservation Service) has provided leadership in a partnership effort to help America's private land owners and managers conserve their soil, water, and other natural resources. NRCS employees provide technical assistance based on sound science and suited to a customer's specific needs. They provide financial assistance for many conservation activities. Participation in the programs is voluntary. The NRCS has a service center located in Ontario.[26] There is a *NRCS Natural Resources Long Range Strategy in Malheur County, Oregon*. It was written in June 2010 and updated in March 2018.

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/contact/local/?cid=nrcs142p2_046133

https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid...ext=pdf

Malheur County Emergency Management

The Malheur County Emergency Management Department maintains files on significant droughts that include County Court declarations of emergency and any other relevant information. Contact the Emergency Management Department for details.

https://www.malheurco.org/emergency-management/

USDA Farm Service Agency in Malheur County

The Malheur County Farm Service Agency (FSA) is located in Ontario. It maintains records on how much drought disaster assistance it has paid to farmers impacted by drought conditions; records go back to 1992. FSA offers disaster assistance and low-interest loan programs to assist agricultural producers in their recovery efforts during qualifying natural disasters.

https://www.fsa.usda.gov/

State Natural Hazard Risk Assessment: Drought

The risk assessment in the *2015 Oregon Natural Hazards Mitigation Plan* provides an overview of drought risk in Oregon and identifies the most significant droughts in Oregon's recorded history. It has overall state and regional information, and includes drought related mitigation actions for the entire state. https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP_5_RAState.pdf

National Drought Mitigation Center: Drought Monitor

On the National Drought Mitigation Center website there is a page called US Drought Monitor. It include a map and weekly summary of current drought conditions for each state in the US. There is an intensity and impacts scale that is used to indicate the severity level of conditions; there are five levels. There is also a section called data which provides a variety of statistics. You can select data

[26] Natural Resources Conservation Service, https://www.nrcs.usda.gov/wps/portal/nrcs/main/or/about/

each week such as percent of area, total area, percent of population and total population. Spatial scale choices include national, state, county and urban areas, and many more.

There is also a Drought Classification page on the website which includes the five levels of severity, and the types of systems used to classify and measure them: the Palmer Drought Severity Index, the CPC Soil Moisture Model, the USGS Weekly Streamflow, the Standardized Precipitation Index, and the Objective Drought Indicator Blends.

https://droughtmonitor.unl.edu/

Future Changing Conditions/ Climate Change

In the Malheur County NHMP, there are several locations that describe future changing conditions or climate change as it relates to the natural hazards that impact Malheur County. In the order of appearance in the NHMP: the Risk Assessment, the Hazards Annexes, and Appendix F contain this information. Within Appendix F there are two documents, the *Future Climate Projections: Malheur County* and the *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports.*

Drought Mitigation Action Items

The drought mitigation actions have been identified by the Malheur County NHMP Steering Committee which includes the Cities of Nyssa, Ontario and Vale. See Table 3-3 Mitigation Actions Table 2019 NHMP and the action item worksheets in Appendix A for a more detailed description of the mitigation actions.

In the HVA, drought had a risk score of 240 out of 240 points and is listed as a high risk level. Drought mitigation actions are identified as a high priority. There are two specific mitigation actions related to drought.

DR #1: “Cooperate and help the Malheur Soil and Water Conservation District (SWCD) maintain and continue in its countywide water assessment project.”

DR #2: “Support the Malheur, Owyhee, and Vale Irrigation Districts’ efforts ongoing efforts to convert dirt irrigation canals into pipes.”

There are seven multi-hazard mitigation actions for the NHMP and several of those include drought related mitigation actions, in conjunction with the other hazards. The multi-hazard mitigation actions are a high priority.

At the August 9, 2018 NHMP Steering Committee meeting, it was agreed that the risk level rankings from the HVA would be used as the way to prioritize the multi-hazard and hazard-specific mitigation actions. The risk level rankings are in Table 2-5 in Section 2 Risk Assessment.

Risk Score: 64

Risk Level: Low

EARTHQUAKE HAZARD ANNEX

Causes and Characteristics of Earthquake

Earthquakes occur in Oregon every day; every few years an earthquake is large enough for people to feel; and every few decades there is an earthquake that causes damage. Each year, the Pacific Northwest Seismic Network locates more than 1,000 earthquakes greater than magnitude 1.0 in Washington and Oregon. Of these, approximately two dozen are large enough to feel. These noticeable events offer a subtle reminder that the Pacific Northwest is an earthquake-prone region.

Seismic hazards pose a real and serious threat to many communities in Oregon, including Malheur County, requiring local governments, planners, and engineers to consider their community's safety. Currently, no reliable scientific means exists to predict earthquakes. Identifying seismic-prone locations, adopting strong policies and implementing measures, and using other mitigation techniques are essential to reducing risk from seismic hazards in Malheur County.[1]

Oregon and the Pacific Northwest in general are susceptible to earthquakes from three sources: 1) shallow crustal fault – slippage events within the North American Plate; 2) deep intraplate events within the subducting Juan de Fuca Plate; and 3) the off-shore Cascadian Subduction Zone.[2]

Crustal Fault Earthquakes

Crustal fault earthquakes are the most common earthquakes and occur at relatively shallow depths of 6-12 miles below the surface.[3] When crustal faults slip, they can produce earthquakes of magnitudes up to 7.0. Although most crustal fault earthquakes are smaller than 4.0 and generally create little or no damage, some of them can cause extensive damage. Crustal earthquakes occur in the North American plate at relatively shallow depths of 10–20 km (6–12 mi) below the surface. Earthquakes related to volcanic activity can also affect the region.

Deep Intraplate Earthquakes

Occurring at depths from 18 to 60 miles below the earth's surface in the subducting oceanic crust, deep intraplate earthquakes can reach magnitude 7.5.[4] This type of earthquake is more common in the Puget Sound; in Oregon these earthquakes occur at lower rates and have none have occurred at

[1] OPDR and OEM, *2012 Oregon Natural Hazards Mitigation Plan*, https://oregonexplorer.info/content/oregon-natural-hazard-mitigation-plan-2012

[2] OPDR, *Planning for Natural Hazards: Oregon Technical Resource Guide*, July 2000, p. 8-88, https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

[3] Madin, Ian P. and Zhenming Wang, *Relative Earthquake Hazard Maps Report*, DOGAMI, 1999.

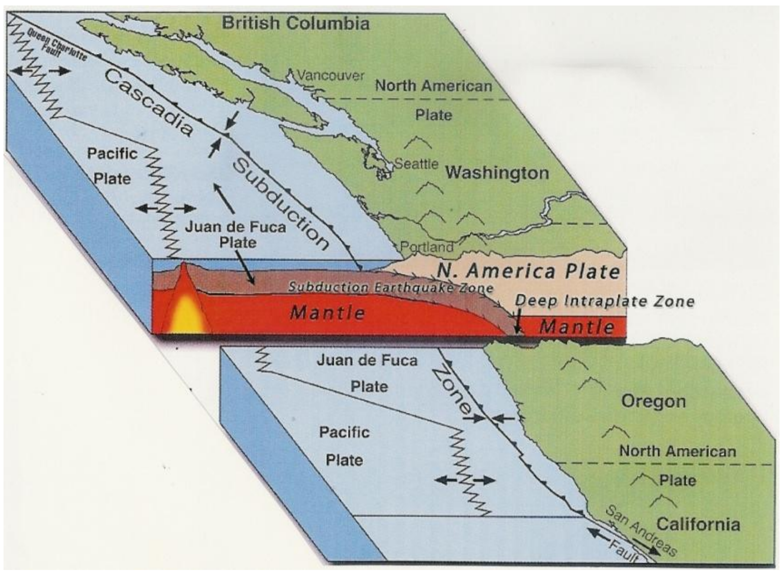
[4] OPDR, *Planning for Natural Hazards: Oregon Technical Resource Guide*, July 2000, p. 8-8, https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

a damaging magnitude.[5] The February 28, 2001 earthquake in Nisqually, Washington was a deep intraplate earthquake. It produced a rolling motion that was felt from Vancouver, British Columbia to Coos Bay, Oregon and east to Salt Lake City, Utah.[6]

Subduction Zone Earthquakes

The Pacific Northwest is located at a convergent continental plate boundary, where the Juan de Fuca and North American tectonic plates meet. The two plates are converging at a rate of about 1.5 inches per year[7]. This boundary is called the Cascadia Subduction Zone (CSZ). It extends from British Columbia to northern California. See Figure EQ-1 for an illustration. Earthquakes are caused by the abrupt release of this slowly accumulated stress.

Figure EQ-1 Cascadia Subduction Zone



Source: Cascadia Region Earthquake Workgroup (2005), http://www.oregongeology.org/pubs/ofr/O-05-05.pdf

Although there have been no large recorded earthquakes along the offshore Cascadia Subduction Zone, similar subduction zones worldwide do produce "great" earthquakes with magnitudes of 8 or larger. Historic subduction zone earthquakes include the 1960 Chile earthquake (magnitude 9.5), the 1964 southern Alaska (magnitude 9.2) earthquakes, the 2004 Indian Ocean earthquake (magnitude 9.0) and the 2011 Tohoku earthquake. Returning to closer to home, geologic evidence shows that the Cascadia Subduction Zone has generated great earthquakes, most recently about 300 years ago.[8] Large earthquakes also occur at the southern end of the Cascadia Subduction Zone (in northern California near the Oregon border) where it meets the San Andreas Fault system.

[5] OPDR and OEM, *2012 Oregon Natural Hazards Mitigation Plan*, https://oregonexplorer.info/content/oregon-natural-hazard-mitigation-plan-2012

[6] Hill, Richard, *Geo Watch Warning Quake Shook Portland 40 Years Ago*, The Oregonian. October 30, 2002.

[7] OPDR and OEM, *2012 Oregon Natural Hazards Mitigation Plan*, https://oregonexplorer.info/content/oregon-natural-hazard-mitigation-plan-2012

[8] Ibid.

These earthquakes occur because the oceanic crust "sticks" as it is being pushed beneath the continent, rather than sliding smoothly. Over hundreds of years, large stresses build which are released suddenly in great earthquakes. Such earthquakes typically have a minute or more of strong ground shaking, and are quickly followed by numerous large aftershocks.

While all three types of earthquakes have the potential to cause major damage, subduction zone earthquakes pose the greatest danger. A major event could generate an earthquake with a magnitude of 9.0 or greater resulting in devastating damage and loss of life. Such earthquakes may cause great damage to the coastal area of Oregon as well as inland areas in western Oregon. Malheur County is unlikely to be directly affected by a subduction zone earthquake; however, it could be affected as populations of refugees flee eastward and supplies are staged in the area. It is estimated that shaking from a large subduction zone earthquake could last up to five minutes.[9]

The specific hazards associated with an earthquake are:

- ground shaking,
- ground shaking amplification,
- surface faulting,
- liquefaction and subsidence, and
- earthquake induced landslides and rockfalls.

Ground Shaking

Ground shaking is the motion felt on the earth's surface caused by seismic waves generated by the earthquake. Ground shaking is the primary cause of earthquake damage. The strength of ground shaking depends on the magnitude of the earthquake, the type of fault that is slipping, and distance from the epicenter (where the earthquake originates). Buildings on poorly consolidated and thick soils will typically see more damage than buildings on consolidated soils and bedrock.

Ground Shaking Amplification

Ground shaking amplification refers to the soils and soft sedimentary rocks near the surface that can modify ground shaking from an earthquake. Such factors can increase or decrease the amplification (i.e., strength) as well as the frequency of the shaking. The thickness of the geologic materials and their physical properties determine how much amplification will occur. Ground motion amplification increases the risk for buildings and structures built on soft and unconsolidated soils.

> *"Due to the amount of faulting in the area, [the 1999 Klamath Falls earthquake] is just business as usual for such a geologically active region. Historic evidence, combined with geologic evidence for large numbers of earthquakes in the prehistoric past, suggest that one or more earthquakes capable of damage (magnitude 4 – 6) hit south-central Oregon every few decades, so it pays to be prepared."*
>
> James Roddey, formerly with DOGAMI

[9] OPDR, *Planning for Natural Hazards: Oregon Technical Resource Guide*, July 2000, p. 8-9, https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

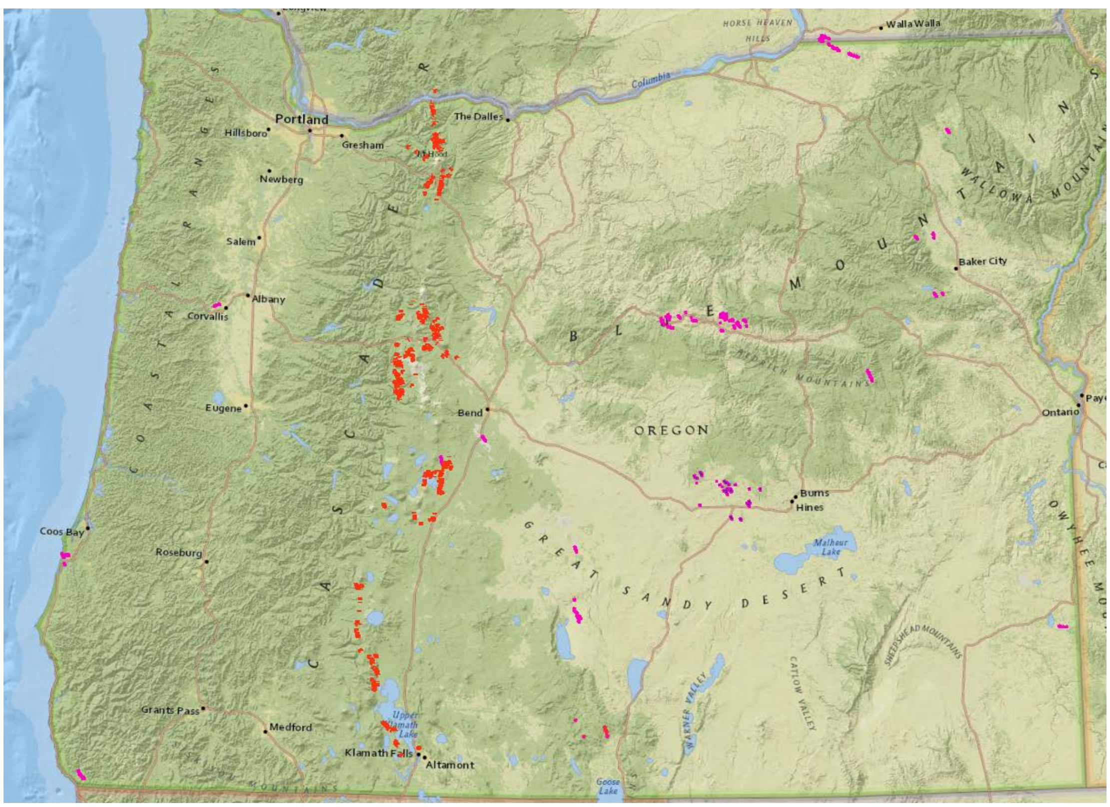
Surface Faulting

Surface faulting are planes or surfaces in Earth materials along which failure occurs. Such faults can be found deep within the earth or on the surface. Earthquakes occurring from deep lying faults usually create only ground shaking.

An article published by DOGAMI and others in September 2018 describes a newly discovered fault zone on Mount Hood. The fault zone includes two faults, the Blue Ridge and the Twin Lakes Faults. The discovery of "this active fault system is important for understanding the potential seismic threat for nearby communities." Based on the estimates of the earthquake capability, which are based on observations of average displacement and surface rupture, the fault could produce an earthquake of 6.5 or greater.

While it is distant from major population centers, the fault zone "poses serious seismic threat to the cities of Hood River, Odell, Parkdale, White Salmon, Stevenson, Cascade Locks, Government Camp, and the Villages at Mount Hood" as well as highway and rail transportation corridors in the Columbia Gorge, power generation facilities at Bonneville Dam, storage reservoirs, and the City of Portland's drinking water system in Bull Run. Impacts of an earthquake along this fault could readily impact Malheur, Lake, and Harney Counties.[10]

Figure EQ-2 Map of Faults in Oregon Identified with Lidar



Source: Ian Madin, DOGAMI, personal communication, October 30, 2018

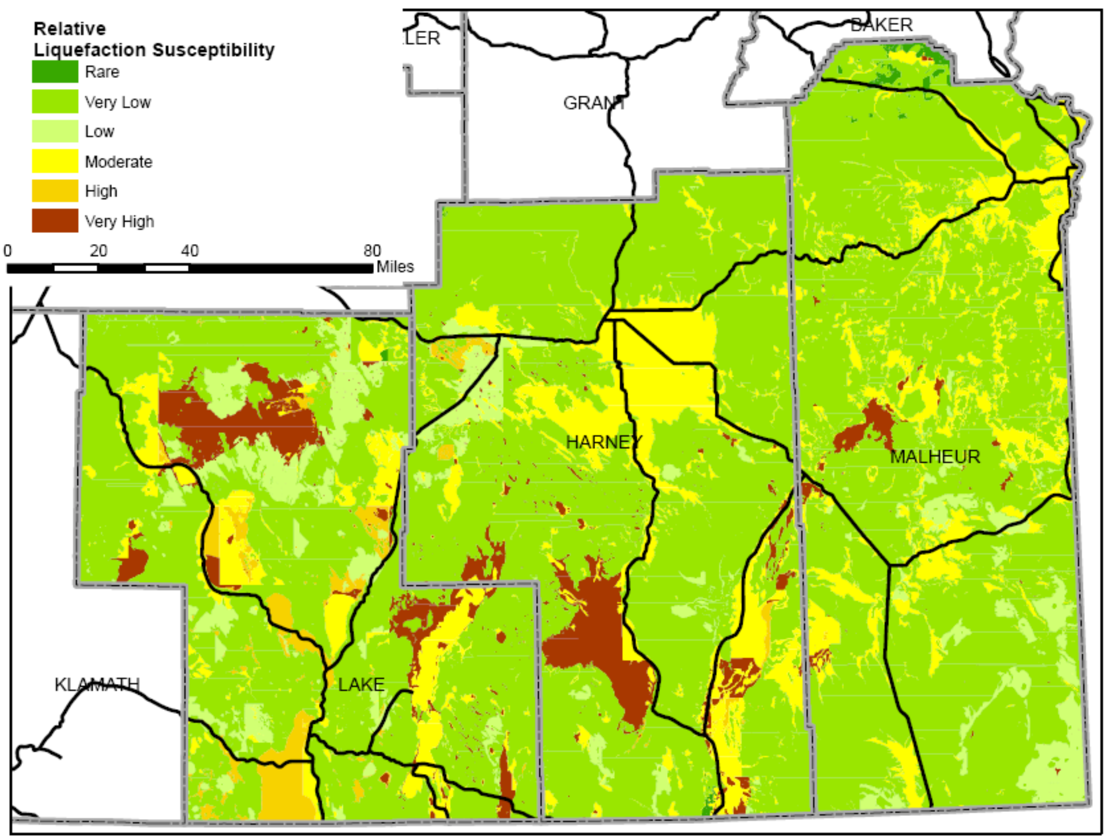
[10] Madin, Ian, Ashley Streig, William J. Burns, and Lina Ma, *The Mount Hood Fault Zone – Late Quaternary and Holocene Fault Features Newly mapped with High-Resolution Lidar Imagery*.

Liquefaction and Subsidence

Liquefaction occurs when ground shaking causes wet, granular soils to change from a solid state into a liquid state. This results in the loss of soil strength and the soil's ability to support weight. When the ground can no longer support buildings and structures (subsidence), buildings and their occupants are at risk. The severity of an earthquake is dependent upon factors including: 1) the distance from the earthquake's source (or epicenter); 2) the ability of the soil and rock to conduct the earthquake's seismic energy; 3) the degree (i.e., angle) of slope materials; 4) the composition of slope materials; 5) the magnitude of the earthquake; and 6) the type of earthquake.[11]

In Figure EQ-3, the most current information about the susceptibility of soils to liquefaction is shown for Malheur, Harney, and Lake Counties (Bill Burns, DOGAMI, personal communication, December 13, 2018). In Figure EQ-6, included later in this Earthquake Annex, the liquefaction susceptibility of Malheur County is shown with categories of high, moderate, and low.

Figure EQ-3 Map of Relative Liquefaction Susceptibility Hazard for Lake, Harney, and Malheur Counties



Source: Burns, et al, 2007. Unpublished Report. *Geologic Hazards, Earthquake and Landslide Hazard Maps, and Future Earthquake Damage and Loss Estimates for three Counties in the southeastern Region Including Lake, Malheur, and Harney*. DOGAMI Open File Report.

---

[11] Burns, et al, 2007. Unpublished Report. *Geologic Hazards, Earthquakes and Landslide Hazard Maps, and Future Earthquake Damage and Loss Estimates for three Counties in the southeastern Region including Lake, Malheur, and Harney*. DOGAMI Open File Report.

Earthquake-Induced Landslides and Rockfalls

Earthquake-induced landslides are secondary hazards that occur from ground shaking and can destroy roads, buildings, utilities and critical facilities necessary to recovery efforts after an earthquake. Some Malheur County communities are built in areas with steep slopes. These areas often have a higher risk of landslides and rockfalls triggered by earthquakes. As noted in "Liquefaction and Subsidence" the severity of an earthquake is dependent upon several factors.

History of Earthquakes in Oregon and Malheur County

The Pacific Northwest has experienced major earthquakes in 1949 (magnitude 7.1), 1962 (magnitude 5.2), and 2001 (magnitude 6.8). Table EQ-1 shows the date, location, size, and description of selected earthquakes that have occurred in Oregon and Washington.

All of Oregon west of the Cascades is at risk from the three earthquake types and associated hazards. East of the Cascades the earthquake hazard is predominately of the crustal type. No deep intraplate earthquakes have occurred in Oregon at a recordable magnitude. A subduction zone earthquake is anticipated to occur off the Oregon and Washington coasts in the next 50 years, as described below in the "Probability Assessment." The amount of earthquake damage at any place will depend on its distance from the epicenter, local soil conditions, and types of construction. Due to Oregon's relatively short written history and the infrequent occurrence of severe earthquakes, few Oregon earthquakes have been recorded in writing.

The Malheur County region has been historically shaken by crustal and intraplate earthquakes centered on the area. In the past century, there have been no reported damage or injuries in Malheur County due to earthquakes. However, several significant earthquake events have occurred in southwestern Oregon in the past 150 years. Details concerning these events are highlighted below. Figure EQ-4 shows selected earthquakes in the Malheur County region from 1989-2013.

Malheur County must consider seismic activity in Oregon and the crustal seismic activity coming from Idaho: in 1983 the 6.9-magnitude Borah Peak earthquake occurred in Idaho and resulted in damage in Vale and Ontario. In addition, the following Idaho events were felt in Malheur County:

- July 12, 1944: Central Idaho hit by an earthquake also felt in Oregon.
- May 12, 1916: Boise hit by an earthquake also felt in Oregon.
- November 11, 1905: A shock in southern Idaho is felt in Oregon.

The 2004 Jordan Valley Swarm

In 2004, Jordan Valley and the vicinity experienced an earthquake swarm. From Idaho Disaster Services: "Boise State University seismologist James Zollweg has reported a swarm of small earthquakes near Antelope Reservoir southwest of Jordan Valley, Oregon. The swarm began April 22, and over 100 events have been recorded so far, with the largest at Magnitude 3.6. While not large enough to be damaging, the activity has not been observed before, and only a few isolated small events have be recorded in the last 20 years. There are several active faults in the area which seismologists believe are capable of producing damaging earthquakes, so we are monitoring the situation." These events occurred without local monitoring equipment. Since this occurrence, USGS has installed monitoring equipment. The swarm originated beneath Antelope Reservoir and is thus earthquakes are a potential concern for the Antelope Reservoir dam.

Table EQ-1 Significant Historic Earthquakes

Date	Location	Size (M)	Description
Approximate years: 1400 BCE*, 1050 BCE, 600 BCE, 400. 750, 900	Offshore Cascadia Subduction Zone (CSZ)	Probably 8.0-9.0	Based on studies of earthquake and tsunami at Willapa Bay, Washington. These are the mid-points of the age ranges for these six events.
Jan. 1700	CSZ	About 9.0	On January 26, 1700, an approximately 9.0 earthquake generated a tsunami that struck Oregon, Washington, and Japan. Destroyed Native American villages along the coast.
Nov. 1873	Brookings, OR	7.3	Impacts: chimneys fell in Port Orford, Grants Pass, and Jacksonville; no aftershocks; origin probably in the Gorda block of the Juan de Fuca plate; intraplate event.
Oct. 1897	Gresham, OR	6.7	Occurred on October 12, 1897.
Feb, 1892	Portland, OR	5.6	Occurred on February 4, 1892.
Mar. 1893	Umatilla, OR	5.7	Occurred on March 7, 1893.
Apr. 1906	North of Lakeview, OR	V	Three felt aftershocks.
May 1916	Richland, WA	5.7	Earthquake on May 13, 1916 centered on Richland, WA.
Apr. 1920	Fort Klamath, OR	5.0	Three shocks felt at Fort Klamath; the center was probably in the vicinity of Crater Lake.
Jan. 1923	Lakeview, OR	VI	
Jul. 1936	Milton-Freewater, OR	6.1	The earthquake occurred on July 16, 1936. There were two foreshocks and many aftershocks felt. Damages were ~ $100,000 (1936 dollars).
Apr. 1949	Olympia, WA	7.1	Significant damage in Washington, including eight deaths. Minor damage in NW Oregon.
Jan. 1951	Hermiston, OR	V Modified Mercalli Intensity	Damage unknown.
Dec. 1953	Portland, OR	5.6	Occurred on December 16, 1953.
Nov. 1962	Vancouver, WA	5.5	Occurred on November 5, 1962. Centered in Vancouver and felt in the metro area, including Portland.
Oct. 1964	Portland, OR	5.3	Occurred on October 1, 1964. Earthquake on Sauvie Island in the Columbia River
Apr. 1965	Seattle-Tacoma, WA	6.5	3 people killed. Only felt shaking in Multnomah County.
May 1968	Near Lakeview, OR	5.1	Occurred on May 30, 1968 and lasted through July, decreasing in intensity. Earthquake near the Adel-Warner Lakes in south central Oregon. Largest of the tremors was 5.1.
Apr. 1976	Near Maupin, OR	4.8	Sounds described as distant thunder, sonic booms, and strong wind.
Feb. 1981	Mt. St. Helens, WA	5.5	Occurred on February 13, 1981. Centered near Mt. St. Helens and shook the Portland area.
Apr. 1992	Cape Mendocino, CA	7.0	Subduction earthquake at the triple junction of the Cascadia Subduction Zone, San Andreas, and Mendocino faults.
Mar. 1993	Scotts Mills, OR	5.6	DR-985. On Mt. Angel-Gales Creek fault. $30 million damage (including Oregon Capitol Building in Salem). Magnitude 5.6 centered near Woodburn occurred on March 23, 1993.
Sep. 1993	Klamath Falls, OR	6.0	DR-1004. Two earthquakes in Klamath Falls, 2 people killed. Occurred on September 20, 1993. Magnitude 6.0 centered 10 mi NW of Klamath Falls and caused damaged to the courthouse and county offices. Magnitude 5.9 centered 15 mi NW of Klamath Falls closed highways and bridges.
Apr. 1999	Christmas Valley, OR	3.8	On April 28 this earthquake was felt and recorded. Damage unknown.
Apr. 1999	Christmas Valley, OR	1.9-3.0	At least 6 earthquakes occurred in the area.
Feb. 2001	Nisqually, WA	6.8	Felt in the region. No damage reported.
Jun. 2004	SE of Lakeview, OR	4.4	On June 30 this earthquakes was felt and recorded. Damage unknown.
Jun. 2004	SE of Lakeview, OR	1.9-3.9	At least 20 earthquakes occurred in the area.

*BCE: Before the Common Era.

Sources: Wong and Bolt, 1995; University of Oregon, Malheur County NHMP, May 2014; DLCD, Oregon NHMP, 2015; FEMA, Disaster Declarations for Oregon, retrieved 2017.

Risk Assessment

How are Hazards Identified?

The Oregon Department of Geology and Mineral Industries (DOGAMI), in partnership with other state and federal agencies, has undertaken a rigorous program in Oregon to identify seismic hazards, including active fault identification, bedrock shaking, tsunami inundation zones, ground motion amplification, liquefaction, and earthquake induced landslides. DOGAMI has published a number of seismic hazard maps that are available for Oregon communities to use. The maps show liquefaction, ground motion amplification, landslide susceptibility, and relative earthquake hazards.

DLCD and Malheur County used the DOGAMI Statewide Geohazards Viewer to create maps of:

- Figure EQ-4 Malheur County Historical Earthquake,
- Figure EQ-5 Malheur County Expected Shaking,
- Figure EQ-6 Malheur County Liquefaction Susceptibility, and
- Figure EQ-7 Malheur County Fault Lines.

The extent of the damage to structures and injury and death to people will depend upon the type of earthquake, proximity to the epicenter and the magnitude and duration of the event. As the maps indicate, the predominant risks lie in the southwestern portion of the County away from populated areas and near geographic center of the County.

Hazard Risk Analysis

The Malheur County NHMP Steering Committee completed a Hazard Vulnerability Assessment/Analysis (HVA) during this NHMP update. This was described in Section 2 Risk Assessment. The method used for the HVA was developed from a Federal Emergency Management Agency (FEMA) tool that has been refined by the Oregon Office of Emergency Management (OEM). It addresses and weights (shown as percent within parentheses) probability (29%), vulnerability (21%), maximum threat (42%) and the history (8%) of each natural hazard and attributes a final hazard analysis score. The methodology produces scores that range from 24 to 240.

For local governments, conducting the HVA is a useful step in planning for hazard mitigation. The method provides the jurisdiction with a relative ranking from which to prioritize mitigation actions, but does not predict the occurrence of a particular hazard.

In 2013 earthquake hazards had a risk score of 72 and a rank of 7 out of 11 natural hazards. In 2018 earthquake hazards had a risk score of 64 and a rank of 10 out of 11 natural hazards.

For more information on all the risk scores and ranks of the natural hazards, see Volume I Basic Plan, Section 2 Risk Assessment of this NHMP.

See Appendix H Malheur County HAZUS Global Reports for Crustal and Probabilistic Scenarios for details about simulated scenarios and the results. Some information below has been excerpted from this prepared by DOGAMI unpublished 2007 report and included here in this Earthquake Annex. The report includes two HAZUS-MH scenarios: Malheur Arbitrary Crustal M6.9 and 2500 Year Probably Scenario M6.5 Driving. The report includes inventories of: buildings; critical facilities; and transportation and utilities. The damage assessment is listed in the categories of direct damage, induced damage, social impact, and economic loss.

Probability Assessment

The DOGAMI report does not explain why these HAZUS-MH probabilistic scenarios were chosen. Nonetheless, the report from 2007 provides useful information, described briefly in the Vulnerability Assessment. Here, we turn to other sources for the probability of earthquake occurrence.

Paleoseismic studies along the Oregon coast indicate that the state has experienced seven Cascadia Subduction Zone (CSZ) events possibly as large as M9 in the last 3,500 years. These events are estimated to have an average recurrence interval between 500 and 600 years, although the time interval between individual events ranges from 150 to 1,000 years. The last CSZ event occurred approximately 300 years ago. Scientists estimate the chance in the next 50 years of a great subduction zone earthquake is between 10 and 20 percent, assuming that the recurrence is on the order of 400 +/- 200 years.[12]

It is simply not scientifically feasible to predict, or even estimate, when the next Cascadia earthquake will occur, but the calculated odds that a Cascadia earthquake will occur in the next 50 years range from 7-15 percent for a great earthquake affecting the entire Pacific Northwest to about 37 percent for a very large earthquake affecting southern Oregon and northern California. The likelihood of a M9 Cascadia earthquake during our lifetimes and the consequences of such an earthquake are both so great that it is prudent to consider this type of earthquake when designing new structures or retrofit of existing structures, evaluating the seismic safety of existing structures, or planning emergency response and preparedness.[13]

New research from Oregon State University suggests that the CSZ has at least four segments that sometimes rupture independently of one another. Magnitude-9 ruptures affecting the entire subduction zone have occurred 19 times in the past 10,000 years. Over that time, shorter segments have ruptured farther south in Oregon and Northern California, producing magnitude-8 quakes. As such, the risks of a subduction zone earthquake may differ from north to south. Earthquakes originating in the northern portion of the CSZ tend to rupture the full length of the subduction zone. In southern Oregon and Northern California, quakes along the subduction zone appear to strike more frequently.[14]

In August 2016, new analysis about CSZ earthquakes, from Oregon State University, was published. The analysis suggests that CSZ earthquakes affecting more heavily populated areas are slightly more frequent than previously thought. These findings show the chances of an earthquake in the next 50 years have increased. “For central and northern Oregon, the chance of a seismic event during that period has been changed to 15-20 percent instead of 14-17 percent. In the zone area within Washington and British Columbia, the chance of an event has increased to 10-17 percent from 8-14 percent.”[15]

---

[12] DOGAMI, *Oregon Geology*, Volume 64, No. 1, Spring 2002, https://www.oregongeology.org/pubs/og/p-OG.htm

[13] Oregon Seismic Safety Policy Advisory Commission (OSSPAC), *The Oregon Resilience Plan: Reducing Risk and Improving Recovery for the Next Cascadia Earthquake and Tsunami, Report to the 77th Legislative Assembly*, February 2013, https://www.oregon.gov/oem/documents/oregon_resilience_plan_final.pdf

[14] Rojas-Burke, Joe, *Predicting the next Northwest mega-quake still a struggle for geologists*, The Oregonian. April 20, 2010.

[15] Meny, E. (2016, August 5). *Subduction zone earthquakes more frequent than originally thought, OSU finds*. KVAL-TV. Retrieved from http://kval.com/news/local/osu-researchers-find-subduction-zone-earthquakes-more-frequent-than-originally-thought

According to Chris Goldfinger of OSU,

These new results are based on much better data than has been available before, and reinforce our confidence in findings regarding the potential for major earthquakes on the Cascadia Subduction Zone, especially the northern parts. The frequency, although not the intensity, of earthquakes there appears to be somewhat higher than we previously estimated.[16]

Establishing a probability for crustal earthquakes is more difficult. There have been two earthquakes above magnitude 4 near the Malheur County region (but predominately north of the county and populated areas). Oregon's seismic record is short and the number of earthquakes above a magnitude 4 centered in the southeastern Oregon region is small. Therefore, any kind of prediction would be questionable. Earthquakes generated by volcanic activity in Oregon's Cascade Range are possible, but likewise unpredictable.

Vulnerability Assessment

The effects of earthquakes span a large area. The degree to which earthquakes are felt, however, and the damages associated with them may vary. At risk from earthquake damage are unreinforced masonry buildings, bridges built before earthquake standards were incorporated into building codes, sewer, water, and natural gas pipelines, petroleum pipelines, and other critical facilities and private property located within the county. The areas that are particularly vulnerable to potential earthquakes in Malheur County have been identified as those with soft, alluvial sediments and lands along stream channels, which appear in an around the cities of Vale and Ontario; see Figure EQ-6 Expected Soft Soil Hazards for more information.

Earthquake damage to roads and bridges can be particularly serious by hampering or cutting off the movement of people and goods and disrupting the provision of emergency response services. Such effects in turn can produce serious impacts on the local and regional economy by disconnecting people from work, home, food, school and needed commercial, medical and social services. A major earthquake can separate businesses and other employers from their employees, customers, and suppliers thereby further hurting the economy. Malheur County is less susceptible to being isolated, unlike other areas of Oregon, due to its location along Highways 20, 26, 30, 95, 76 and I-84, which run through multiple locations in the county. It should be stated that following an earthquake event, the cleanup of debris can be a huge challenge for the community.

As mentioned previously, Appendix H Malheur County HAZUS Global Reports for Crustal and Probabilistic Scenarios has details about two simulated scenarios and the results: Malheur Arbitrary Crustal M6.9 and 2500 Year Probable Scenario M6.5 Driving. Both are described below.

Malheur Arbitrary Crustal M6.9: The damage assessment is listed in the categories of direct damage, induced damage, social impact, and economic loss. The information below is excerpted from the unpublished 2007 DOGAMI report, *Malheur County HAZUS Global Reports for Crustal and Probabilistic Scenarios*.

In the direct damage category:

[16] Ibid.

HAZUS estimated that 4,290 buildings will be at least moderately damaged. That is over 45% of the buildings in the region. There will be an estimated 1,187 buildings that will be damaged beyond repair. HAZUS estimated that only one bed in the only hospital in Malheur County would be available for use. After one week the estimate is 12% of the beds and after 30 days 48% of the beds will be available. The transportation and utility lifeline damage is shown in multiple tables with damage to the transportation system, utility system, pipelines, potable water, and electric power.

In the induced earthquake damage category:

There are two categories: fire following earthquake and debris generation. Fires often occur after an earthquake. HAZUS estimated that fires will displace 38 people and burn 1 million dollars of building value. HAZUS estimated the amount of two categories of debris: brick and wood, and concrete and steel. In the report, the total amount of debris is not listed but it does state that brick and wood will comprise 42% and the remainder will be concrete and steel.

In the social impact category:

HAZUS estimates that 1,224 households would be expected to be displaced from their homes. Of these, 347 people out of a total population of 31,615 will seek temporary shelter in public shelters. HAZUS estimates the number of injuries and casualties from the earthquake in four levels of severity and at three times of day.

In the economic loss category:

HAZUS estimates the total economic loss from the earthquake to be 604.42 million dollars, which includes building and lifeline related losses. The building losses are described in two categories: direct building losses and business interruption losses. Building direct losses were 453.47 million dollars. 64% of the total loss was from residential occupancies. Transportation system losses include those from highways, railways, light rail, bus, ferry, ports, and airports. Utility system losses include potable water, wastewater, natural gas, oil systems, electrical power, and communication. There is also a table about indirect economic impact with outside aid.

2500 Year Probably Scenario M6.5 Driving: The damage assessment is listed in the categories of direct damage, induced damage, social impact, and economic loss. The information below is excerpted from the unpublished 2007 DOGAMI report, *Malheur County HAZUS Global Reports for Crustal and Probabilistic Scenarios*.

In the direct damage category:

HAZUS estimates that about 2,151 buildings will be at least moderately damaged. That’s over 23% of the buildings in the region. 297 buildings will be damaged beyond repair. The one hospital in the county will be damaged such that 27% beds will be available for use immediately, 59% will be available after one week, and after 30 days there will be 91% of the beds available. The transportation and utility lifeline damage is shown in multiple tables with damage to the transportation system, utility system, pipelines, potable water, and electric power.

In the induced earthquake damage category:

There are two categories: fire following earthquake and debris generation. Fires often occur after an earthquake. HAZUS estimated that fires will displace 33 people and burn 1 million dollars of building value. HAZUS estimated the amount of two categories of debris: brick and wood, and concrete and steel. In the report, the total amount of debris is not listed but it does state that brick and wood will comprise 46% and the remainder will be concrete and steel.

In the social impact category:

HAZUS estimates 357 households will be displaced from their homes. Of that, 99 people out of a total population of 31,615 will seek temporary shelter in public shelters. HAZUS estimates the number of injuries and casualties from the earthquake in four levels of severity and at three times of day.

In the economic loss category:

HAZUS estimates the total economic loss from the earthquake to be 210.09 million dollars, which includes building and lifeline related losses. The building losses are described in two categories: direct building losses and business interruption losses. Building direct losses were 143.37 million dollars. 68% of the total loss was from residential occupancies. Transportation system losses include those from highways, railways, light rail, bus, ferry, ports, and airports. Utility system losses include potable water, wastewater, natural gas, oil systems, electrical power, and communication. There is also a table about indirect economic impact with outside aid.

Building Collapse Potential

In 2007, DOGAMI completed a rapid visual screening (RVS) of educational and emergency facilities in communities across Oregon, as directed by the Oregon Legislature in Senate Bill 2 (2005). RVS is a technique used by the Federal Emergency Management Agency (FEMA), known as FEMA 154, to identify, inventory, and rank buildings that are potentially vulnerable to seismic events. DOGAMI surveyed 30 facilities in Malheur County. DOGAMI scored each building with a ‘low,’ ‘moderate,’ ‘high,’ or ‘very high’ potential of collapse in the event of an earthquake. It is important to note that these rankings represent a probability of collapse based on limited observed and analytical data and are therefore approximate rankings.[17]

To fully assess a building’s potential of collapse, a more detailed engineering study completed by a qualified professional is required, but the RVS study can help to prioritize which buildings to retrofit. There has not been a new study since 2007, so the same table that was included in the *2014 Malheur County NHMP* is included again in this updated NHMP. See Table EQ-2, Rapid Visual Survey Scores. In the table, note that of the school facilities evaluated by DOGAMI using RVS, five buildings have high (greater than 10% chance) collapse potential; 23 buildings have very high (100% chance) collapse potential.

Malheur County and the Cities have opted to consolidate the *2014 Malheur County NHMP* mitigation actions related to the facilities that have a “high” or “very high” ratings in the table. For the *2019 Malheur County NHMP*, the County and the Cites have established one mitigation action for earthquakes – See Table 3-3. It involves review of the Critical Infrastructure List; the list will be evaluated and a priority will be determined for seismic retrofits or replacements of buildings. Malheur County recognizes the buildings are located throughout the County and that all of them can play a key role in disasters events during the event and during long-term recovery.

[17] State of Oregon Department of Geologic and Mineral Industries, *Implementation of 2005 Senate Bill 2 Relating to Public Safety, Seismic Safety and Seismic Rehabilitation of Public Building,* May 22, 2007, Open File Report 0-07-02.

The Steering Committee agreed that prioritization is important with limited budgets. Including the Critical Infrastructure List in the County and Cities strategic plans would keep this as an important action – see earthquake #1 mitigation action. Also, they noted earthquake hazards are listed as a low risk level and many other natural hazards were identified with higher risk scores and risk levels.

Table EQ-2 Rapid Visual Survey Scores

	Level of Collapse Potential			
Facility	Low (< 1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Adrian Elementary School				X
Adrian RFPD			X	
Jordan Valley VFD	X			
Nyssa High School	X	X		X
Nyssa Middle School				X
Nyssa Elemntary School	X			
Nyssa City Police Department				X
Nyssa Fire Department				X
Aiken Elementary School	X, X			
Alameda Elementary School				X
Cairo Elementary School		X		
May Roberts Elementary School	X			X
Ontario High School				X, X, X
Ontario Middle School	X	X, X, X	X, X	
Pioneer Elementary School	X		X	X
Holy Rosary Medical Center - Ontario	X			
Ontario Fire Department				X
Ontario Police Department				X
Barber Hall Administration Building				X
Easley Memorial Gymnasium				X
Four Rivers Cultural Center and Museum	X			
Malheur Dormitory	X			
Weese Building				X
Oregon Trail Building				X
Tech Lab Building				X
Vale High School	X		X	X
Vale Middle School				X, X
Vale Elementary School	X	X		X, X
Vale Fire Department	X			
Malheur County Sheriff	X			

Source: DOGAMI 2007, Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment. http://www.oregongeology.org/sub/projects/rvs/county/county-malheur.htm, accessed September 05, 2013.

Community Hazard Issues

Earthquake damage occurs because humans have built structures that cannot withstand severe shaking. Buildings, airports, schools, and lifelines (highways, phone lines, gas, water, etc.) suffer damage in earthquakes and can ultimately result in death or injury to humans. Listed below are the top earthquake concerns followed by more general issues:

- Some of the County and Cities' critical infrastructure is built from unreinforced masonry, the most vulnerable building material to earthquake damage. Mitigation action EQ #1 refers to the Critical Infrastructure List prepared for the *2019 Malheur County NHMP*; it requires the communities to evaluate the list and determine the priority buildings for seismic retrofits or replacements. Also, to include the Critical Infrastructure List in the County and the Cities strategic plans.
- Providing the community with information on protecting one's home and property in the event of an earthquake could help spread awareness and increase knowledge.
- Antelope Reservoir was the site of seismic activity in 2004; little is known about its ability to withstand future activity.

Death and Injury

Death and injury can occur both inside and outside of buildings due to falling equipment, furniture, debris, and structural materials. Likewise, downed power lines or broken water and gas lines endanger human life. Death and injury are highest in the afternoon when damage occurs to commercial and residential buildings and during the evening hours in residential settings.[18]

Building and Home Damage

Wood structures tend to withstand earthquakes better than structures made of brick or unreinforced masonry buildings.[19] Building construction and design play a vital role in the survival of a structure during earthquakes. Damage can be quite severe if structures are not designed with seismic reinforcements or if structures are located atop soils that liquefy or amplify shaking. Whole buildings can collapse or be displaced.

2001 Nisqually Earthquake

A 6.8 magnitude earthquake centered southwest of Seattle struck on February 28, 2001, followed by a mild aftershock the next morning, and caused more than $1 billion worth of damage. Despite this significant loss, the region escaped with relatively little damage for two reasons: the depth of the quake center and preparations by its residents. Washington initiated a retrofitting program in 1990 to strengthen bridges, while regional building codes mandated new structures withstand certain amounts of movement. Likewise, historic buildings have been voluntarily retrofitted with earthquake-protection reinforcements.

Source: "Luck and planning reduced Seattle quake damage", CNN Report, March 1, 2001

Bridge and Damage

All bridges can sustain damage during earthquakes, leaving them unsafe for use. More rarely, some bridges have failed completely due to strong ground motion. Bridges are a vital transportation link; damage to them can make some areas inaccessible.

Because bridges vary in size, materials, siting, and design, earthquakes will affect each bridge differently. Bridges built before the mid 1970's often do not have proper seismic reinforcements. These bridges have a significantly higher risk of suffering structural damage during a moderate to

[18] OPDR, *Planning for Natural Hazards: Oregon Technical Resource Guide*, (July 2000, https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

[19] Wolfe, Myer, et al. *Land Use Planning for Earthquake Hazard Mitigation: A Handbook for Planners*, Special Publication 14, Natural Hazards Research and Applications Information Center.

large earthquake. Bridges built in the 1980's and after are more likely to have the structural components necessary to withstand a large earthquake.[20]

Damage to Lifelines

Lifelines are the connections between communities and critical services. They include water and gas lines, transportation systems, electricity, and communication networks. Ground shaking and amplification can cause pipes to break open, power lines to fall, roads and railways to crack or move, and radio or telephone communication to cease. Disruption to transportation makes it especially difficult to bring in supplies or services. Lifelines need to be usable after an earthquake to allow for rescue, recovery, and rebuilding efforts and to relay important information to the public. Section 2 Risk Assessment includes this information specific to Malheur County and the Cities; see Table 2-7, Critical Facilities, Critical Infrastructure, and Lifelines.

Image of damage from the 2001 Nisqually earthquake near Seattle

Disruption of Critical Facilities, Infrastructure, and Lifelines

Critical facilities sometimes referred to as essential facilities, are police stations, fire stations, hospitals, and shelters. These are facilities that provide services to the community and need to be functional after an earthquake event. The earthquake effects outlined above can cause emergency response to be disrupted.[21] Section 2 Risk Assessment includes Table 2-7, Critical Facilities, Critical Infrastructure, and Lifelines and more details on them.

Economic Loss: Equipment and Inventory Damage, Lost Income

Seismic activity can cause great loss to businesses, either a large-scale corporation or a small retail shop. Losses not only result in rebuilding cost, but fragile inventory and equipment can be destroyed. When a company is forced to stop production for just a day, business loss can be tremendous. Residents, businesses, and industry all suffer temporary loss of income when their source of finances are damaged or disrupted.

Fire

Downed power lines or broken gas mains can trigger fires. When fire stations suffer building or lifeline damage, quick response to quench fires is less likely.

[20] University of Washington, www.geophys.washington.edu/SEIS/PNSN/INFO_GENERAL/faq.html#3.

[21] DOGAMI, *Earthquake Damage in Oregon: Preliminary Estimates of Future Earthquake Losses*, https://www.oregongeology.org/pubs/sp/SP-29.pdf

Debris

After damage occurs to a variety of structures, access may be limited in many places. It will take time to clean up brick, glass, wood, steel or concrete building elements, office and home contents, and other materials.

City Specific Damage

Information on specific buildings' estimated seismic resistance, determined by DOGAMI in 2007, is available on the DOGAMI "Statewide Seismic Needs Assessment using Rapid Visual Screening" webpage[22] (http://www.oregongeology.org/sub/projects/rvs/). Table EQ-2 lists those buildings. There is one earthquake specific mitigation action in this update to the *2019 Malheur County NHMP*.

Ontario

The concentration of residents and infrastructure within Ontario city limits is greater than anywhere else in Malheur County. Much of the City of Ontario's critical infrastructure, including city hall, several local schools, public works facilities, and hospital, are almost exclusively unreinforced masonry, which is especially vulnerable to seismic events.

Nyssa

Much of the City of Nyssa's critical infrastructure, including public works facilities, city hall, and numerous downtown buildings on the National Historic Register, are almost exclusively unreinforced masonry, which is especially vulnerable to seismic events.

Vale

Like the County and Nyssa, much of the City' of Vale's critical infrastructure, including public works facilities, city hall, and numerous downtown buildings (some on the National Historic Register), are almost exclusively unreinforced masonry, which is especially vulnerable to seismic events. The City is particularly concerned about the seismic safety of city hall, the Old Stonehouse (also called the Rinehart Stone House) (built in 1872), and the Vale Hotel (built in 1907).

The 1984 Borah Peak earthquake in Idaho damaged the original, oldest wing of Vale Elementary School, a three-story structure. This part of the structure, while still standing after the earthquake, had to be vacated and ultimately demolished due to damages and safety concerns.

Existing Hazard Mitigation Activities and Resources

Mitigation through either regulatory or non-regulatory, voluntary strategies allow communities to gain cooperation, educate the public and provide solutions to increase safety in the event of an earthquake.[23]

---

[22] DOGAMI, Statewide Seismic Needs Assessment using Rapid Visual Screening, http://www.oregongeology.org/sub/projects/rvs/

[23] OPDR, *Planning for Natural Hazards: Oregon Technical Resource Guide*, July 2000, p. 8-20. https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

Ordinances

- Malheur County contracts with a private firm to administer state building codes, including those for seismic resistance on new structures. Ordinances are available on file in the Malheur County Planning Department. The Cities of Ontario, Nyssa, and Vale also have building code requirements.
    - Malheur County Code, Title 5, Building and Flood Control Regulations, https://www.sterlingcodifiers.com/codebook/index.php?book_id=695
    - City of Ontario, http://www.ontariooregon.org/
    - City of Nyssa, https://www.nyssacity.org/
    - City of Vale, https://www.cityofvale.com/

Studies/Reports

- The USGS *Open File Report for Quaternary Faults and Folds in Oregon* contains a list of documented faults in Malheur County and their basic geologic properties. It notes that none have shown activity within the timeframe of Oregon's historical record (but have been active in the distant geologic past). See https://pubs.usgs.gov/of/2003/ofr-03-095/

- In 2007, DOGAMI prepared *HAZUS Global Reports for Crustal and Probabilistic Scenarios for Malheur County*. These reports provide a comprehensive cost assessment of two potential earthquake scenarios which could impact the county; but the reports were not published. The citation for the information is: Burns, et al, 2007. Unpublished Report. *Geologic Hazards, Earthquake and Landslide Hazard Maps, and Future Earthquake Damage and Loss Estimates for three Counties in the southeastern Region Including Lake, Malheur, and Harney*. DOGAMI Open File Report. See Appendix H.

- Oregon Senate Bill 2, Statewide Seismic Needs Assessment Using Rapid Visual Screening (RVS) (2005) directed DOGAMI, in consultation with project partners, to develop a statewide seismic needs assessment that included seismic safety surveys of K-12 public school buildings and community college buildings that had, at the time, a capacity of 250 or more persons, hospital buildings with acute inpatient care facilities, fire stations, police stations, sheriffs' offices and other law enforcement agency buildings. See https://www.oregonlegislature.gov/bills_laws/lawsstatutes/2005orLaw0763ses.html.

- In 2007, DOGAMI released the Statewide Seismic Needs Assessment Using Rapid Visual Screening (RVS), which contains a preliminary assessment of the seismic resilience of critical infrastructure in each county in Oregon. Table EQ-2, Rapid Visual Survey Scores, shows the results of the assessment for Malheur County. For more information on the Statewide Seismic Assessment Using Rapid Visual Screenings, see https://www.oregongeology.org/rvs/default.htm.

State Natural Hazard Risk Assessment

- The risk assessment in the *2015 Oregon Natural Hazards Mitigation Plan* provides an overview of seismic risk in Oregon and identifies the most significant earthquakes in

Oregon's recorded history. It has overall state and regional information, and includes earthquake related mitigation actions for the entire state. https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP_5_RAState.pdf

- Published in 2013, *The Oregon Resilience Plan: Reducing Risk and Improving Recovery for the Next Cascadia Earthquake and Tsunami* provides excellent information on the seismic situation in Oregon. https://www.oregon.gov/oem/documents/oregon_resilience_plan_final.pdf

Planning for Natural Hazards: Oregon Technical Resource Guide

- This guide describes basic mitigation strategies and resources related to earthquakes and other natural hazards, including examples from communities in Oregon. https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

Individual Preparedness

At an individual level, preparedness for an earthquake is minimal as perception and awareness of earthquake hazards are low.[24] Strapping down heavy furniture, water heaters and expensive personal property as well as having earthquake insurance, is a step towards earthquake mitigation.

Earthquake Awareness Month

April is Earthquake Awareness Month. Oregon Office of Emergency Management coordinates activities such as earthquake drills and encourages individuals to strap down computers, heavy furniture and bookshelves in homes and offices.

School Education

Schools conduct earthquake drills regularly throughout Oregon and teach students how to respond when an earthquake event occurs.

Building Codes

The Oregon State Building Codes Division adopts statewide standards for building construction that are administered by the state, cities and counties throughout Oregon. The codes apply to new construction and to the alteration of, or addition to, existing structures. Within these standards are six levels of design and engineering specifications that are applied to areas according to the expected degree of ground motion and site conditions that a given area could experience during an earthquake.

The *2014 Oregon Structural Special Code* (*OSSC*) requires a site-specific seismic hazard report for projects including critical/essential facilities such as hospitals, fire and police stations, emergency response facilities, and special occupancy structures, such as large schools and prisons.

[24] Darienzo, Mark, Oregon Office of Emergency Management, personal communication, February 22, 2001.

See http://ecodes.biz/ecodes_support/free_resources/Oregon/14_Structural/14_ORStructural_main.html.

The seismic hazard report required by *OSSC* for critical/essential facilities and special occupancy structures considers factors such as the seismic zone, soil characteristics including amplification and liquefaction potential, any known faults, and potential landslides. The findings of the seismic hazard report must be considered in the design of the building.

The *2017 Oregon Residential Special Code* (*ORSC*) incorporates prescriptive requirements for foundation reinforcement and framing connections based on the applicable seismic zone for the area. The cost of these requirements is rarely more than a small percentage of the overall cost for a new building. See https://codes.iccsafe.org/content/document/1018?site_type=public.

Requirements for existing buildings vary depending on the type and size of the alteration and whether there is a change in the use of the building that is considered more hazardous. Oregon State Building Codes recognize the difficulty of meeting new construction standards in existing buildings and allow some exception to the general seismic standards. Upgrading existing buildings to resist earthquake forces is more expensive than meeting code requirements for new construction. The state code only requires seismic upgrades when there is significant structural alteration to the building or where there is a change in use that puts building occupants and the community at greater risk.

Local building officials are responsible for enforcing these codes. Although there is no statewide building code for substandard structures, local communities have the option of adopting a local building code to mitigate hazards in existing buildings. Oregon Revised Statutes allow municipalities to create local programs to require seismic retrofitting of existing buildings within their communities. The building codes do not regulate public utilities or facilities constructed in public right-of-way, such as bridges.

Future Changing Conditions/ Climate Change

Several locations in the Malheur County NHMP describe future changing conditions or climate change as it relates to the natural hazards that impact Malheur County. In the order of appearance in the NHMP: the Risk Assessment, the Hazards Annexes, and Appendix F contain this information. Appendix F has two documents, the *Future Climate Projections: Malheur County* and the *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports.*

Earthquake Mitigation Action Items

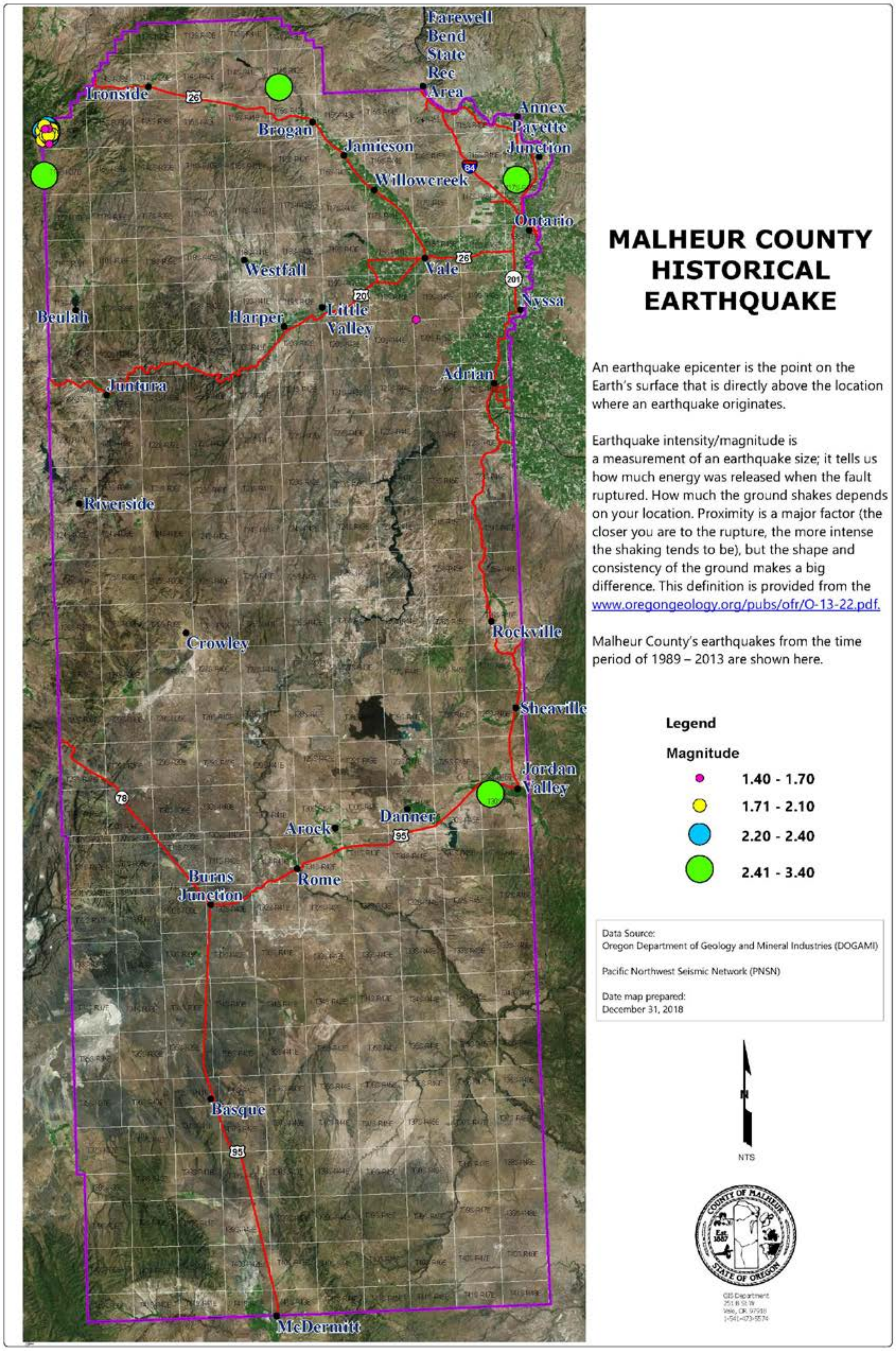
The earthquake mitigation actions have been identified by the Malheur County NHMP Steering Committee which includes the Cities of Nyssa, Ontario and Vale. See Table 3-3 Mitigation Actions Table 2019 NHMP and the Action Item Forms in Appendix A for a more detailed description of the mitigation actions.

There is one earthquake specific mitigation action which is "Review Critical Infrastructure List prepared for the 2018-2019 NHMP. Evaluate the list and determine the priority buildings for seismic retrofits or replacements. Include the Critical Infrastructure List in the strategic plans for the County and the Cities." The Critical Infrastructure List is included in Section 2 Risk Assessment. The mitigation action has a low priority because the Hazard Vulnerability Assessment (HVA) resulted in earthquakes having a low risk level.

There are seven multi-hazard mitigation actions for the NHMP and several of those include earthquake related mitigation actions, in conjunction with the other hazards. The multi-hazard mitigation actions are a high priority.

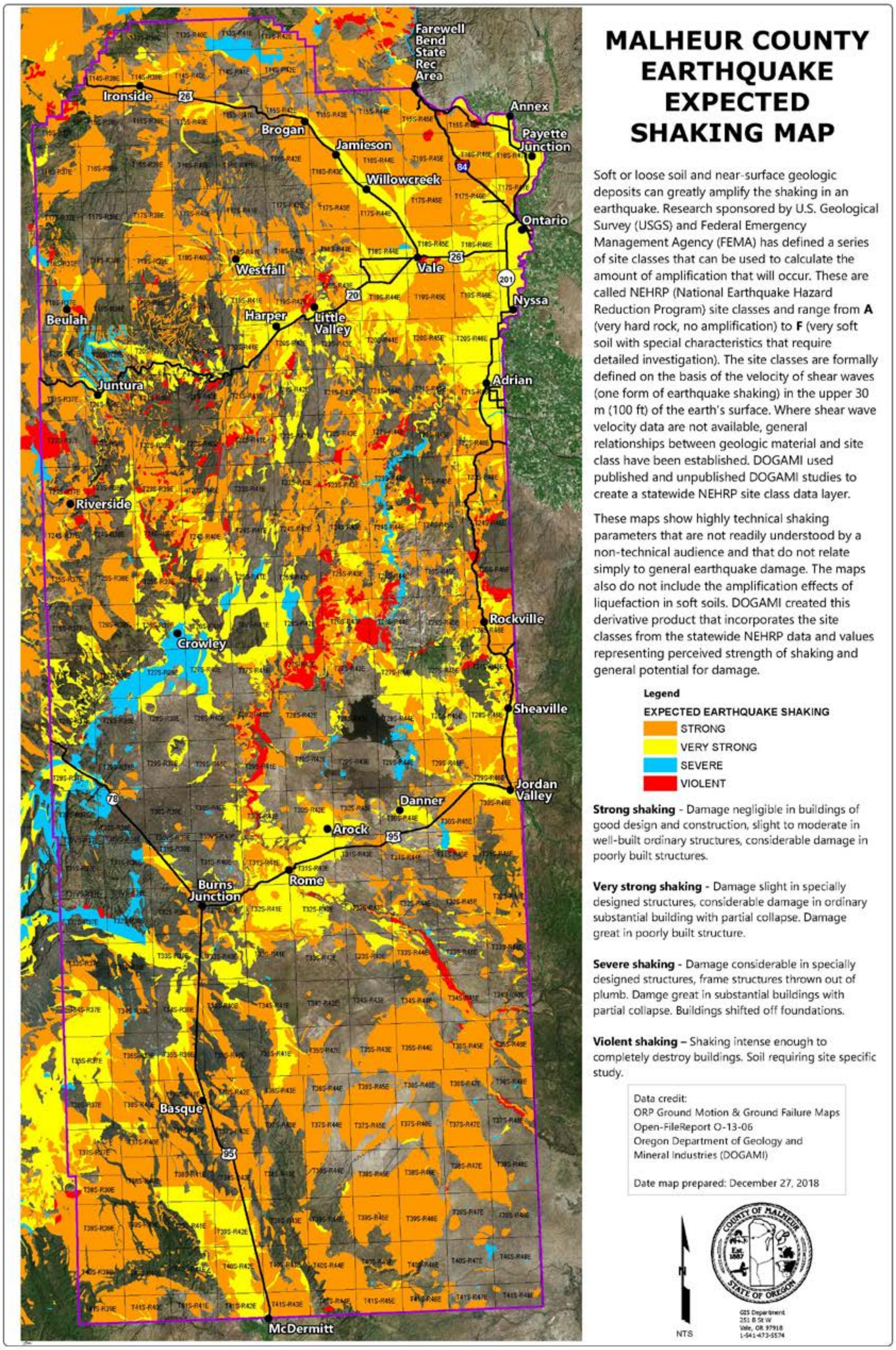
At the August 9, 2018 NHMP Steering Committee meeting, it was agreed that the risk level rankings from the HVA would be used as the way to prioritize the multi-hazard and hazard-specific mitigation actions. The risk level rankings are in Table 2-5 in Volume I Section 2 Risk Assessment.

Figure EQ-4 Malheur County Historical Earthquake



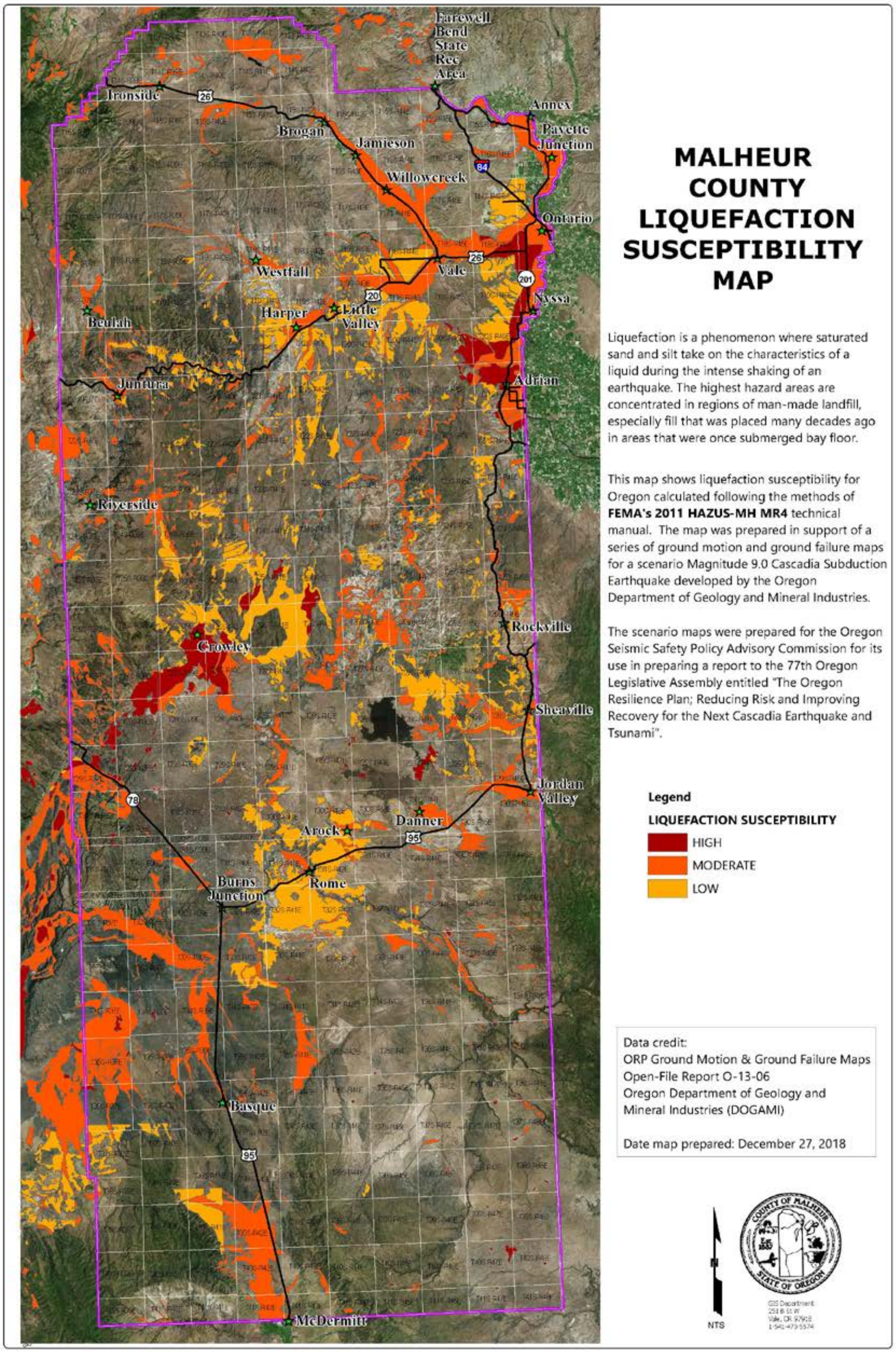
Source: Gina Lewis, Malheur County, January 2, 2019

Figure EQ-5 Malheur County Earthquake Expected Shaking Map



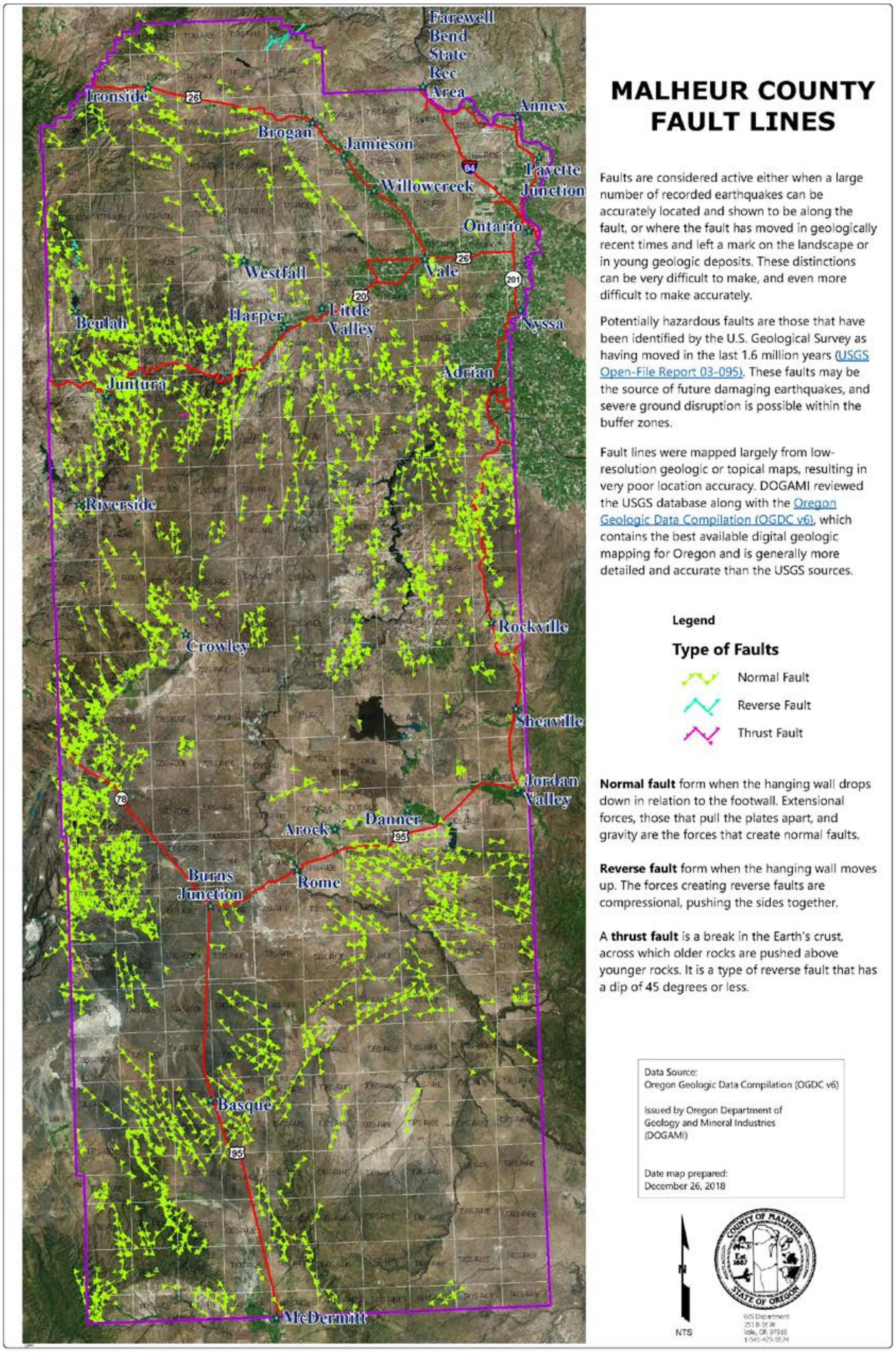
Source: Gina Lewis, Malheur County, December 31, 2018

Figure EQ-6 Malheur County Liquefaction Susceptibility Map



Source: Gina Lewis, Malheur County, January 2, 2019

Figure EQ-7 Malheur County Fault Lines



Source: Gina Lewis, Malheur County, January 2, 2019

Risk Score: 188

Risk Level: High-Medium

FLOOD HAZARD ANNEX

Causes and Characteristics of Flood

Flooding results when rain and snowmelt creates water flow that exceeds the carrying capacity of rivers, streams, channels, ditches, and other watercourses. In Oregon, flooding is most common from October through April when storms from the Pacific Ocean bring intense rainfall. Most of Oregon's destructive natural disasters have been floods.[1] Flooding can be aggravated when rain is accompanied by snowmelt and frozen ground; these are often called rain-on-snow events. The spring cycle of melting snow is the most common source of flood in the region.

Anticipating and planning for flood events is an important activity for Malheur County. Federal programs provide insurance and funding to communities engaging in flood hazard mitigation. The Federal Emergency Management Association (FEMA) manages the National Flood Insurance Program (NFIP) and the Hazard Mitigation Grant Program (HMGP). These programs provide grant money to owners of properties who have suffered losses from floods, and in some cases, suffered losses from other natural hazard events.

- The NFIP provides flood insurance and pays claims to policyholders who have suffered losses from floods.
- The HMGP provides grants to help mitigate flood hazards by elevating structures or relocating or removing them from flood hazard areas.

The principal types of flood that occur or may occur in Malheur County include riverine, flash floods, ice jams, and dam failures. These are discussed in the following paragraphs.

Riverine Flooding (Spring/ Snowmelt) Flooding

Flooding throughout the region is most commonly linked to the spring cycle of melting snow. Rain-on-snow floods are common in western Oregon, and also occur east of the Cascades. The weather pattern that produces these floods may occur during the winter or spring months and has come to be associated with La Nina events, a three to seven year cycle of cool, wet weather. In brief, cool, moist weather conditions are followed by a system of warm, moist air from tropical latitudes. The intense warm rain associated with this system quickly melts foothill and mountain snow. Above-freezing temperatures may occur well above pass levels (4,000-5,000 feet). Some of Oregon's most devastating floods are associated with these rain-on-snow events.

Spring runoff has caused significant riverine flooding in the County, resulting in damage along the Malheur, Snake, and Owyhee Rivers, in addition to some smaller tributaries. Most spring flooding has been precipitated by a particular combination of factors: ground saturation followed by a heavy ground freeze, a heavy snowpack in higher elevations, and then spring rains and Chinook winds causing sudden snow melt.

[1] Taylor, George H. and Chris Hannan, *The Oregon Weather Book*, Oregon State University Press, 1999.

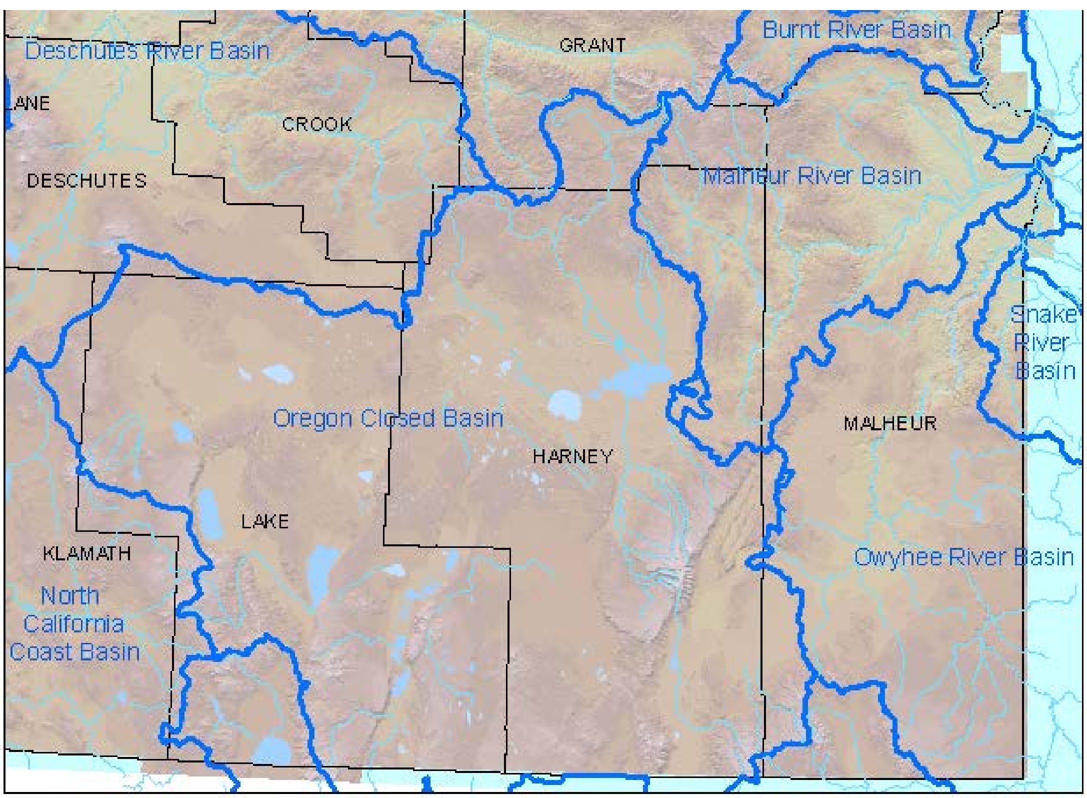
Flash Floods

Flash floods usually result from intense storms dropping large amounts of rain within a brief period. They usually occur in the summer during thunderstorm season, appear with little or no warning and can reach full peak in only a few minutes. They are most common in arid and semi-arid areas of Oregon like Malheur County where there is often steep topography, little vegetation, and intense but short-duration rainfall

In flash flood situations, waters not only rise rapidly, but also generally move at high velocities and often carry large amounts of debris. In these instances a flash flood may arrive as a fast moving wall of debris, mud, water or ice. Such material can accumulate at a natural or man-made obstruction and restrict the flow of water. Water held back in such a manner can cause flooding both upstream and then later downstream if the obstruction is removed or breaks free.

Malheur County experiences flash flood warnings every year. Generally, these have occurred in remote, sparsely populated areas of the County and have resulted in no widespread property or infrastructure damage. Some crop damage has occurred. Additionally, flash flooding risk is exacerbated by wildfire, which destroys flood mitigating vegetation and weakens soil, thus increasing an area’s vulnerability to severe flood-induced erosion. Irrigation districts have reported chronic minor problems with debris clogging along open irrigation canals as a result of flash floods.

Figure FL-1 Map of Major Drainage Basins, Lakes, Streams, and Rivers in the Region



Source: *2014 Malheur County NHMP*, Department of the Interior - Bureau of Land Management (BLM), Portland, Oregon.

Ice Jams

An ice jam, or ice dam, happens when chunks of ice clump together to block the flow of a river.This can result in severe flooding. Ice jams are caused by melting snow and ice in the springtime. Warm temperatures and spring rains cause snow and ice to melt very rapidly. This extra water causes frozen rivers and streams to swell up, and the layer of ice on top of the river begins to break up. The rushing river carries large chunks of ice downstream, and sometimes a group of ice chunks get stuck in a narrow river passage. The ice chunks form an ice jam, which blocks the natural flow of the river.[2]

Ice jams on the Snake and Malheur Rivers have created flood conditions in the past and will continue to do so due to local topography. Ice jams commonly happen during the winter and early spring, while the river is still frozen. Sudden warming at higher altitudes can melt waters resulting in increased runoff of water and ice into large reaches of frozen river below. On the way downstream, the ice can "jam" in narrow places on the river or against a road crossing, effectively damming the river, sometimes followed by a sudden breach and release of the water and ice. According to an Army Corps of Engineers report, this type of flooding is predictable, with the determining factor being a daily high temperature at Glenns Ferry, Idaho of 5 degrees F for five consecutive days. This will result in ice jams in the Ontario area. There are several bridges in the County, which can jam up with ice and debris flow in the aftermath of weather events such as the freezing and melting events mentioned above.[3]

Bridges which can be sites of ice jamming:

- 36th St Bridge outside Ontario, and
- Union Pacific railroad trestle near Nyssa.

Dam Failure

Major flooding could also result from partial or complete failure of man-made structures constructed to restrict the flow of water on Malheur County's waterways, either impounding reservoirs or diversion dams. There are 106 dams located in Malheur County that meet the statutory definition and are listed in the Oregon Water Resources Department's dam inventory datatabase (https://apps.wrd.state.or.us/apps/misc/dam_inventory/). The statutory definition is a dam that is 10 feet or higher and has a capacity for storage of at least 3 million gallons of water. This definition includes all the Bureau of Reclamation dams.[4] The largest dam in Malheur County is Owyhee Dam. Dams will be further discussed in the Hazard Vulnerability section of this Flood Hazard Annex.

---

[2] NOAA, *What is an Ice Jam?,* https://scijinks.gov/ice-jams/

[3] *2014 Malheur County Natural Hazards Mitigation Plan*, https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf

[4] Keith Mills, Oregon Water Resources Department, personal communication, December 27, 2018.

Factors that contribute to flooding in Malheur County

Precipitation

Malheur County averages 9 inches of rainfall and 11 inches of snow per year. On average, there are 211 sunny days per year. The July high temperature is around 92 degrees and the January low is around 22 degrees.[5] See the Severe Weather Hazard Annex for more details on weather and climate, as well as Appendix F Future Climate Projections Reports. As described in the previous paragraphs, rain-on-snow events often occur in the winter or spring and are the most common cause of flooding in Malheur County. Some of the most severe flood events in Malheur County were the result of rain falling on snow pack.

Geography

Malheur County is Oregon's second largest county in terms of landmass, covering 9,926 square miles. This is a region of high desert, mountain ranges, plateaus, and river valleys. Elevation in the county ranges from about 2,000 feet to nearly 8,000 feet above sea level.

Vegetation Cover

Malheur County has a relative lack of forested land. Grasslands naturally cover most of the region. Other vegetation, such as agricultural lands cover the county. The County is 94 percent rangeland.[6]

Location of Development

Development has followed the land use patterns of the early settlers; locating near Malheur County's large bodies of water in the northern portion. Consequently, development surrounding these low-lying water bodies is subject to increased risk from associated flood hazards.

When development is located in the floodplain, it may cause floodwaters to rise higher than before the development was located in the floodplain. This is particularly true if the development is located within the floodway. When structures or fill are placed in the floodplain, water is displaced. Development raises the base flood elevation by forcing the river to compensate for the flow space obstructed by the inserted structures. Over time, when structures or materials are added to the floodplain and no fill is removed to compensate, serious problems can arise.

Displacement of a few inches of water can mean the difference between no structural damage occurring in a given flood event and the inundation of many homes, businesses, and other facilities. Careful attention must be paid to development that occurs within the floodplain and floodway of a river system to ensure that structures are prepared to withstand flood events.

---

[5] Best Places, https://www.bestplaces.net/climate/county/oregon/malheur, accessed December 26, 2018.

[6] *Malheur County Community Wildfire Protection Plan (CWPP),* 2009, https://www.oregon.gov/ODF/Documents/Fire/CWPP/MalheurCounty.pdf

Surface Permeability

In urbanized areas, increased pavement leads to an increase in volume and velocity of runoff after a rainfall event, exacerbating potential flood hazards. Storm water systems collect and concentrate rainwater and then rapidly deliver it into the local waterway. Traditional stormwater systems are a benefit to urban areas, by quickly removing captured rainwater. However, they can be detrimental to areas downstream because they cause increased stream flows due to the rapid influx of captured stormwater into the waterway. It is very important to evaluate stormwater systems in conjunction with development in the floodplain to prevent unnecessary flooding to downstream properties. Frozen ground is another contributor to rapid runoff in the urban and rural environment.

Terms Related To Flooding

Floodplain

A floodplain is land adjacent to a river, stream, lake, estuary or other water body that is subject to inundation of water, otherwise known as flooding. These areas, if left undisturbed, act to store excess floodwater. The floodplain is made up of two areas: the flood fringe and the floodway. These are described below and illustrated in Figures FL-2 and FL-3.

Floodplains perform functions valuable to both humans and wildlife. Important functions of the floodplain might include: flood water storage, water quality maintenance, fish and wildlife habitat, and recreation/open space. Floodplains provide important habitat areas including river channels, riparian buffers, and wetlands. The variety of habitat types, the presence of water, and other factors result in a rich diversity of plant and animal species. Additionally, vegetation that grows in the floodplain influences how water flows across the land and can play a major role in controlling erosion and sediment deposition. When these features are lost, habitat and species diversity suffer.[7]

Under the National Floodplain Insurance Program (NFIP), areas that have a 1% chance in any given year of being covered by flood waters are mapped as a Special Flood Hazard Areas (SFHA), requiring floodplain management according to NFIP standards.[8] SFHA is the area where flood insurance is typically required for structures with federally-backed mortgages. The SFHA represents inundation from a given flooding source, such as a river, ocean, or lake, during a 1 percent annual chance probability (aka 100-year) flood event. The Base Flood Elevation (BFE) is the elevation of the 100-year flood event at a specific location in the SFHA.[9]

Floodway

The floodway is the portion of the floodplain that is closer to the river or stream. For NFIP and regulatory purposes, floodways are defined as the channel of a river or stream, and the over-bank

[7] Oregon Department of Land Conservation and Development, https://www.oregon.gov/lcd/NH/Pages/NFIP.aspx, accessed December 26, 2018.

[8] Ibid.

[9] DOGAMI, *Base Flood Elevation Determinations Fact Sheet*, https://www.oregongeology.org/pubs/fs/BFE-fact-sheet.pdf, accessed December 26, 2018.

areas adjacent to the channel. Unlike floodplains, floodways do not reflect a recognizable geologic feature. The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest.

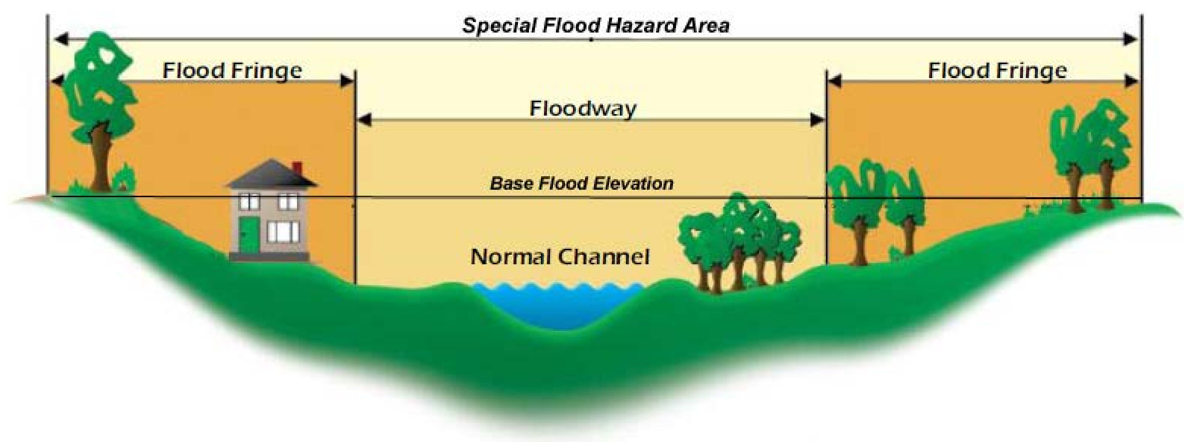
NFIP regulations require that the floodway be kept open and free from development or other structures, so that flood flows are not obstructed or diverted onto other properties. Floodways are not mapped for all rivers and streams but are typically mapped in developed areas.

According to FEMA, A "Regulatory Floodway" means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. Communities must regulate development in these floodways to ensure that there are no increases in upstream flood elevations. For streams and other watercourses where FEMA has provided Base Flood Elevations (BFEs), but no floodway has been designated, the community must review floodplain development on a case-by-case basis to ensure that increases in water surface elevations do not occur, or identify the need to adopt a floodway if adequate information is available.[10]

The Flood Fringe

The flood fringe refers to the outer portions of the floodplain, beginning at the edge of the floodway and continuing outward. This is the area where development is most likely to occur, and where precautions to protect life and property need to be taken.

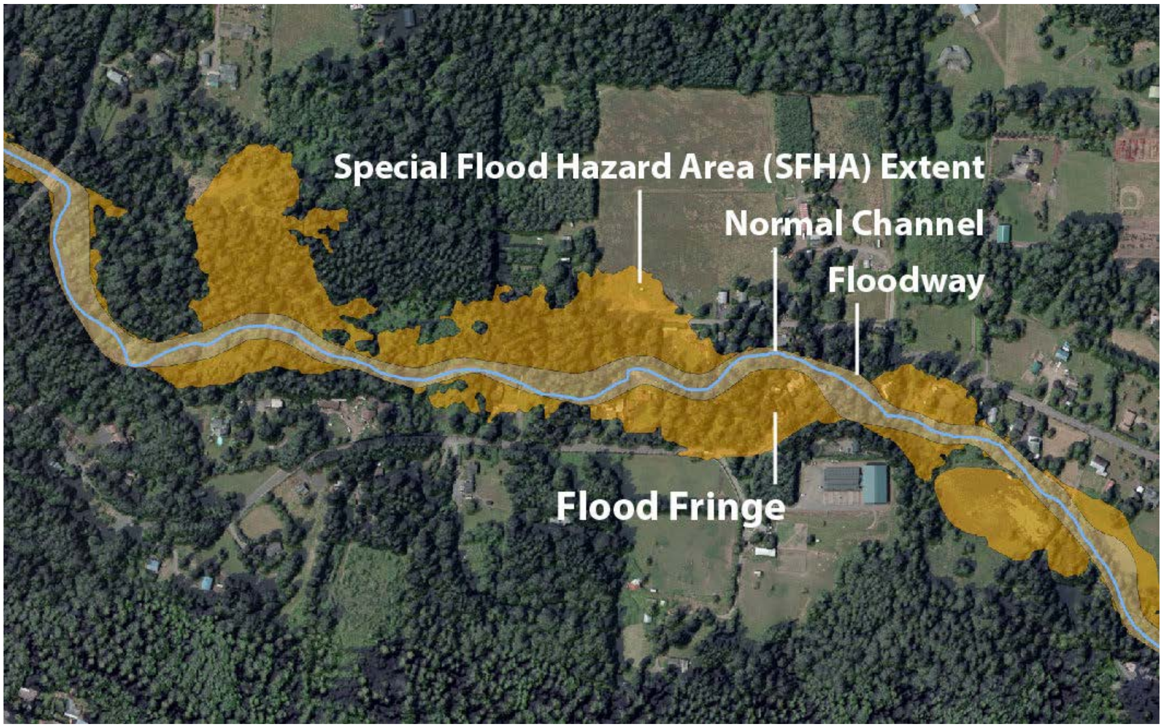
Figure FL-2 Cross Section View of the SFHA and its Components



Source: DOGAMI, Base Flood Elevation Determinations Fact Sheet, https://www.oregongeology.org/pubs/fs/BFE-fact-sheet.pdf, accessed December 26, 2018.

[10] FEMA, *Definition of Floodway*, https://www.fema.gov/floodway, accessed December 26, 2018.

Figure FL-3 Map View of the SFHA and its Components



Source: DOGAMI, Base Flood Elevation Determinations Fact Sheet, https://www.oregongeology.org/pubs/fs/BFE-fact-sheet.pdf, accessed December 26, 2018.

History of Floods in Malheur County

The interior drainage of closed basin lakes and creeks and rivers in southeastern Oregon have a long history of flooding. Floods are one of Malheur County's greatest natural hazard risks. Floods occur frequently and have historically caused damage to residential, commercial, and agricultural lands. Flooding in the County generally involves a rise in rivers or creeks caused by three frequently – occurring natural situations and one man-made situation: spring and summer flash floods, ice jams, spring runoff, and dam failure. These were described previously. Most of the lake water originates from high mountain snowpack above the basin. Flooding follows winters with deep snow accumulation. Such was the case in 1952 and subsequent years, when rain and snowmelt on frozen ground caused economic damage within the region. [11] Residential development, farms, ranches, public and private utilities, roads, and highways are at risk.

The floodplains along the Malheur River are devoted to agriculture while the floodplains along the Snake River include residential, commercial, industrial, and agricultural development.[12] Flooding also occurs on Jordan Creek and the Owyhee River.

Not all flood sources affect all jurisdictions in Malheur County. Principal flood sources in Malheur County are, according to FEMA's *Malheur County Flood Insurance Study*: Snake River, Malheur River, Owyhee River, Bully Creek, Willow Creek, Jordan Creek, Indian Creek, Clover Creek, and

---

[11] FEMA, *Malheur County Flood Insurance Study* (FIS), September 29, 1986.

[12] Ibid.

Cottonwood Creek.[13] Floods of significant size have occurred periodically within Malheur County, particularly in association with flooding of the Malheur and Snake Rivers. Damaging floods have occurred on the Malheur River as early as 1910. Other floods along the Malheur River caused significant damage in 1910, 1952, and 1957. Damaging floods along the Snake River have occurred since early settlements. Table FL-1 shows the history of major flood events within Malheur County.

Table FL-1 Significant Historic Floods

Date	Location	Type of Flood	Description
1904	Harney and Malheur Counties	River flooding	Severe flooding on the Silvies and Malheur Rivers. The City of Vale was impacted.
Mar. 1910	Malheur County	River flooding	Severe Malheur River flooding in March.
Feb. 1925	Malheur County	River flooding	Flooding
Mr. 1932	Malheur County	River flooding	The Malheur, Grande Ronde, John Day, and Umpqua Rivers flooded.
May 1948	Columbia River	River flooding	Columbia River crested at 34.4 ft. Flood stage at that time was 15 ft. This is the flood that destroyed the City of Vanport. Fifteen people died in the flood.
1952	Harney and Malheur Counties	River flooding	Severe flooding on Jordan Creek, and the Silvies, Malheur, Grand Ronde, and John Day Rivers. The highest flood stages on these rivers in 40 years; 6 families evacuated. Bridges and railroads under water.
Dec. 1955	Statewide	Rain on snow	DR-49. Event occurred on December 29, 1955. Flooding and strong winds; 5 fatalities.
Jul. 1956	Statewide	Storms, flooding	DR-60. Event occurred on July 20, 1956. Storms and flooding.
Feb. 1957	Harney and Malheur Counties	Warm rain on snow/frozen ground	Severe flooding on Jordan Creek, the Silvies and Malheur Rivers. $3.2 million in flood damage. Vale business district inundated, agricultural damage, cattle drowned, two bridges washed out, and 40 homes inundated.
Mar. 1957	Statewide	Flooding	DR-69. Event occurred on March 1, 1957.
1959	Malheur County	Flooding	Flooding on Jordan Creek in Jordan Valley.
Oct. 1962	Statewide	Storms	DR-136. Event occurred on October 12, 1962. Referred to as the Columbus Day Storm.
Feb. 1963	Statewide	Flooding	DR-144. Event occurred on February 25, 1963. There was flooding in Vale area along the Malheur River.
Dec. 1964	Statewide	Heavy rains, flooding, rain on snow	DR-184. Event occurred on December 24, 1964. Statewide damage totaled $157 million and 17 deaths.
Jan. 1971	Malheur County	Flooding	Moderate flooding on the Malheur River.
Apr. 1972	Malheur County	Flooding	Moderate flooding on the Owyhee River.
Jan. 1974	Western Oregon	Rain on snow, flooding	DR-413. Flooding resulted from rain on snow events. Willamette River at Portland crested at 25.7 feet. Nine counties declared disasters.
Apr. 1978	Malheur County	Flooding	Moderate flooding on Malheur, Owyhee, and Bully Creek Rivers; cost $46,000.
Fe. 1982	Malheur County	Flooding	Moderate flooding in the Malheur and Owyhee Basins. One bridge was damaged, four homes and several agricultural fields flooded.
Mar. 1983	Malheur County	Flooding	Mild flooding in Vale; one house was surrounded by water.
Mar. – Apr. 1983	Malheur County	Flooding	Moderate flooding on Owyhee River; cost $2,750,000.
Dec. 1985	Malheur County	Ice jam flooding	40 miles of ice on Snake River between Farewell Bend and Ontario. At least 35 people evacuated.
Feb. 1986	Statewide	Snow melt, flooding	Intense rain, a melting snow, and flooding. Some homes evacuated. Event occurred February 22-23.
Jun. 1989	Malheur County	Flash flood	Flash Flood, high winds, and crops damaged. It was near Nyssa.
Jul. 1989	South and Central Oregon	Flooding	On July 15, there was snow melt flood in Lake, Malheur, and neighboring counties. Warm rains, hail caused extensive

[13] ibid.

Date	Location	Type of Flood	Description
			snowpack melt which occurred quickly; many rivers and creeks overflowed.
1990	Western Oregon	Rain on snow, flooding	Ten rivers in eight counties were flooding in a rain-on-snow weather event. Many bridges were washed away.
Aug. 1990	Harney and Malheur Counties	Thunderstorms	Thunderstorms, hail, wind, and flooding occurred on August 20. There was $2,500 in crop damage in Harney County and $27,500 damage in Malheur County.
Mar. 1993	Malheur and Harney Counties	Warm rain on heavy snowpack	There was widespread flooding in rural areas; highways were closed. The Owyhee River had flood of record. Event occurred March 18-21. There were 4 houses evacuated; 36th St. bridge in Ontario damaged. Noted $550,000 property damage.
Feb. 1996	Statewide	Storms, flooding, rain on snow	DR-1099. Winter storms with rain, snow, ice, floods, and landslides. Power outages, road closures and property damage. Warm temperatures, record breaking rains; extensive flooding in Multnomah County; widespread closures of major highways and secondary roads; 8 fatalities. There are 27 counties covered by the disaster declaration.
Aug. 1996	Malheur County	Flooding	There was a flash flood west of Burns Junction on August 27.
Dec. 1996-Jan. 1997	Statewide	Winter storm, flooding	DR-1160. Severe snow and ice. Up to 4 to 5 inches of ice in the Columbia Gorge. Interstate 84 closed for 4 days. Hundreds of downed trees and power lines. Lake County received $219,382; Lakeview receive $30,701, and Paisley received $2,909 from FEMA to repair and replace damaged structures.
Jun. 1997	Malheur County	Flooding	On June 11 there was a flash flood near Westfall; it was caused by a thunderstorm.
Sep. 1997	Malheur County	Flooding	Heavy showers and thunderstorms triggered minor flash flooding in Adrian and Nyssa on September 11.
Apr. - May 1998	Malheur, Lake, and Harney Counties	Persistent rain on mountain snowpack	Numerous monthly rainfall records set. There was widespread flooding; mudslides in Malheur County. There was a flood in Jordan Valley on May 13. Three homes were sandbagged. There was a flood on May 23 north of Harper. Also on May 23, in Westfall, a house had its shingles torn off and the siding come off the barn. Secretarial Natural Disaster Determination for flooding in Lake County.
Jun. 1998	Malheur County	Flooding	Severe thunderstorm, flooding, and landslides throughout the county on June 12. Flash flood in the Juntura area.
Jul. 1998	Malheur County	Flooding	Scattered thunderstorms produced minor flash floods. There was a flash flood in Ironside.
Jan.-Feb. 1999	NW Oregon	Rain, flooding, landslides, mudslides	Widespread flooding on smaller rivers and streams; numerous landslides and mudslides.
Jun. 2002	Malheur County	Flooding	Slow moving thunderstorms dropped heavy rainfall on June 23. Flash flood near the Bake-Malheur County line.
Aug. 2002	Malheur County	Flooding	Very heavy rainfall and flash flood in Juntura.
Jul. 2003	Malheur County	Flooding	Very heavy rainfall from slow moving thunderstorms caused flash flooding. Occurred in east-central Malheur County. Flash flood in Ontario and Harper on July 26.
Jun. 2004	Malheur County	Flooding	On June 29 there was a flash flood in Sheaville.
Jun. 2004	Malheur County	Flooding	On June 30 there was a flash flood between Harper and Westfall.
Jan. – Apr. 2006	Malheur County	Flooding	Malheur River flooded. Moderate flooding, roads blocked by high water, minor roadway damage, agricultural fields flooded.

Date	Location	Type of Flood	Description
Nov. 2006	Statewide	Severe storms, flooding, landslides, mudslides	DR-1672. The events occurred November 6-8, 2006. The declared disaster included Hood River, Clatsop, Lincoln, and Tillamook Counties.
Dec. 2008	Statewide	Winter storms, heavy rain, flooding	DR-1824. Severe winter storm, flooding, winds, record and near record snow, landslides and mudslides. Gresham received, 26" of snow. Many roads closed. Significant damages to public infrastructure, homes and businesses. Event occurred Dec. 13-26. Counties in the declaration: Clackamas, Clatsop, Columbia, Marion, Multnomah, Polk, Yamhill, and Hood River.
Jun. 2009	Harney and Malheur Counties	Thunderstorm flood	Sections of 205 washed out near Wild Horse Ranch. On June 13 there was a flash flood in Unity as a result of high intensity rainfall.
Aug. 2010	Malheur County	Flooding	On August 6 there was a flash flood in Ontario.
Jan. 2011	Statewide	Winter storm	DR-1956. Severe winter storm, flooding, mudslides, landslides, and debris flows. Malheur River flooded on January 17.
Apr. 2011	Harney, Malheur, and Baker Counties	Basin flooding	There was widespread basin flooding on the Silvies River. ODOT closed and breached U.S.20 at milepost 132.6 on April 8, 2011, for flood relief. The breach was done by the request of Harney County Emergency Operations Center to avoid damage to nearby residences; larger culverts were later installed. Heavy Rain and snowmelt in Baker and Malheur County on May 15.
Jan. 2012	W. Oregon	Severe winter storms, flooding, landslides, mudslides	DR-4055. The incident period was January 12-21, 2012. Severe winter storm with flooding, landslides, and mudslides. Declaration involves 12 counties including Hood River County.
Dec. 2015	Western Oregon	Winter storm, heavy rain	DR-4258. Severe winter storms, straight-line winds, flooding, landslides, and mudslides.
Jan. 2017	Hood River, Columbia, Deschutes, Josephine Counties	Severe winter storms, flooding, landslides, mudslides	DR-4238. The event occurred January 7-10, 2017.

Sources: University of Oregon, Malheur County NHMP, May 2014; DLCD, Oregon NHMP, 2015; FEMA, Disaster Declarations for Oregon, retrieved 2017; Taylor and Hatton, 1999.

Risk Assessment

How are Hazards Identified?

Malheur County features multiple rivers and creeks that are susceptible to annual flooding events that pose threats to life and safety and cause significant property damage. These flood sources include Malheur River, Snake River, Bully Creek, Willow Creek, Owyhee River, and Jordan Creek.[14] Malheur County's FIRM floodplain maps have not been updated since 1986 and the maps do not reflect current flood patterns. Updating the floodplain maps would be a useful action that would increase the accuracy of floodplain information and increase the County's ability, as well as the Cities abilities, to make sound planning and hazard mitigation decisions about flood management.

[14] FEMA, *Malheur County FIS*, September 29, 1986

National Flood Insurance Program (NFIP)

The Malheur County Flood Insurance Rate Maps (FIRMs), like much of eastern Oregon, are not modernized. Table FL-2 shows that as of November 2018, Malheur County, including the incorporated cities, has 109 National Flood Insurance Program (NFIP) policies in force.

There have been 26 paid claims. The last Community Assistance Visit (CAV) in Malheur County was on September 27, 2011 with the City of Ontario. Malheur County and the Cities of Ontario, Nyssa, and Vale are not members of the Community Rating System (CRS).

The table for Malheur County identifies zero repetitive loss building and zero severe repetitive loss claims. There are also zero repetitive loss and repetitive severe loss buildings within the Cities of Nyssa, Vale and Ontario.[15]

[15] Celinda Adair, Department of Land Conservation and Development, November 30, 2018 and David Lentzner, Department of Land Conservation and Development, personal communication, December 14, 2018.

Table FL-2 Flood Insurance Detail

Jurisdiction	Insurance in Force	Total Paid Claims	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Paid Amount	Repetitive Loss Structures	Severe Repetitive Loss Properties	# Policies	Last Community Assistance Visit
Malheur County	$ 20,455,100	26	13	1	$ 104,198	0	0	109	-
Unincorporated	$13,463,500	15	5	1	$30,230	0	0	69	6/28/1993
Adrian	$ 300,500	0	0	0	$0.00	0	0	2	7/1/1989
Jordan Valley	993,400	0	0	0	$ -	0	0	5	6/30/1993
Nyssa	128,700	1	1	0	$ 2,736	0	0	1	
Ontario	4,484,000	3	1	0	58,195	0	0	28	9/27/2011
Vale	1,085,000	7	6	0	13,037	0	0	4	7/1/1989

NP - Not Participating , No FIRM

NA - Information not Available/ Not Applicable

-- none

CIS accessed 11/30/2018 by Celinda Adair, NFIP Coordinator

Source: Celinda Adair, Department of Land Conservation and Development, November 30, 2018 and David Lentzner, Department of Land Conservation and Development, personal communication, December 14, 2018.

Hazard Risk Analysis

The Malheur County NHMP Steering Committee (SC) completed a Hazard Vulnerability Assessment/Analysis (HVA) on April 18, 2018. This was described in Section 2 Risk Assessment. The method used for the HVA was developed from a Federal Emergency Management Agency (FEMA) tool that has been refined by the Oregon Military Department – Office of Emergency Management (OEM). It addresses and weights (shown as percent within parentheses) probability (29%), vulnerability (21%), maximum threat (42%) and the history (8%) of each natural hazard and attributes a final hazard analysis score. The methodology produces scores that range from 24 to 240.

For local governments, conducting the HVA is a useful step in planning for hazard mitigation. The method provides the jurisdiction with a relative ranking from which to prioritize mitigation actions, but does not predict the occurrence of a particular hazard.

In 2013 flood hazards had a risk score of 240 and a rank of 1 out of 11 natural hazards. In 2018 flood hazards had a risk score of 188 and a rank of 4 out of 11 natural hazards.

For more information on all the risk scores and ranks of the natural hazards, see Volume I Basic Plan, Section 2 Risk Assessment of this NHMP.

Probability Assessment

The probability of an occurrence has been assessed by FEMA and is displayed on the Federal Insurance Rate Maps (FIRM). FEMA has mapped the 10, 50, 100, and 500-year floodplains in the Malheur County. This corresponds to a 10%, 2%, 1% and 0.2% chance of a certain magnitude flood in any given year. In addition, FEMA has mapped the 100-year floodplain (i.e., 1% flood) in the incorporated cities. The 100-year flood is the benchmark upon which the National Flood Insurance Program (NFIP) is based. The FIRM maps were issued on September 29, 1986 for Malheur County.

Vulnerability Assessment

The County has insufficient data to fully calculate potential flood losses. This is due to the unpredictability of flood severity and length, limited local records in terms of quantifying losses, and the use of outdated maps from 1986. The SC identified a mitigation action “update the FEMA Flood Insurance Rate Maps (FIRMs) for the County and Cities” (FL-#4). The priority of the mitigation action is medium-high, which corresponds to the risk level that the SC determined for floods using the OEM Methodology. See Section 2 Risk Assessment for additional information.

The potential for dam failures exists in Malheur County. The Oregon Water and Resources Department (OWRD) has inventoried all dams located in Oregon and Malheur County. Table FL-3 lists the number of dams by hazard level: high, significant, and low. Table FL-4 ldescribes the high hazard dams and reservoirs. These facilities need regular maintenance and repair; dams may crack or break. Inspections occur to check the conditions of the dams and reservoirs.

Of particular concern for Vale is the Bully Creek Dam and Reservoir. According to OWRD staff, there Bully Creek Dam failed in 1925 and after that the Bureau of Reclamation took ownership. Other notable concerns include the Willow Creek 3 (Malheur Dam) and the Malheur Reservoir (see below for additional information), the Pole Creek Dam, the Crowley Dam, and the Owyhee Dam. Willow Creek (Malheur) Dam is a 110 foot tall dam on Willow Creek in the northern part of Malheur County. Willow Creeks flows between Ironside and Vale, OR. The dam is listed in unsatisfactory condition and is owned by Orchard Water Company. Pull Creek Dam is also owned by the Orchard Water Company and it is listed in poor condition. Crowley Dam in Crowley is in unsatisfactory condition and is owned by an individual.[16]

Table FL-3 Malheur County Dam Inventory

Number of Dams	Hazard Level or Potential
10	High
4	Significant
92	Low

Source: Oregon Water Resources Department, Dam Inventory Query, http://apps.wrd.state.or.us/apps/misc/dam_inventory/, accessed December 27, 2018.

Table FL-4 High Hazard Level Dams and Reservoirs in Malheur County

Large Dams and Reservoirs	Acre Feet Capacity	Hazard Level or Potential	Location
Owyhee Dam and Reservoir	715,000 acre feet	High	31 miles SW of Nyssa
Warm Springs Dam and Reservoir	192,400 acre feet	High	13 miles SW of Juntura*
Agency Valley Dam and Reservoir	59,900 acre feet	High	15 miles N of Juntura
Bully Creek Dam and Reservoir	31.650 acre feet	High	10 miles W of Vale
Antelope Reservoir**	70,000 acre feet	High	11 miles SW of Jordan Valley
Willow Creek 3 (Malheur) and Malheur Reservoir**	94,000 acre feet	High	18 miles E of Ironside, near Brogan
Pole Creek Reservoir	1,525 acre feet	High	15 miles N of Vale
Crowley Dam	3,700 acre feet	High	115 miles SW of Ontario
Rock Creek	834 acre feet	High	9 miles W of Vale
Lonesome Lake	186 acre feet	High	On the border of Oregon and Idaho south of Adrian (Google maps lists it at 43◦36’27.8”N, 117◦01’36.9”W)

*Unincorporated community
**Not operated by the federal Bureau of Reclamation; owned and operated by irrigation districts or water companies.

[16] Keith Mills, Oregon Department of Water Resources, personal communication, December 27, 2018.

Source: Oregon Water Resources Department, Dam Inventory Query, http://apps.wrd.state.or.us/apps/misc/dam_inventory/, accessed March 2013 for the 2014 Malheur County NHMP and data was updated and expanded on December 27, 2018 and January 14, 2019; Tony Janicek, Oregon Department of Water Resources, personal communication, February 25, 2019; Keith Mills, Oregon Department of Water Resources, personal communication, February 26, 2019.

Willow Creek 3 (Malheur) Dam

The following information is provided by Keith Mills and Tony Janicek of OWRD. The note the dam is much more vulnerable to failure in a flood (or in other conditions as well) than any other dam in Malheur County, and is the only one that they are aware of with a formal safety restriction. [17]

Malheur (Willow Creek 3) Dam was designed as a 125 foot embankment dam. However, when originally constructed in 1911 the dam was only built to a height of 100 feet. At some point during the Depression the dam was raised an additional 25 feet to the full 125 foot design height. Due to limited water availability, the reservoir did not fill to the level of the raised portion until 1942. Shortly after the water reached this level, movement and cracking of the raised portion of the dam was observed, and a potential failure condition existed. An investigation concluded that the movement and cracking resulted from saturation and consolidation of the material in the raised portion. The investigation also determined that the material used to build the 25 foot raised portion of the dam was of poor quality and not suitable for use in building the dam. As a result, a water level restriction was set so that the water level in the reservoir would not reach the raised portion of the embankment. The dam has not been rehabilitated to fix deficiencies of the 25 foot raised portion and the water level restriction remains in place. The dam remains in unsatisfactory condition, and is unsafe if water levels rise much above the formal restriction.

A spillway is a key safety feature of a dam that allows the dam to pass flood flows from significant storm events without the dam overtopping. In the case of Malheur Dam, the water level restriction is well below the entrance to the emergency spillway. As a result, any significant incoming flood flows would raise the reservoir level past the restriction level before the reservoir level reached the emergency spillway and make the dam unsafe. As seen in the 1943 incident, when the water level reaches the restriction level, the structural integrity of the dam is compromised, greatly increasing the risk of dam failure. Since the restriction was put in place, there has not been a significant storm event that could generate flood flows which would cause the reservoir level to exceed the restriction level. However, a significant storm event will eventually occur that causes the reservoir level to increase past the restriction level. If the flood is large enough, it will cause the dam to fail.

When a dam fails, known as a dam breach, a large flood wave is generated which ultimately inundates areas downstream of the dam. If Malheur dam were to breach, large portions of Vale and Ontario (several hundred homes and businesses) would be inundated by the breach flood wave, to depths and velocities that would result in many fatalities.

Two important projects that provide irrigation water in Malheur County are the Vale Project and the Owyhee Project, both are operated by the Bureau of Reclamation.

[17] Keith Mills, OWRD, personal communication, January 2 and 14, 2019.

Vale Project

"The Vale Project lands are located along the Malheur River and Willow Creek in east-central Oregon, surrounding the town of Vale. The project furnishes irrigation water to 35,000 acres of land. Features include Agency Valley Dam and Beulah Reservoir, Bully Creek Dam and Reservoir, Harper Diversion Dam, Vale Main Canal, and a distribution and drainage system. To supplement project needs, the Federal Government purchased one-half of the storage rights in the Warm Springs Reservoir built by the Warm Springs Irrigation District."[18]

Owyhee Project

The Owyhee Dam and Reservoir make up the Bureau of Reclamation's Owyhee Project, which is designed to furnish irrigation water to the land along the Snake River in Malheur County and in Idaho. "The Owyhee Project lies west of the Snake River in Malheur County, Oregon, and Owyhee County, Idaho. Principal towns in the area are Homedale, Idaho, and Adrian, Nyssa, and Ontario, Oregon. The project furnishes a full irrigation water supply to over 105,000 acres of land lying along the west side of the Snake River in eastern Oregon and southwestern Idaho. An additional 13,000 acres are furnished supplemental water. About 72 percent of the lands are in Oregon, and 28 percent in Idaho. Irrigable lands are divided into the Mitchell Butte, Dead Ox Flat, and Succor Creek Divisions. The key feature of the project is Owyhee Dam, on the Owyhee River about 11 miles southwest of Adrian, Oregon, which acts as both a storage and diversion structure. Project works also include canals, pipelines, tunnels, 9 pumping plants, laterals and drains."[19]

According to the Bureau of Reclamation staff, the Owyhee Project now serves 124,992 acres.[20]

A complete failure of Owyhee Dam would inundate the cities of Ontario, Nyssa, and Adrian, in addition to residential and agricultural land along the Owyhee River and potentially the Snake and Malheur Rivers as well. The risk of dam failure was assessed by the Steering Committee during the *2014 Malheur County NHMP* and again during the *2019 Malheur County NHMP*. They used the OEM methodology described in Volume I, Section 2 Risk Assessment. The SC found that while the maximum threat for dam failure was high (major disaster), the probability of such an event is low, as is vulnerability. Of note, the Malheur County Sheriff's Office keeps emergency plans on file for each major County dam in addition to those managed by Idaho, which could potentially affect Malheur County. An Emergency Action Plan is required for all high hazard dams. These must be completed by owners of high hazard dams and copies must be sent to the Dam Safety Program and to the State Emergency Management Office.[21]

The Owyhee Dam was created [partially] in attempt to control flooding. Owyhee Dam impounds 715,000 acre feet of irrigation water and powers a small electrical generation station. The total

---

[18] Bureau of Reclamation, https://www.usbr.gov/projects/index.php?id=415, accessed December 26, 2018. Reaffirmed by Kayla Griffin, Bureau of Reclamation, personal communication, January 9, 2019.

[19] Bureau of Reclamation, https://www.usbr.gov/projects/index.php?id=374, accessed December 26, 2018.

[20] Kayla Griffin, Bureau of Reclamation, personal communication, January 9, 2019.

[21] Oregon Water Resources Department, https://www.oregon.gov/OWRD/programs/streamslakessanddams/dams/DSProgram/Pages/default.aspx, accessed December 26, 2018.

capacity is 1,120,000 acre-feet.[22] The informal flood control allocation curves require a minimum of 70,000 acre-feet of vacant space through the end of February, and more beginning in January, if the inflow forecast is sufficiently large. The goal of the flood control is to limit the flow of the Owyhee River below the Owyhee Dam to 12,000 cfs.[23]

High vulnerabilities for Malheur County and the Cities:

- Outdated FIRM maps for the County and the Cities. Having updated, digital maps would greatly help the County and the Cities plan flood mitigation actions.
- Evaluate and update County and the Cities floodplain ordinances. Using updated, digital maps to re-evaluate and update ordinances could better address existing and new development in the floodplain.
- The County and Cities participation in NFIP could be evaluated and further addressed for more effective mitigation of the flood hazard.
- Ontario has minor issues with stormwater drainage in flood conditions and has a list of recommended repairs/upgrades in its *2003 Stormwater Management Plan*. These recommendations should be implemented.
- The location of so many critical facilities, infrastructure, and lifelines in areas subject to floods (see Table 2-7) increases Malheur County's and the City of Ontario's vulnerability.

Community Hazard Issues

What is susceptible to damage during a hazard event?

The extent of the damage and risk to people caused by flood events is primarily dependent on the depth and velocity of floodwaters. Fast moving floodwaters can wash buildings off their foundations and sweep vehicles downstream. Roads, bridges, other infrastructure, and lifelines (pipelines, utility, water, sewer, communications systems, etc.) can be seriously damaged when high water combines with flood debris, mud and ice. Extensive flood damage to residences and other structures can result in basement flooding and landslide damage related to soil saturation. Surface water entering into crawlspaces, basements, and daylight basements is common during flood events not only in or near flooded areas but also on hillsides and other areas far removed from floodplains. Most damage is caused by water saturating materials susceptible to loss (e.g., wood, insulation, wallboard, fabric, furnishings, floor coverings and appliances). If not properly protected from the entry of floodwaters, mechanical, electrical and similar equipment can also be damaged or destroyed by flooding.

Community Flood Issues

Human Life

Protection of human life is of primary importance. Keeping homes, businesses, and other places safe from floods will also help protect human life.

[22] Bureau of Land Reclamation, Owyhee Dam, https://www.usbr.gov/projects/index.php?id=315, accessed December 26, 2018.

[23] Brule Lehman, Owyhee Irrigation District, personal communication, January 2, 2019.

Critical Facilities/Lifelines

Critical Facilities, Critical Infrastructure, and Lifelines for Malheur County and the Cities are identified in Table 2-7 in Volume I Section 2 Risk Assessment. Of note, quite a few of the listed facilities are subject to potential flood impacts, including the major regional hospital for Malheur County. The hospital is located in Ontario; it is outside of the Special Flood Hazard Area. The location of so many critical facilities in areas subject to floods increases Malheur County's and the City of Ontario's vulnerability.

Private Property

Homes

Homes in frequently flooded areas can also experience blocked sewer lines and damage to septic systems and drain fields. This is particularly the case of residences in rural flood prone areas who commonly utilize private individual sewage treatment systems. Inundation of these systems can result in the leakage of wastewater into surrounding areas creating the risk of serious water pollution and public health threats. This kind of damage can render homes unlivable.

Manufactured Homes

Many older manufactured home parks are located in floodplain areas. Manufactured homes have a lower level of structural stability compared to traditional lumber-built homes. Manufactured homes in floodplain zones should be anchored to provide additional structural stability during flood events.

Businesses

Floods impact businesses by damaging property and interrupting commerce. The economic losses due to business closures often total more than the initial property losses that result from 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. Flood events can cut off customer access and close businesses for repairs. A quick response to the needs of businesses affected by flood events can help a community maintain economic viability in the face of flood damage.

Public Infrastructure Flood Issues

Public buildings such as libraries, schools, and government buildings are of concern to Malheur County due to their potential utility in the event of a flood. These buildings can sometimes be used as temporary locations for medical and emergency housing services.

Road are important to the local economy, and during hazard events, resilient road connections are critical for providing essential and emergency services. Roads are maintained by multiple jurisdictions. Federal, state, county, and city governments all have a stake in protecting roads from flood damage. Road networks in Malheur County frequently cross floodplain and floodway areas.

Bridges

Bridges are key points of concern during flood events for two primary reasons:

1. Bridges are often important links in road networks, crossing watercourses or other significant natural features.

2. Bridges can be obstructions in the floodway, collecting debris and inhibiting the flow of water during flood events. This can cause water to back up and inundate areas upstream from the bridge that would not otherwise be affected. Also, this build-up of water can suddenly release, causing a flash flood of larger magnitude downstream.

Wastewater and Drinking Water Systems

Flood events significantly impact drinking water and wastewater systems. When sewer systems are inundated with floodwaters, raw sewage can be flushed into the waterways, posing a significant health hazard. Additionally, drinking water supplies can be contaminated with flushed wastewater or high levels of solids (eroded soil for example), and made unsafe for consumption. Both water and sewage systems often require significant repair and maintenance work following a flood event.

Stormwater

Stormwater systems collect and concentrate rainwater and rapidly deliver it into the local waterway. This infusion of water causes increased flows downstream. During large rainstorms and floods, these systems are pushed past their capacity and storm water begins flowing over-ground, causing other infrastructure damage. Traditional stormwater systems are a benefit to urban areas by quickly removing captured rainwater, however, they can be detrimental to areas downstream.

Other problems often develop where open ditches enter culverts or go underground into stormwater systems. An obstruction at these intersections causes overland water flow. The filling of ditches and swales near buildings can inhibit or prevent the flow of water can compound these problems. Inadequate maintenance, especially following leaf accumulation in the fall, can also contribute to the flood hazard in urban areas.

Parks and Open Space

Public parks and publicly owned open space can provide a buffer between flood hazards and private property. Wetlands in public ownership can reduce flood impacts by absorbing floodwaters and buffering water level fluctuations.

Power Supply

Flooding also significantly impacts electrical supply systems. Floodwaters short-out electrical lines and cause transformers to fail. Additionally, debris transported by floods can knock down power poles and put live, high-voltage lines in the water, posing a serious electrocution hazard to people.

Communications/Phone Lines

Telephone and cable lines are similarly susceptible to floodwaters and floating debris. Underground lines are more resistant to flood damage, but often are exposed and damaged by swift currents.

City Specific Damage

There are four mitigation actions related to the County and Cities and four specific to the Cities.

Ontario

The City of Ontario is adjacent to both the Snake and Malheur Rivers and vulnerable to flooding from both of these sources, especially from spring runoff and ice jams. According to Table FL-2, there have only been three paid NFIP claims in Ontario. There are two mitigation actions specific to the City of Ontario, FL-3 and FL-7.

Nyssa

Much of the City's infrastructure is located on the Snake River's floodplain. Nyssa is bordered on the east by the Snake River. Like all other Malheur County cities except for Vale, Nyssa is also within the floodway should the Owyhee Dam collapse. Steering Committee members noted that the City has not had significant flooding in approximately 20 years. Minor flooding (described as often just outside of city limits, none in the downtown core) has occurred relatively frequently. For example, in 2006, most parts of Malheur County near waterways experienced flooding.

Ice jams are the biggest flood concern for floods on the Snake River near Nyssa, but spring runoff flooding and flash floods are also a risk. A Union Pacific railroad trestle located just south of the City is the most frequent site of the ice jams, which cause water on the Snake River to back up and send overflow waters into agricultural and light industrial/commercial areas on the south side of Nyssa. Ice jam floods have also historically threatened the public school buildings and blocked Main Street and State Highway 20/26, at the western edge Nyssa where it crosses the Snake River into Idaho.

The City's domestic water wells #s 1-5 are located near the Snake River and in flood events are at risk of inundation, posing a threat to the City's potable water supply. The City has two other municipal water wells, #s 7 and 9, but these do not have an arsenic removal system and are thus unusable for drinking water. Nyssa did a project to make the well water in South Park available in case of an emergency. They did the necessary tests and received approval from Oregon DEQ to use the well water in time of an emergency. See Appendix G Success Stories for more information.

The City has built a new wastewater treatment facility and new sewage lagoons have berms to protect them from floodwaters. Future expansion includes sewer connections along the bridge that spans the Snake River into Idaho.

Because there are no National Weather Service gauges or other information-gathering resources on this section of the Snake River, official records on past flood events are limited. The NWS does have a river gauge on the Snake River at Weiser, but this is approximately 30 miles downstream of Nyssa.

Vale

Vale is adjacent to the Malheur River and has a history of flooding. Mild to moderate flooding has historically been a frequent occurrence, but severe floods have not occurred as often, primarily due to the mitigation provided by the dike.

Spring runoff flooding on the Malheur River is the biggest flood concern for flood events in Vale, but the City itself has not experienced severe flooding since 1957. After that flood, the Army Corps of Engineers installed dikes to manage the river and prevent another disastrous flood event. Dikes and levees on the Malheur River get inspected annually for safety and soundness by the U.S. Army Corps of Engineers.

More recent floods have caused road blockages and minor problems with the City's stormwater system. The last major flooding was a flash flood event in 2010. The City would like to replace a faulty storm valve that has led to flood concerns in the vicinity of the school district's bus shed.

The Malheur River is the major flood source in the City. Its flow can be affected several miles upstream of Vale by Bully Creek, which has its own dam and an irrigation reservoir and ultimately flows into the Malheur. Flooding has not occurred on Bully Creek for nearly 30 years. There are two mitigation actions in this NHMP specific to the Bully Creek Levee System, FL-5 and FL-6.

Existing Hazard Mitigation Activities and Resources

Floodplain Ordinances (Planning)

- The Malheur County and the Cities of Ontario and Nyssa floodplain ordinances are available online.
  - Malheur County Code, Title 5, Building and Flood Control Regulations, https://www.sterlingcodifiers.com/codebook/index.php?book_id=695
  - City of Ontario Comprehensive Plan, Goal 7, Areas Subject to Natural Disasters and Hazards, https://library.municode.com/or/ontario/codes/planning_and_zoning_development_standards?nodeId=TIT10COPL_GOAL_7ARSUNADIHA_10-7-4FLSTSLHAPO
  - City of Ontario, Title 10, Flood Hazard Overlay Zone, https://library.municode.com/or/ontario/codes/planning_and_zoning_development_standards?nodeId=TIT10ASUZORE_CH10A-47FHFLHAOVZO
  - City of Nyssa, Title 10, Flood Control, https://www.sterlingcodifiers.com/codebook/index.php?book_id=988
- The City of Vale's ordinances are not available online.

After Incident Reports (Emergency Services)

- The Malheur County Emergency Services Department maintains files on significant floods that include County Court declarations of emergency and any other relevant information, including photographs. At the time of the *2019 Malheur County NHMP*, files were only available for selected flood years and are on hard copy file in the Malheur County Emergency Services Department.[24]

State Natural Hazard Risk Assessment: Flood

The risk assessment in the *2015 Oregon Natural Hazards Mitigation Plan* provides an overview of flood risk in Oregon and identifies the most significant floods in Oregon's recorded history. It has overall state and regional information, and includes flood related mitigation actions for the entire state. https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP_5_RAState.pdf

[24] *2014 Malheur County NHMP*. Reaffirmed by Rich Harriman, personal communication, December 27, 2018.

Planning for Natural Hazards: Oregon Technical Resource Guide

This guide describes basic mitigation strategies and resources related to coastal hazards and other natural hazards, including examples from communities in Oregon. https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

Emergency Operations Plans

- The Malheur County Emergency Services Department (Sheriff's Office) keeps emergency plans on file for every major dam in the County, in addition to those in Idaho which could affect the County.[25]

There are programs to mitigate flooding in Malheur County; these range from federally funded national programs to individual projects by landowners. This section outlines a few of these.

Federal Programs

The National Flood Insurance Program (NFIP)

Properties in and near the floodplains in Malheur County are subject to flooding. Since flooding is such a pervasive problem throughout the County, some residents maintain flood insurance policies to help recover from losses incurred from floods. Most people get insurance through the NFIP; however there are some private companies that also offer flood insurance. While it is most common to purchase insurance when properties are within the Special Flood Hazard Area (SFHA), not all insurance policy holders are within the SFHA (also known as the 1% or 100-year flood area).

In Malheur County, including the Cities and the unincorporated areas, there are 109 NFIP policies[26] in force. The number of policy holders who have private flood insurance is unknown. These numbers suggest that a significant number of property owners lack flood insurance coverage.

Figure FL-4 shows the entire land area of County, the location of the SFHA or 1% flood area, and the.02% flood area. This map uses FEMA printed FIRMs from 1986 that have been digitized by Malheur County staff. Figure FL-5 shows the entire land area of the County with the SFHA or 1% flood area only. The information is from the Statewide Flood Hazard Database for Oregon.

There are 3,548 total parcels within the 1% and .02% areas shown on Figure FL-4. Within that total there are 1,395 parcels in the 1% flood area or SFHA and 2,153 parcels in the .02% flood area.[27]

The NFIP is a federal program administered by the Federal Emergency Management Agency (FEMA). The function of the NFIP is to provide flood insurance to homes and businesses located in floodplains at a reasonable cost, and to encourage the location of new development away from the floodplain. The program maps flood risk areas, and requires local implementation to reduce the risk, primarily through restricting new development in floodplains. The maps are known as Flood

[25] Ibid.

[26] Celinda Adair, Celinda Adair, Department of Land Conservation and Development, personal communication, November 30, 2018.

[27] Gina Lewis, Malheur County, personal communication, December 28, 2018

Insurance Rate Maps (FIRM). Malheur County's FIRMs have not been updated since 1986 and the maps do not reflect current flood patterns.

Flood insurance covers only the improved land, or the actual building structure. Malheur County is a participating community in the NFIP. The number of claims in the Cities, in the unincorporated areas, and the total claims from this program in the County are shown in Table FL-2. It is important to note that property located outside the SFHA may still be subject to severe flooding. FEMA reports that 25% of all flood insurance claims are from owners of property located in low to moderate-risk areas located outside of the SFHA.[28]

Repetitive loss structures are defined as a NFIP- insured structure that has had at least two paid flood losses of more than $1,000 each in any 10-year period since 1978[29]. Repetitive loss structures are troublesome because they continue to expose lives and property to flooding. Local governments and the federal agencies, such as FEMA, attempt to address losses through floodplain insurance and attempts to remove the risk from repetitive loss of properties through projects such as acquiring land and improvements, relocating homes or elevating structures. Continued repetitive loss claims from flood events lead to an increased amount of damage caused by floods, higher insurance rates, and contribute to the rising cost of taxpayer funded disaster relief for flood victims[30].

Community Rating System (CRS)

The Community Rating System (CRS) voluntary program recognizes and rewards efforts that go beyond the minimum standards of the NFIP. This recognition is in the form of reduced flood insurance premiums for communities that adopt such standards. CRS encourages voluntary community activities that reduce flood losses, facilitate accurate insurance rating, and promote flood insurance awareness. Malheur County and the Cities do not currently participate in the CRS. For CRS communities, flood insurance premium rates are discounted in increments of 5%; i.e., a Class 1 community would receive a 45% premium discount, while a Class 9 community would receive a 5% discount.[31] The table below illustrates how the CRS point system is broken down.

[28] Federal Emergency Management Agency, *Definitions*, https://www.fema.gov/txt/rebuild/repetitive_loss_faqs.txt, accessed December 27, 2018.

[29] Ibid.

[30] National Flood Insurance Program, https://www.fema.gov/national-flood-insurance-program, accessed December 27, 2018.

[31] Ibid.

Table FL-5 Summary of Points and Insurance Rate Discounts Under CRS

Credit Points	Class	Premium Reductions
0-499	10	0%
500-999	9	5%
1000-1499	8	10%
1500-1999	7	15%
2000-2499	6	20%
2500-2999	5	25%
3000-3499	4	30%
3500-3999	3	35%
4000-4599	2	40%
4500+	1	45%

Source: FEMA, National Flood Insurance Program, http://www.fema.gov/national-flood-insurance-program, accessed December 27, 2018.

State Programs

State Land Use Planning Goals

There are 19 statewide planning goals that guide land use in the State of Oregon. These became law via Senate Bill 100 in 1973.[32] One goal in particular focuses on land use planning and natural hazards.

Goal 7 Areas Subject to Natural Disasters and Hazards,[33] requires local governments to identify hazards and adopt appropriate safeguards for land use and development. Goal 7 advocates the continuous incorporation of hazard information in local land use plans and policies.

The communities of Malheur County, Nyssa, Ontario and Vale all have approved comprehensive plans that include information pertinent to Goal 7.

Silver Jackets

The Silver Jackets program is a joint state-federal-local flood mitigation subcommittee, which is tied to a national USACE initiative. Silver Jackets provides a forum where DLCD, DOGAMI, OEM, USACE, FEMA, USGS, and additional federal, state and sometimes local and Tribal agencies can come together to collaboratively plan and implement flood mitigation, optimizing multi-agency utilization of federal assistance by leveraging state/local/Tribal resources, including data/information, talent and funding, and preventing duplication among agencies.

Objectives of this subcommittee include:

---

[32] Oregon Department of Land Conservation and Development, https://www.oregon.gov/lcd/OP/Pages/History.aspx, accessed December 27, 2018.

[33] Oregon Department of Land Conservation and Development, https://www.oregon.gov/lcd/OP/Pages/Goals.aspx, accessed December 27, 2018.

- Facilitate strategic life-cycle flood risk reduction,
- Create or supplement a continuous mechanism to collaboratively solve state-prioritized issues and implement or recommend those solutions,
- Improve processes, identifying and resolving gaps and counteractive programs,
- Leverage and optimize resources,
- Improve and increase flood risk communication and present a unified interagency message, and
- Establish close relationships to facilitate integrated post-disaster recovery solutions.

The State of Oregon established the Silver Jackets as a subcommittee to the Interagency Hazard Mitigation Team (IHMT), with the primary intents of strengthening interagency relationships and cooperation, optimizing resources, and improving risk communication and messaging.

County and City Programs

Zoning Ordinance – Floodplain Standards

Community participation in the NFIP requires the adoption and enforcement of a local floodplain management ordinance that controls development in the floodplain. Malheur County and the cities of Nyssa, Ontario and Vale participate in the National Flood Insurance Program (NFIP). Communities participating in the NFIP may adopt regulations that are more stringent than those contained in 44 CFR 60.3, but not less stringent.[34]

This type of ordinance is currently in effect in Malheur County, Ontario, Nyssa, and Vale. See links to the websites as noted above. The ordinance identifies the types of uses allowed in the floodplain and floodway; and outlines the compliance procedures and restrictions imposed on each use. It also describes construction performance standards and specifications for flood hazard protection.

Floodplain Development

To minimize damage to structures during flood events, the County requires all new construction in the floodplain to get a floodplain development permit. The permit requires development to be anchored against movement by floodwaters, resistant to flood forces, constructed with flood resistant materials, and flood-proofed or elevated so that the first floor of living space, as well as all mechanical and services, is at least one foot above the elevation of the 100-year flood. These standards apply to new structures and to substantial improvements of existing structures. Critical facilities are required to the extent possible to be outside of the SFHA. Other types of development within the floodplain, such as, grading, cut and fill, installation of riprap, and other bank stabilization techniques also require a floodplain development permit.

Elevation Certificate Maintenance

Elevation certificates are administered by Development Services and are required for buildings constructed in the floodplain in order to demonstrate that the building is elevated adequately to

[34] FEMA, Region 10, *Floodplain Management: a Local Administrator's Guide to the National Flood Insurance Program*, https://www.fema.gov/media-library/assets/documents/15477.

protect it from flooding.[35] The Elevation Certificate is an important administrative tool of the NFIP. It is used to determine the proper flood insurance premium rate; it can be used to document elevation information necessary to ensure compliance with community floodplain management regulations; and it may be used to support a request for a Letter of Map Amendment (LOMA) or Letter of Map Revision based on fill (LOMR-F).

FEMA Flood Maps

The flood maps are known as Flood Insurance Rate Maps (FIRM). Malheur County's FIRMs have not been updated since 1986 and the maps do not reflect current flood patterns.

Future Changing Conditions/ Climate Change

In the Malheur County NHMP, there are several locations that describe future changing conditions or climate change as it relates to the natural hazards that impact Malheur County. In the order of appearance in the NHMP: the Risk Assessment, the Hazards Annexes, and Appendix F contain this information. Within Appendix F there are two documents, the *Future Climate Projections: Malheur County* and the *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports.*

Flood Mitigation Action Items

The flood mitigation actions have been identified by the Malheur County NHMP Steering Committee which includes the Cities of Nyssa, Ontario and Vale. See Table 3-3 Mitigation Actions Table 2019 NHMP and the action item worksheets in Appendix A for a more detailed description of the mitigation actions.

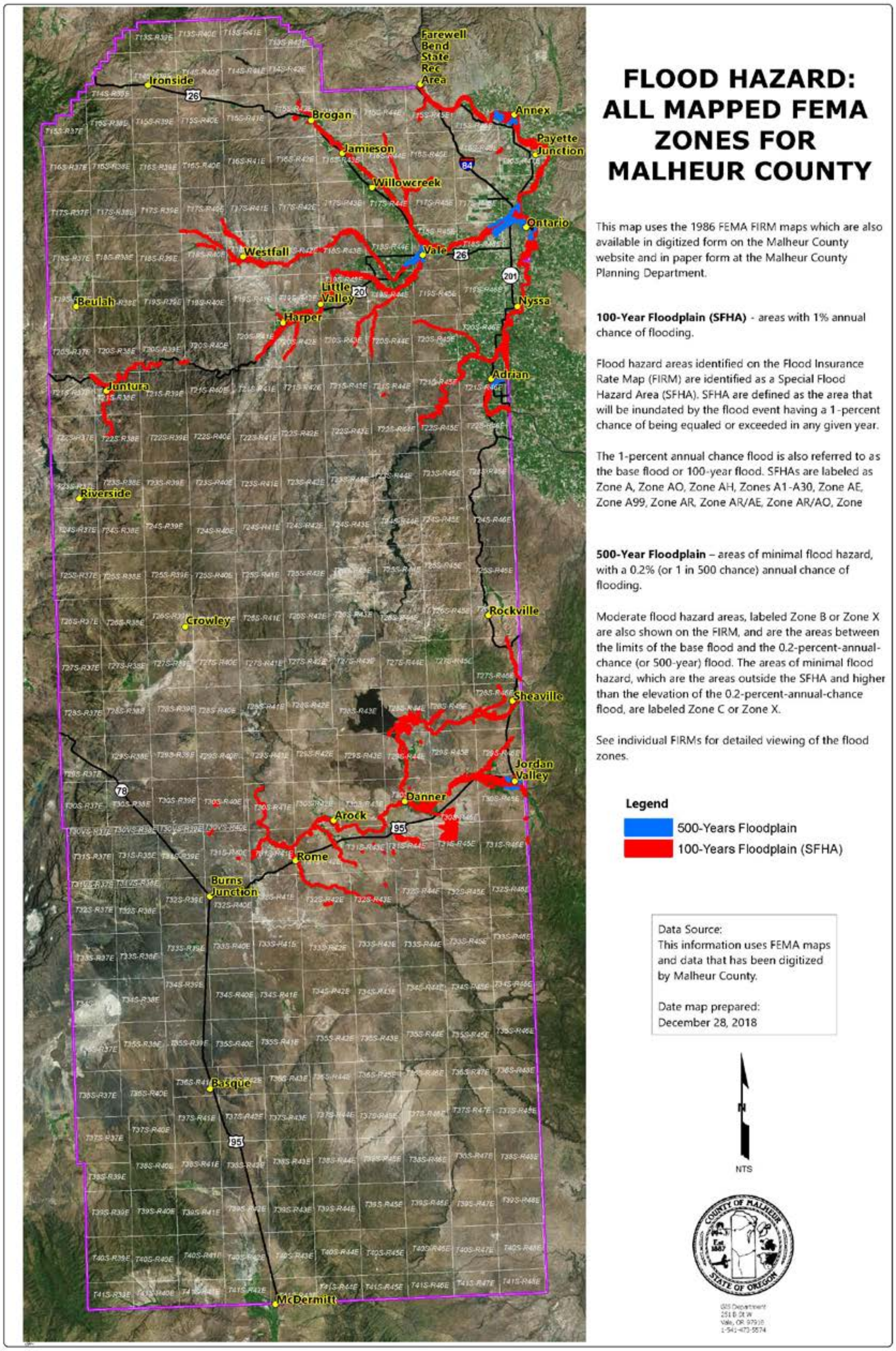
There are eight specific mitigation actions for flood. The mitigation actions have high-medium priority because the Hazard Vulnerability Assessment (HVA) resulted in floods having a low hig-medium risk level.

There are seven multi-hazard mitigation actions for the NHMP and several of those include flood related mitigation actions, in conjunction with the other hazards. The multi-hazard mitigation actions are a high priority.

At the August 9, 2018 NHMP Steering Committee meeting, it was agreed that the risk level rankings from the HVA would be used as the way to prioritize the multi-hazard and hazard-specific mitigation actions. The risk level rankings are in Table 2-5 in Section 2 Risk Assessment.

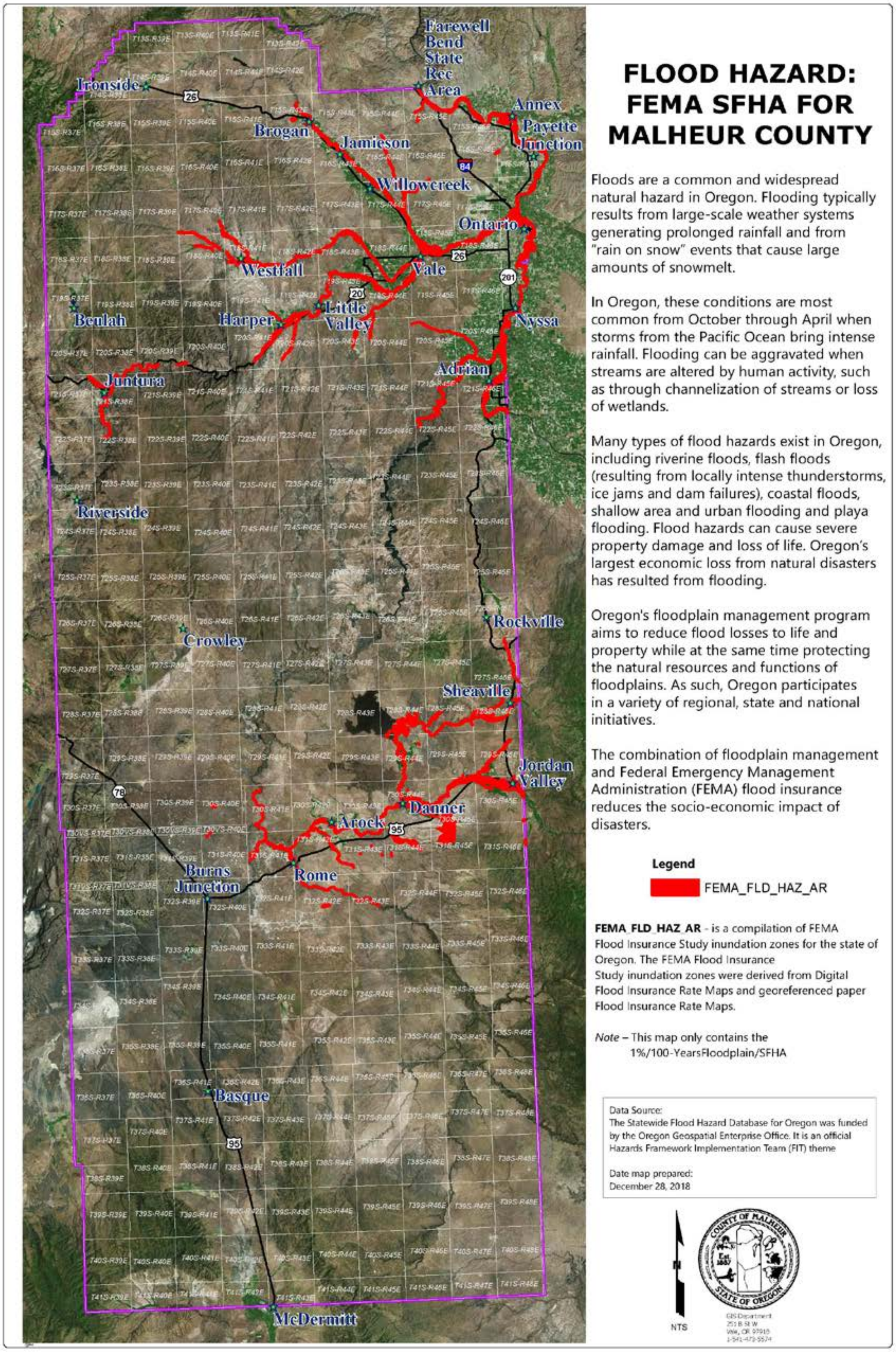
[35] Ibid.

Figure FL-4 Flood Hazard: All Mapped FEMA Zones for Malheur County



Source: Gina Lewis, Malheur County, January 3, 2019

Figure FL-5 Flood Hazard: FEMA SFHA For Malheur County



Source: Gina Lewis, Malheur County, January 2, 2019

Risk Score: 60 Risk Level: Low

Landslide Hazard Annex

Causes and Characteristics of Landslides

Landslides are a geologic hazard in almost every state in America. Nationally, landslides cause 25 to 50 deaths each year.[1] In Oregon, economic losses due to landslides for a typical year are estimated to be over $10 million.[2] In years with heavy storms, such as in 1996, losses can be an order of magnitude higher and exceed $100 million.[3] In Oregon, a significant number of locations are at risk to dangerous landslides. While not all landslides result in private property damage, many landslides impact transportation corridors, fuel and energy conduits, and communication facilities. They can also pose a serious threat to the lives of humans and animals, and to the environment.

Types of Landslides

Landslides are downhill or lateral movements of rock, debris, or soil mass. Landslides vary greatly in the volumes of rock and soil involved, the length, width, and depth of the area affected, frequency of occurrence, and speed of movement. Some characteristics that determine the type of landslide are slope of the hillside, moisture content, and the nature of the underlying materials. Landslides are given different names depending on the type of failure and their composition and characteristics. According to Bill Burns of DOGAMI, all landslides can be classified into six types of movement: 1) falls, 2) topples, 3) slides, 4) spreads, 5) flows, and 6) complex. See Figure LS-1 for illustration of landslide types.[4]

Although the factors determining what type of movement will manifest for any given landslide are very complex, the topographic nature of the slope and the type of slope material often play dominant roles. Most slope failures are complex combinations of these distinct types, but the generalized groupings provide a useful means for framing discussion of the type of hazard and potential mitigation alternatives. Movement type should be combined with other landslide characteristics such as type of material, rate of movement, depth of failure, and water content in order to more fully understand the landslide behavior. For a more complete description of the different types of landslides, see U.S. Transportation Research Board *Special Report 247* (Turner and Schuster, 1996), which has an extensive chapter on landslide types and processes.[5] It is common for

[1] Mileti, Dennis. 1999. *Disasters by Design: A Reassessment of Natural Hazards in the United States*. Washington D.C.: Joseph Henry Press.

[2] Wang, Yumei, Renee D. Summers, R. Jon Hofmeister, and Oregon Department of Geology and Mineral Industries. 2002. *Open-File Report O-02-05: Landslide Loss Estimation Pilot Project in Oregon*. https://www.oregongeology.org/pubs/ofr/O-02-05.pdf, accessed February 14, 2010 and reaffirmed January 22, 2019.

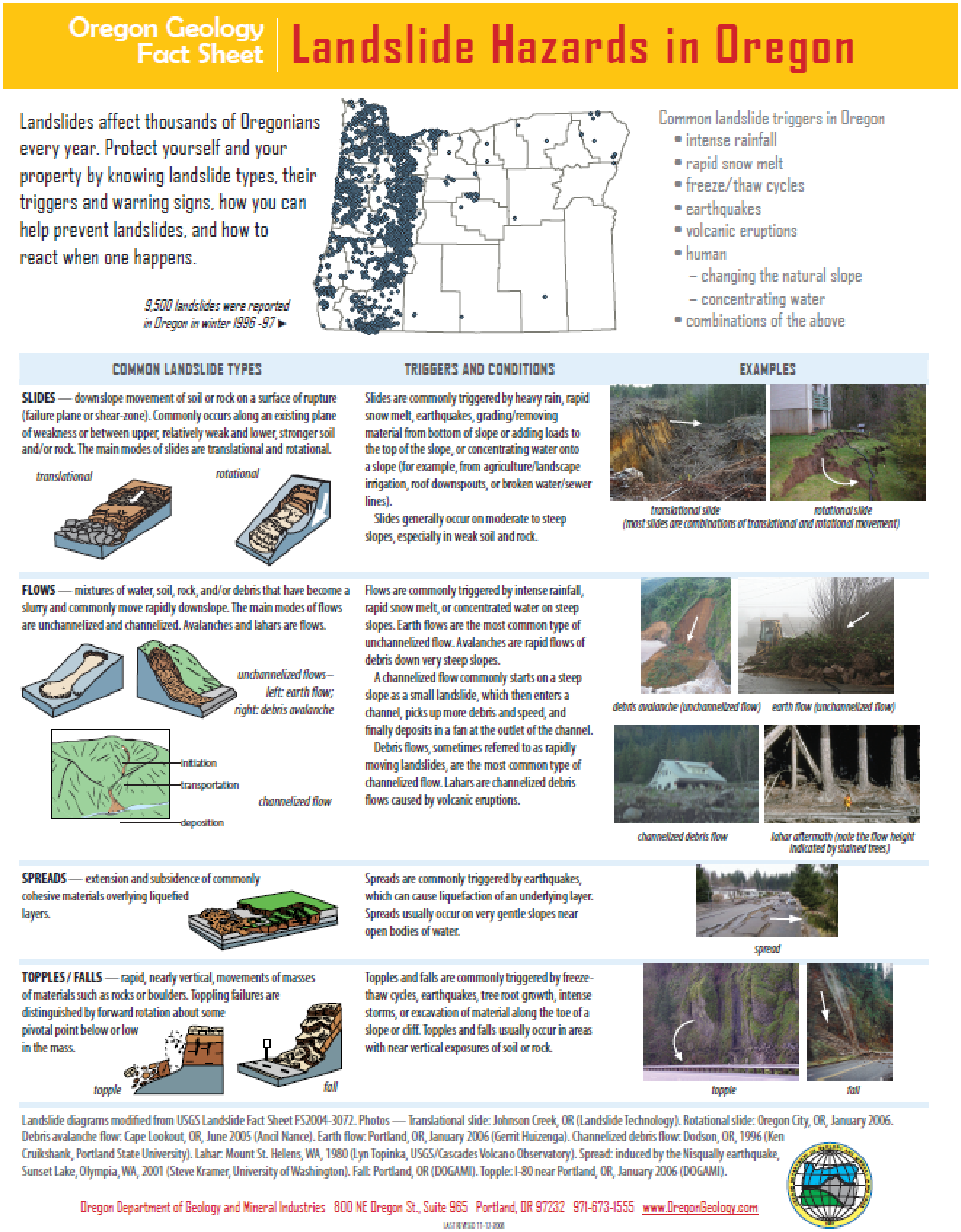
[3] Ibid.

[4] Bill Burns, DOGAMI, personal communication, January 2019.

[5] Turner, A. K., and Schuster, R. L., eds., 1996, *Landslides: Investigation and Mitigation*, National Research Council, Transportation Research Board Special Report 247, 673 p.

failures to reoccur where previous ones happened; this is true for all types of landslide movements and over periods much longer than human recorded history.

Figure LS-1 Landslide Types



Oregon Geology Fact Sheet | Landslide Hazards in Oregon

Landslides affect thousands of Oregonians every year. Protect yourself and your property by knowing landslide types, their triggers and warning signs, how you can help prevent landslides, and how to react when one happens.

9,500 landslides were reported in Oregon in winter 1996-97 ▶

Common landslide triggers in Oregon
- intense rainfall
- rapid snow melt
- freeze/thaw cycles
- earthquakes
- volcanic eruptions
- human
  - changing the natural slope
  - concentrating water
- combinations of the above

COMMON LANDSLIDE TYPES	TRIGGERS AND CONDITIONS	EXAMPLES
SLIDES — downslope movement of soil or rock on a surface of rupture (failure plane or shear-zone). Commonly occurs along an existing plane of weakness or between upper, relatively weak and lower, stronger soil and/or rock. The main modes of slides are translational and rotational. *translational* *rotational*	Slides are commonly triggered by heavy rain, rapid snow melt, earthquakes, grading/removing material from bottom of slope or adding loads to the top of the slope, or concentrating water onto a slope (for example, from agriculture/landscape irrigation, roof downspouts, or broken water/sewer lines). Slides generally occur on moderate to steep slopes, especially in weak soil and rock.	*translational slide* *rotational slide* *(most slides are combinations of translational and rotational movement)*
FLOWS — mixtures of water, soil, rock, and/or debris that have become a slurry and commonly move rapidly downslope. The main modes of flows are unchannelized and channelized. Avalanches and lahars are flows. *unchannelized flows— left: earth flow; right: debris avalanche* initiation transportation deposition *channelized flow*	Flows are commonly triggered by intense rainfall, rapid snow melt, or concentrated water on steep slopes. Earth flows are the most common type of unchannelized flow. Avalanches are rapid flows of debris down very steep slopes. A channelized flow commonly starts on a steep slope as a small landslide, which then enters a channel, picks up more debris and speed, and finally deposits in a fan at the outlet of the channel. Debris flows, sometimes referred to as rapidly moving landslides, are the most common type of channelized flow. Lahars are channelized debris flows caused by volcanic eruptions.	*debris avalanche (unchannelized flow)* *earth flow (unchannelized flow)* *channelized debris flow* *lahar aftermath (note the flow height indicated by stained trees)*
SPREADS — extension and subsidence of commonly cohesive materials overlying liquefied layers.	Spreads are commonly triggered by earthquakes, which can cause liquefaction of an underlying layer. Spreads usually occur on very gentle slopes near open bodies of water.	*spread*
TOPPLES / FALLS — rapid, nearly vertical, movements of masses of materials such as rocks or boulders. Toppling failures are distinguished by forward rotation about some pivotal point below or low in the mass. *topple* *fall*	Topples and falls are commonly triggered by freeze-thaw cycles, earthquakes, tree root growth, intense storms, or excavation of material along the toe of a slope or cliff. Topples and falls usually occur in areas with near vertical exposures of soil or rock.	*topple* *fall*

Landslide diagrams modified from USGS Landslide Fact Sheet FS2004-3072. Photos — Translational slide: Johnson Creek, OR (Landslide Technology). Rotational slide: Oregon City, OR, January 2006. Debris avalanche flow: Cape Lookout, OR, June 2005 (Ancil Nance). Earth flow: Portland, OR, January 2006 (Gerrit Huizenga). Channelized debris flow: Dodson, OR, 1996 (Ken Cruikshank, Portland State University). Lahar: Mount St. Helens, WA, 1980 (Lyn Topinka, USGS/Cascades Volcano Observatory). Spread: induced by the Nisqually earthquake, Sunset Lake, Olympia, WA, 2001 (Steve Kramer, University of Washington). Fall: Portland, OR (DOGAMI). Topple: I-80 near Portland, OR, January 2006 (DOGAMI).

Oregon Department of Geology and Mineral Industries 800 NE Oregon St., Suite 965 Portland, OR 97232 971-673-1555 www.OregonGeology.com

DOGAMI, *Oregon Geology Fact Sheet: Landslide Hazards in Oregon*, https://www.oregongeology.org/pubs/fs/landslide-factsheet.pdf

Slides

Slides move in contact with the underlying surface. These movements include rotational slides where sliding material moves along a curved surface and translational slides where movement occurs along a flat surface. These slides are generally slow moving and can be deep. Slow-moving landslides can occur on relatively gentle slopes and can cause significant property damage, but are far less likely to result in serious injuries than rapidly moving landslides.[6]

Topples and Falls

Rock falls occur when blocks of material come loose on steep slopes. Weathering, erosion, or excavations, such as those along highways, can cause falls where the road has been cut through bedrock. They are fast moving with the materials free falling or bouncing down the slope.

In falls, material is detached from a steep slope or cliff. The volume of material involved is generally small, but large boulders or blocks of rock can cause significant damage. Rock falls have the potential to break off power poles located on hillsides.[7]

Spreads

Spreads are an extension and subsidence of commonly cohesive materials overlying layers. They are commonly triggered by earthquakes. Spreads usually occur on gentle slopes near open bodies of water.[8]

Flows

Flows are plastic or liquid movements in which land mass (e.g. soil and rock) breaks up and flows during movement. Earthquakes often trigger flows.[9] Flows can be channelized and unchannelized, and may also be called debris avalanches and earth flows. Debris flows normally occur when a landslide moves downslope as a semi-fluid mass scouring, or partially scouring soils from the slope along its path. Flows are typically rapidly moving and also tend to increase in volume as they scour out the channel. [10] Flows often occur during heavy rainfall, can occur on gentle slopes, and can move rapidly for large distances.

The channelized debris flow, which is sometimes referred to as "rapidly moving landslide" can be life threatening. They often initiate on a steep slope, move into a steep channel (or drainage), increase in volume by incorporating channel materials, and then deposit material, usually at the mouth of the channel on existing fans. Debris flows are commonly mobilized by other types of landslides that

---

[6] DLCD, *2015 Oregon Natural Hazards Mitigation Plan*, https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP.pdf

[7] Ernie, Eichorn, Field Representative, Chemawa District, Bonneville Power Authority, personal communication, November 10, 2004.

[8] DOGAMI, *Oregon Geology Fact Sheet: Landslide Hazards in Oregon*, https://www.oregongeology.org/pubs/fs/landslide-factsheet.pdf

[9] Robert Olson Associates, June 1999, *Metro Regional Hazard Mitigation Policy and Planning Guide*.

[10] Ibid.

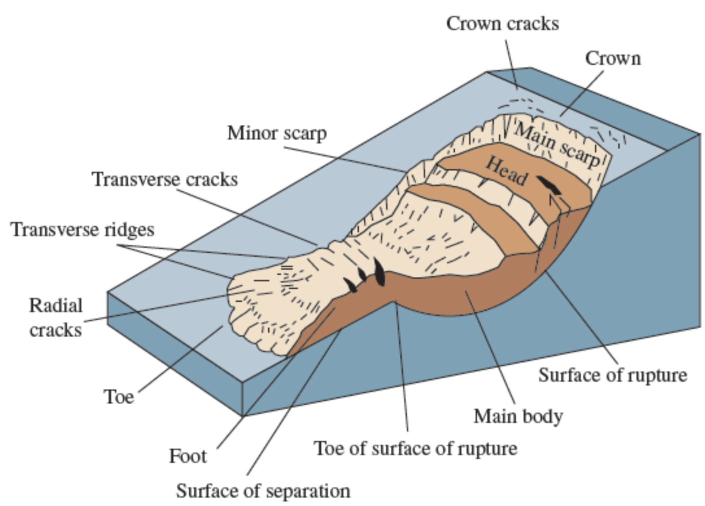
occur on slopes near a channel. They can also initiate within channels from accelerated erosion during heavy rainfall or snowmelt.[11]

Over time, ditches and culverts beneath hillside roads can become blocked with debris. If the ditches are blocked, run-off from the slopes is inhibited during periods of precipitation. This causes the run-off water to collect in soil, and in some cases, cause a slide. Usually the slides are small (100 – 1,000 cubic yards), but they can be quite large.

Complex

Complex landslides are the combinations of two or more types. A common complex landslide is a slump-earth flow, which usually exhibits slump features in the upper region and earth flow features near the toe.[12]

Figure LS-2 Landslide Features



Source: USGS, *Landslide Factsheet*, https://pubs.usgs.gov/fs/2004/3072/pdf/fs2004-3072.pdf

Conditions Affecting Landslides

Natural conditions and human activities can both play a role in causing landslides. Certain geologic formations are more susceptible to landslides than others. The incidence of landslides and their impact on people and property can be accelerated by development. Those who are uninformed about geologic conditions and processes may create conditions that can increase the risk of or even trigger landslides.

These are the principal factors that affect or increase the likelihood of landslides:

---

[11] Bill Burns, DOGAMI, personal communication, January 2019.

[12] Burns, Bill and Ian Madin, DOGAM, *Protocol for Inventory Mapping of Landslide Deposits from Light Detection and Ranging (LIDAR) Imagery*, Special Paper 42, 2009, https://www.oregongeology.org/pubs/dds/slido/sp-42_onscreen.pdf.

- Natural conditions and processes including the geology of the site, rainfall, rapid snowmelt, freeze/thaw cycles, wave and water action, seismic tremors and earthquakes, and volcanic activity.
- Excavation and grading on sloping ground for homes, roads and other structures.
- Drainage and groundwater alterations that are natural or human-caused can trigger landslides. Human activities that may cause slides include broken or leaking water or sewer lines, water retention facilities, irrigation and stream alterations, ineffective stormwater management and excess runoff due to increased impervious surfaces.
- Change or removal of vegetation on very steep slopes due to timber harvesting, land clearing and wildfire.
- Any combination of these factors.[13]

History of Landslides in Malheur County

Most of Oregon's landslide damage has been associated with severe winter storms where landslide losses can exceed $100 million in direct damage such as the February 1996 event. Annual average maintenance and repair costs for landslides in Oregon are over $10 million.[14] During 1996 and 1997, there were five heavier than normal rains that caused thousands of landslides throughout Oregon. Of these, roughly 9,500 were identified and added to a DOGAMI database. Some of these landslides were the reactivation of ancient and historically active landslides and some were new failures.

Table LS-1 Significant Historic Landslides/ Debris Flows

Date	Location	Description
Dec. 1964	Statewide	DR-184. Heavy rains and flooding, with landslides, on December 24, 1964.
Feb. 1996	Statewide	DR-1099. Heavy rains and rapidly melting snow contributed to hundreds of landslides / debris flows across the state; many occurred on clear cuts that damaged logging roads.
Dec. 2003-Jan. 2004	Statewide	DR-1510. Winter storms with landslides.
May 2006	Statewide	DR-1632. Statewide impacts from storms, floods, landslides, and mudslides.
Dec. 2008	Statewide	DR-1824. Severe winter storm, flooding, winds, record and near record snow, landslides and mudslides. Gresham received, 26" of snow. Many roads closed. Significant damages to public infrastructure, homes and businesses. Event occurred Dec. 20-26.
Jan. 2011	Statewide	DR-1956. Severe winter storm, flooding, mudslides, landslides, and debris flows.
Jan. 2012	W. Oregon	DR-4055. The incident was January 12-21, 2012. Severe winter storm with flooding, landslides, and mudslides. Declaration involves 12 counties including Benton, Columbia, Coos, Curry, Douglas, Hood River, Lane, Lincoln, Linn, Marion, Polk, and Tillamook.

Source: University of Oregon, Malheur County NHMP, May 2014; DLCD, Oregon NHMP, 2015; FEMA, Disaster Declarations for Oregon, retrieved 2017; Hazards and Vulnerability Research Institute (2007); the Spatial Hazard Events and Losses

[13] DOGAMI, *Oregon Geology Fact Sheet: Landslide Hazards in Oregon*, https://www.oregongeology.org/pubs/fs/landslide-factsheet.pdf

[14] Wang and Chaker, DOGAMI, 2004, *Geological Hazards Study for the Columbia River Transportation Corridor*, Open File Report OFR 0-4-08, https://www.oregongeology.org/pubs/ofr/O-04-08.pdf.

Database for the United States, Version 5.1 (online database), Columbia, S.C: University of South Carolina, available from http://www.shieldus.org/.

DOGAMI maps the State Landslide Information Layer for Oregon (SLIDO). The database contains only landslides that have been located on these maps. Many landslides have not yet been located or are not on these maps and therefore are not in this database. This database does not contain information about relative hazards[15].

Compared to other natural hazards with the potential to affect Malheur County and a proven history of past damages, landslides are not considered a major hazard.

The map in Figure LS-3 shows the vast majority of Malheur County to be at low risk for landslide activity, though the map also shows a fair amount of moderate susceptibility. There are a few clusters of high and very high susceptibility. This information is based on SLIDO (version 3.4) and the *2016 Landslide Susceptibility Overview Map of Oregon* with its corresponding Open File Report, O-16-02.[16] Historically, no severe landslide events have occurred and been recorded in Malheur County, and Steering Committee members did not identify any events other than some small-scale chronic rock fall and areas with unstable ground; therefore, Table LS-1 does not contain any detailed descriptions of local landslide events in Malheur County. See the Vulnerability Assessment below.

Risk Assessment

How are Hazards Identified?

Geologic and geographic factors are important in identifying landslide-prone areas. Stream channels, for example, have major influences on landslides, due to undercutting of slopes by stream erosion and long-term hillside processes. The severity or extent of landslides is typically a function of geology and the landslide triggering mechanism. Even small slides can cause property damage, result in environmental destruction, and cause injuries or death to people and animals.

The Oregon Department of Forestry (ODF) *Storm Impacts and Landslides of 1996: Final Report* conducted after the 1996-97 landslide events found that the highest probability for the initiation of shallow, rapidly moving landslides was on slopes of 70 to 80 percent steepness. A moderate hazard of shallow rapid landslide initiation can exist on slopes between 50 and 70 percent.[17]

Areas at risk to landslides do not always have steep slopes (25 percent or greater,) or a history of nearby landslides. As indicated by the DOGAMI Open File Report O-16-02 and Special Paper 42, both previously mentioned, landslide hazards may be more effectively recognized using Light Detection and Ranging Imagery (LIDAR or lidar). Using lidar to craft inventory maps as well as shallow and deep susceptibility maps provides a substantial amount of information on the location and nature of the landslide hazards. Further mapping of Malheur County for landslides hazards is recommended.

[15] DOGAMI. Statewide Landslide Information Database for Oregon (SLIDO 3.4). https://www.oregongeology.org/slido/index.htm

[16] *2016 Landslide Susceptibility Overview Map of Oregon* with its corresponding Open File Report, O-16-02, https://www.oregongeology.org/pubs/ofr/p-O-16-02.htm

[17] Oregon Department of Forestry, *Storm Impacts and Landslides of 1996: Final Report*, June 1999. https://digital.osl.state.or.us/islandora/object/osl%3A19728

Hazard Risk Analysis

The Malheur County NHMP Steering Committee completed a Hazard Vulnerability Assessment/Analysis (HVA) on April 12, 2018. This was described in Section 2 Risk Assessment. The method used for the HVA was developed from a Federal Emergency Management Agency (FEMA) tool that has been refined by the Oregon Office of Emergency Management (OEM). It addresses and weights (shown as percent within parentheses) probability (29%), vulnerability (21%), maximum threat (42%) and the history (8%) of each natural hazard and attributes a final hazard analysis score. The methodology produces scores that range from 24 to 240.

For local governments, conducting the HVA is a useful step in planning for hazard mitigation. The method provides the jurisdiction with a relative ranking from which to prioritize mitigation actions, but does not predict the occurrence of a particular hazard.

In 2013 landslide hazards had a risk score of 165 and a rank of 4 out of 11 natural hazards. In 2018 earthquake hazards had a risk score of 60 and a rank of 11 out of 11 natural hazards.

For more information on all the risk scores and ranks of the natural hazards, see Volume I Basic Plan, Section 2 Risk Assessment of this NHMP.

Probability Assessment

As has been noted in this Annex already, many factors contribute to the probability of landslides. The probability of an area to have a landslide is increased depending on the factors that reduce the stability without causing failure. When several of these factors are combined, such as an area with steep slopes, weak geologic material, and previous landslide movement, the probability of future landslides is increased. There is a strong correlation between intensive winter rainstorms and the occurrence of rapidly moving landslides (debris flows). The Oregon Department of Forestry tracks storms during the rainy season, monitors rain gauges and snow melt, and issues warnings as conditions warrant. Other agencies such as ODOT, DOGAMI, USGS, and National Weather Service also track weather conditions and potential landslide situations.

Vulnerability Assessment

To a large degree, landslides are very difficult to predict. Vulnerability assessments assist in predicting how different types of property and population groups will be affected by a hazard.[18] The optimum method for doing this analysis at the city or county level is to use parcel-specific assessment data on land use and structures.[19] Data that includes specific landslide-prone and debris flow locations in the county can be used to assess the population and total value of property at risk from future landslide occurrences.

Landslides can occur on their own or in conjunction with other hazards, such as flash flooding, when the damage is likely to compound and cascade. Depending upon the type, location, severity and area affected, severe property damage, injuries and loss of life can be caused by landslide hazards. Landslides can damage or temporarily disrupt utility services, block off or damage roads, critical lifeline services such as police, fire, medical, utility and communication systems, and emergency

[18] Burby, R., ed. 1998. *Cooperating with Nature.*

[19] Ibid.

response. Were a significant landslide to occur along the Owyhee Reservoir, it could cause spillover flooding over the dam or other problems with the current dam and irrigation system.

Landslides could potentially occur nearly anywhere in Malheur County with slopes, but the risk in most locations is low. The greatest risk is located in areas with steep slopes or weak geologic material. Currently the County does not have sufficient data to calculate potential landslide losses. This is due both to the unpredictability of landslide severity/location, limited local records in terms of quantifying losses, and lack of lidar mapping at the County level.

Although there is no record of major landslide events, the following areas in Malheur County are at greater landslide risk due to steep slopes and unstable ground:

- The westernmost 20-30 miles of Highway 20 near Juntura.
- Lytle Boulevard, which is the main access road to Owyhee Dam for Vale residents, experiences chronic minor rock fall and debris due to the steepness of the slope into which the road was constructed. The County road department maintains this road and if serious rock fall or landslide activity occurred, access to and from the dam could be completely cut off until the debris was cleared. No such serious incidents have occurred. The main road to Owyhee Dam for others is Highway 201.
- Owyhee Dam is also vulnerable in certain places along the reservoir and its canal system to landslides and debris flow – a major landslide into Owyhee Dam when full could cause spillover and temporary flooding. One area at the dam site prone to chronic minor landslides has been reinforced and thus far has had no further landslide activity.
- Along the banks of Lake Owhyee (Owhyee Reservoir).
- A portion of Oregon Highway 201 near the northern border of the County (known locally as “The Slides”) experiences chronic ground instability and must be re-coated with asphalt annually at a cost of $30,000/year to ODOT. It is a low-volume road and is not slated for major repair efforts on the state or local level. It is documented as a concern, but no mitigation actions have been developed at this time.
- The City of Nyssa’s three-million gallon water storage tank sits atop a hillside adjacent to Main Street (highway 26) that is prone to erosion from irrigation of nearby fields. It this erosion continues without reinforcing the tank and hillside, it is at risk of damaging 2 nearby houses and blocking Highway 26.

Community Hazard Issues

What is susceptible to damage during a hazard event?

Depending upon the type, location, severity and area affected, severe property damage, injuries and loss of life can be caused by landslide hazards. Landslides can damage or temporarily disrupt utility services, roads and other transportation systems and critical lifeline services such as police, fire, medical, utility and communication systems, and emergency response. In additional to the immediate damage and loss of services, disruption of roads, infrastructure and critical facilities and services may have longer term impacts on the economy of the community and surrounding area.

These factors can increase the risk to people and property from the effects of landslides:

- Improper excavation practices, sometimes aggravated by drainage issues, can reduce the stability of otherwise stable slopes.

- Allowing development on or adjacent to existing landslides or known landslide-prone areas raises the risk of future slides regardless of excavation and drainage practices. Homeowners and developers should understand that in many potential landslide settings there are no development practices that can completely assure slope stability from future slide events.

- Building on fairly gentle slopes can still be subject to landslides that begin a long distance away from the development. Sites at greatest risk are those situated against the base of very steep slopes, in confined stream channels (small canyons), and on fans (rises) at the mouth of these confined channels. Home siting practices do not cause these landslides, but rather put residents and property at risk of landslide impacts. In these cases, the simplest way to avoid such potential effects is to locate development out of the impact area, or construct debris flow diversions for the structures that are at risk.

- Certain forest practices can contribute to increased risk of landslides. Forest practices may alter the physical landscape and its vegetation, which can affect the stability of steep slopes. Physical alterations can include slope steepening, slope-water effects, and changes in soil strength. Of all forest management activities, roads have the greatest effects on slope stability, although changing road construction and maintenance practices are reducing the effects of forest roads on landslides.

- High rainfall accumulation in a short period of time increases the probability of landslide. An extreme winter storm can produce inches of rainfall in a 24 hour period; if the storm occurs well into the winter season, when the ground is already saturated, the hydraulic overload effect is heightened.

- Stormwater management.

City Specific Damage

Ontario

The City of Ontario has had no problems with landslides in city limits in known history and is located in a generally stable area. A few neighborhoods on the northwest edge of the City and immediately outside of city limits (Ontario Heights) are located on steep hillsides surrounding the town but have not experienced problems in the past.

Nyssa

The City of Nyssa has had no problems with landslides in city limits in known history and is located in a generally stable area. However, Nyssa's water storage tank, which has a three million gallon capacity, is located on an unstable hillside that has experienced erosion from irrigation runoff from nearby agricultural fields. Mitigation has occurred to reduce immediate threats with terracing and drainage improvements (installation of French drain) to the hillside. There are at least two residential homes in the path of the water storage tank which would be impacted should it ever fall, in addition to Highway 26, which is the city's Main Street and a major route into Idaho to the east.

Vale

The City of Vale has not had problems with landslides in city limits in known history and is located in a generally stable area. Outside of the City, in unincorporated areas, there are areas of steep hillsides. These areas have not experienced significant problems in the past.

Existing Hazard Mitigation Activities and Resources

State Natural Hazard Risk Assessment

The risk assessment in the *2015 Oregon Natural Hazards Mitigation Plan* provides an overview of landslide risk in Oregon and identifies the most significant landslides in Oregon's recorded history. It has overall state and regional information, and includes landslide mitigation actions for the entire state. https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP_5_RAState.pdf

Planning for Natural Hazards: Oregon Technical Resource Guide

This guide describes basic mitigation strategies and resources related to landslides and other natural hazards, including examples from communities in Oregon. https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

Oregon Department of Forestry (ODF)

According to the *Forest Facts: Landslides and Debris Flows* handout on their website, "the Oregon Department of Forestry regulates forest practices to manage landslide risk in order to protect the public's safety. Forest Practices Act rules for timber harvesting and constructing roads help minimize surface erosion and the potential for landslides, which provides protection for natural resources. The department's geotechnical specialists assist foresters and landowners by providing guidance and assessing the landslide hazards and risks.

Rule protections include such measures as prohibiting timber harvest, specifying how trees should be replanted or roads should be constructed, leaving trees and vegetation undisturbed along streams, and requiring that trees be harvested with a skyline cable logging system, rather than using ground-based equipment" https://www.oregon.gov/ODF/Documents/AboutODF/LandslidesDebrisFlowsFactsheet.pdf.

The ODF debris flow maps include locations subject to naturally occurring debris flows and include the initiation sites and locations along the paths of potential debris flows (confined stream channels and locations below steep slopes). These maps neither consider the effects of management-related slope alterations (drainage and excavation) that can increase the hazard, nor do they consider very large landslides that could possibly be triggered by volcanic or earthquake activity. Areas identified in these maps are not to be considered "further review areas" as defined by Senate Bill 12 (1999).[20]

[20] *2014 Malheur County NHMP* identifies the source as the *Western Oregon Debris Flow Hazard Maps: Methodology and Guidance for Map Use*. 1999, https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf

Oregon Department of Geology and Mineral Industries (DOGAMI)

The Oregon Department of Geology and Mineral Industries (DOGAMI) "works to increase understanding of Oregon's geologic resources and hazards through science and stewardship" (https://www.oregongeology.org/default.htm) and has many landslide related resources. https://www.oregongeology.org/Landslide/landslidehome.htm. Resources previously mentioned such as the *Landslide Hazards Fact Sheet*, SLIDO, and the *Landslide Susceptibility Overview Map* of Oregon with its corresponding *Open File Report, O-16-02*, are just a few of the items found on their website. DOGAMI also has the Oregon HazVu: Statewide Geohazard Viewer where you can type in an address and discover the geohazards impacting that site. https://www.oregongeology.org/hazvu/

A historic example, after the 1996-1997 storm events, DOGAMI developed a landslide public outreach brochure in cooperation with several other state agencies. Forty thousand copies were printed in November 1997 and were distributed widely through building code officials, county planners, local emergency managers, natural resource agency field offices, banks, real estate companies, insurance companies, and other outlets.[21]

Debris Flow Warning System

The debris flow warning system was initiated in 1997 and involves collaboration between ODF, DOGAMI, the Oregon Department of Transportation (ODOT), local law enforcement, and National Oceanic and Atmospheric Administration (NOAA) Weather Radio and other media.

DOGAMI's website states, "Throughout the rainy season, the National Weather Service highlights the potential for debris flows and landslides as part of a flood watch, for areas included in the flood watch" (https://www.oregongeology.org/Landslide/debrisflow.htm). The information is provided by the National Weather Service (NWS) and broadcast via the NOAA Weather Radio, and on the Law Enforcement Data System. The information provided does not include the Debris Flow Warning System as originally designed. NWS provides the following language in their flood watches that highlights the potential for landslides and debris flows[22]:

> *A flood watch means there is a potential for flooding based on current forecasts. Landslides and debris flows are possible during this flood event. People, structures and roads located below steep slopes, in canyons and near the mouths of canyons may be at serious risk from rapidly moving landslides.*

DOGAMI provides information on debris flows through the media. ODOT provides warning signs to motorists in landslide prone areas during high-risk periods.

Oregon State Building Code Standards

The Oregon Building Codes Division adopts statewide standards for building construction that are administered by the state and local municipalities throughout Oregon. The *2017 Oregon Residential Special Code* (*ORSC*) contains requirements for one- and two-family dwellings

---

[21] *2014 Malheur County NHMP*, https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf

[22] NOAA, NWS. Letter dated December 20, 2010 from Stephen K. Todd, Meteorologist-in-Charge.

(https://codes.iccsafe.org/content/document/1018?site_type=public) and the *2014 Oregon Structural Special Code* (*OSSC*) (http://ecodes.biz/ecodes_support/free_resources/Oregon/14_Structural/14_ORStructural_main.html) contains provisions for grading and site preparation for the construction of building foundations.

Both codes contain requirements for cut, fill and sloping of the lot in relationship to the location of the foundation. There are also building setback requirements from the top and bottom of slopes. The codes specify foundation design requirements to accommodate the type of soils, the soil bearing pressure, and the compaction and lateral loads from soil and ground water on sloped lots.

The building official has the authority to require a soils analysis for any project where it appears the site conditions do not meet the requirements of the code, or that special design considerations must be taken. ORS 455.447 and the OSSC require a seismic site hazard report for projects that include essential facilities such as hospitals, fire and police stations and emergency response facilities, and special occupancy structures, such as large schools and prisons. This report includes consideration of any potentially unstable soils and landslides.[23]

Future Changing Conditions/ Climate Change

In the Malheur County NHMP, there are several locations that describe future changing conditions or climate change as it relates to the natural hazards that impact Malheur County. In the order of appearance in the NHMP: the Risk Assessment, the Hazards Annexes, and Appendix F contain this information. Within Appendix F there are two documents, the *Future Climate Projections: Malheur County* and the *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports.*

Landslide Mitigation Action Items

The landslide mitigation actions have been identified by the Malheur County NHMP Steering Committee which includes the Cities of Nyssa, Ontario and Vale. See Table 3-3 Mitigation Actions Table 2019 NHMP and the action item worksheets in Appendix A for a more detailed description of the mitigation actions.

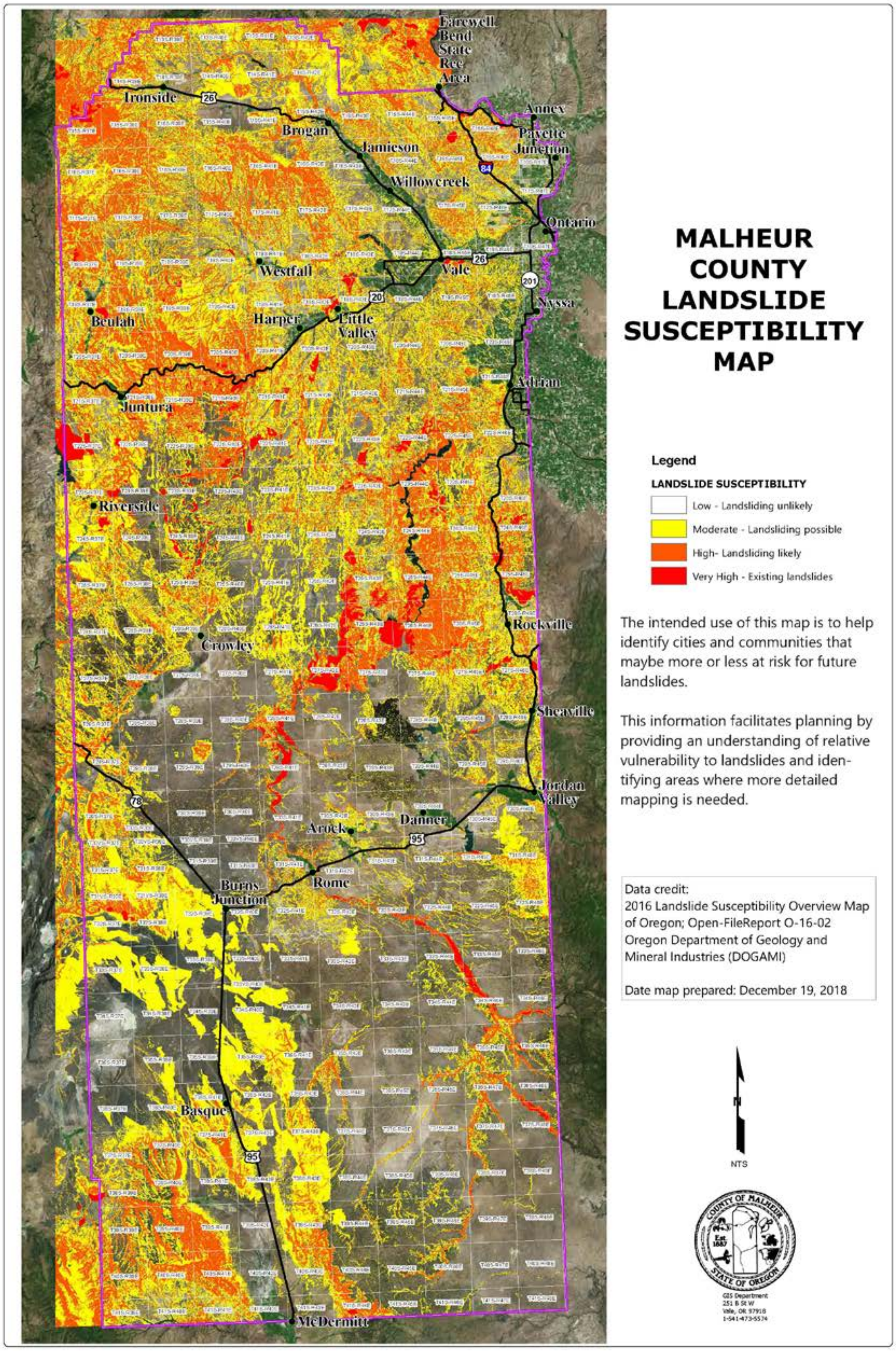
There are no landslide specific mitigation actions. If there were, the mitigation action would have a low priority because the Hazard Vulnerability Assessment (HVA) resulted in landslides having a low risk level.

There are seven multi-hazard mitigation actions for the NHMP and several of those include landslide related mitigation actions, in conjunction with the other hazards. The multi-hazard mitigation actions are a high priority.

At the August 9, 2018 NHMP Steering Committee meeting, it was agreed that the risk level rankings from the HVA would be used as the way to prioritize the multi-hazard and hazard-specific mitigation actions. The risk level rankings are in Table 2-5 in Section 2 Risk Assessment.

[23] DLCD and OPDR, *Planning for Natural Hazards: Oregon Technical Resource Guide*, July 2000, Chapter 5, https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

Figure LS-3 Malheur County Landslide Susceptibility Map



Source: Gina Lewis, Malheur County, December 31, 2018.

There are five hazards in this Annex. See below.

SEVERE WEATHER HAZARD ANNEX

Causes and Characteristics of Severe Weather

The purpose of this annex is to summarize four different hazards: dust storm, extreme temperature, wind storm, and winter storm (collectively called severe weather); provide their hazards history; and list the risk score and risk level for each hazard. Climate data is included. The Malheur County NHMP Steering Committee determined a Hazard Vulnerability Assessment risk score (described later in this Annex and previously in Volume 1 Section 2 Risk Assessment) for severe weather, as well as for dust storm, extreme temperature, wind storm, and winter storm. These weather related hazards have significant impacts on the County and Cities. In Ontario, they sometimes open warming and cooling centers in extreme temperature or severe weather events.

Severe Weather (Rain, Hail, etc.)

Risk Score: 165

Risk Level: High-Medium

Because Malheur County is located in an arid high desert region, severe thunderstorms with significant quantities of rain are not as frequent an occurrence as in other parts of Oregon. However, when these events do occur, they can exacerbate or cause other hazards, including landslides and flash floods. Lightning is another significant concern that stems from thunderstorms, as it is a primary source of wildfires in the summer season. Microbursts are another thunderstorm-related hazard. A microburst is a localized column of rapidly sinking air, producing damaging divergent and straight-line winds, often with precipitation, in an area 4 km or less. Microbursts are similar to tornadoes and can produce winds of over 75 mph. Winds from microbursts have been recorded up to 49 mph in Malheur County. While infrequent, tornadoes have occurred historically in the County and have caused damages to property. No injuries or deaths have been recorded.

Dust Storm

Risk Score: 116

Risk Level: Medium

A dust storm is a strong, violent wind that carries fine particles such as silt, sand, clay, and other materials, often for long distances. A dust storm can spread over hundreds of miles and rise over 10,000 feet. They have wind speeds of at least 25 miles per hour. Dust storms usually arrive with little warning and advance in the form of a big wall of dust and debris. The dust is blinding, making driving safely a challenge. A dust storm may last only a few minutes at any given location, but often leave behind damage such as car accidents. The arid regions of southeastern Oregon can experience sudden dust storms on windy days. These are produced by the interaction of strong winds, fine-grained surface material, and landscapes with little vegetation. The winds involved can be as small as "dust devils" or as large as fast moving regional air masses.[1]

1 OPDR, *2012 Oregon NHMP*, https://oregonexplorer.info/content/oregon-natural-hazard-mitigation-plan-2012.

Extreme Temperatures

Risk Score: 126
Risk Level: Medium

Southeast Oregon can also be a place of extreme temperatures events. From extreme cold spells to extreme heat waves, extreme temperatures events have the potential to inflict serious health damage. In extreme heat environments the body must work harder to maintain a normal temperature, these conditions can induce heath related illnesses, particularly among vulnerable populations. In most of the United States, extreme heat is defined as a long period (2 to 3 days) of high heat and humidity with temperatures above 90 degrees.[2] Extreme cold events can be described similarly in that the body must work harder and conditions can cause overexertion. Hypothermia, injuries from car accidents, frostbite, and carbon monoxide poisoning can also result from extreme cold.[3] The Malheur County NHMP Steering Committee noted that consecutive hot days have increased and in the past 10 years they have set records for that.

Wind Storm

Risk Score: 195
Risk Level: High-Medium

Extreme winds occur throughout Oregon. The most persistent high winds take place along the Oregon Coast and in the Columbia River Gorge. However, extreme weather events occur in all regions of Oregon.[4] West winds generated from the Pacific Ocean are strongest along the coast and slow down inland due to the obstruction of the Coastal mountain range.[5] Prevailing winds in Oregon vary with the seasons. In summer, the most common wind directions are from the west or northwest; in winter, they are from the south and east. Local topography, however, plays a major role in affecting wind direction.[6] The Malheur County NHMP Steering Committee stated that the wind blows at a particularly high level during March and April.

Areas most vulnerable to wind storm damage are concentrated near the five incorporated cities and the unincorporated communities. Cairo Junction is particularly vulnerable to wind storms due to wind tunneling. Wind storms can have negative effects on agricultural, residential, and commercial property. The Malheur County NHMP Steering Committee identified wind storms as the third highest risk score after drought (risk score 240) and winter storms (risk score 226).

As mentioned in the Severe Weather paragraph previously, although rare, tornados can and do occur in Oregon. Tornadoes are the most concentrated and violent storms produced by the earth's atmosphere. They are created by a vortex of rotating winds and strong vertical motion, which possess remarkable strength and cause widespread damage. Wind speeds in excess of 300 mph have been observed within tornadoes, and it is suspected that some tornado winds exceed 400 mph. The low pressure at the center of a tornado can destroy buildings and other structures.

---

2 FEMA, *Extreme Heat*, http://www.ready.gov/heat.

3 FEMA, *Snowstorms and Extreme Cold*, https://www.ready.gov/winter-weather.

4OPDR, *2012 Oregon NHMP*, https://oregonexplorer.info/content/oregon-natural-hazard-mitigation-plan-2012.

5*2014 Malheur County NHMP*, https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf

6Statesman Journal, February 8, 2002.

Tornadoes are most common in the Midwest, and are more infrequent and generally small west of the Rockies. Nonetheless, Oregon and other western states have experienced tornadoes on occasion, many of which have produced significant damage and occasionally injury or death. Oregon's tornadoes can be formed in association with large Pacific storms arriving from the west. Most of them, however, are caused by intense local thunderstorms. These storms also produce lightning, hail, and heavy rain, and are more common during the warm season from April to October.[7] Southeast Oregon's relatively low population may cause many tornadoes to go unreported.[8]

Winter Storm

Risk Score: 226
Risk Level: High

Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. Specific characteristics of winter storms vary by temperature, wind velocity, ground saturation, and snowpack. Winter storms occur over eastern Oregon regularly during December through February.[9] Southeast Oregon is known for cold, snowy winters. This is advantageous in at least one respect: in general, the region is prepared, and those visiting the region during the winter, usually come prepared. However, there are occasions when preparation cannot meet the challenge or the unprepared find themselves in a storm.

Drifting, blowing snow has often brought traffic to a standstill on highways and other roads. Windy, icy conditions have often closed mountain passes and canyons to certain classes of truck traffic. In these situations, travelers must seek accommodations, sometimes in communities where lodging is very limited. For local residents heating, food, and the care of livestock and other animals are everyday concerns; winter storms can provide challenges to accomplishing those tasks. Access to farms and ranches can be difficult and present a serious challenge to local emergency managers.[10]

Ice storms can occur anywhere in Oregon. Like snow, ice storms are comprised of cold temperatures and moisture, but subtle changes can result in varying types of ice formation, including freezing rain, sleet, and hail. While sleet and hail can create hazards for motorists when it accumulates, freezing rain can cause the most dangerous conditions within a community. Ice buildup can bring down trees, communication towers, buildings, and electrical lines creating hazards for property owners, motorists, and pedestrians alike. The most common freezing rain occurs near the Columbia Gorge, but it also poses a hazard to Southeast Oregon.[11] Snowstorms are common to central and eastern Oregon because the air can get cold enough and the only necessary ingredient is sufficient moisture.

7Taylor, George H., Holly Bohman, and Luke Foster, August 1996, *A History of Tornadoes in Oregon*, Oregon Climate Service. Corvallis, OR: Oregon State University.

8 Taylor, George; Hatton Raymond, *Oregon Weather Book*, 1999, http://osupress.oregonstate.edu/book/oregon-weather-book.

9OPDR, *2012 Oregon NHMP*, Winter Storms Chapter, https://oregonexplorer.info/content/oregon-natural-hazard-mitigation-plan-2012.

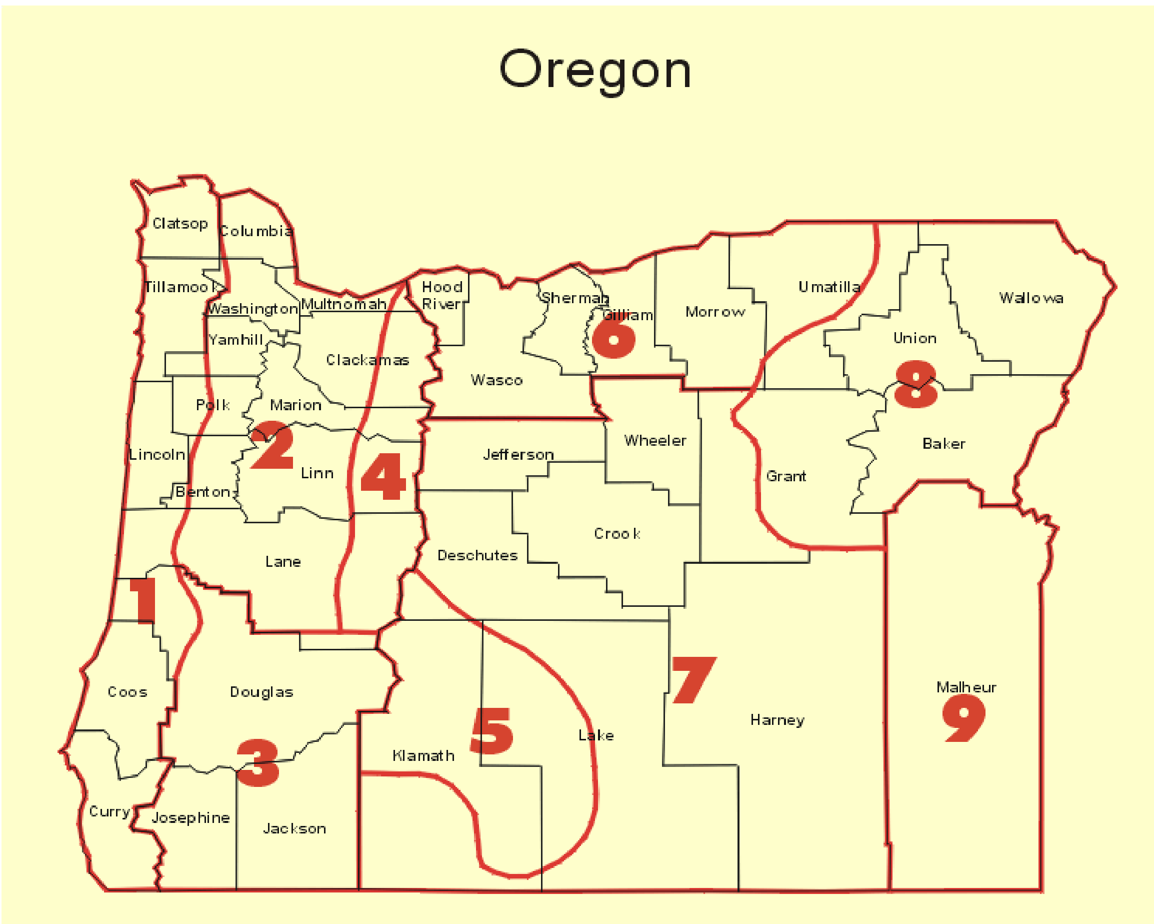
10 Ibid

11 Taylor, George; Hatton Raymond, *Oregon Weather Book*, 1999, http://osupress.oregonstate.edu/book/oregon-weather-book.

Climate Data for Malheur County

The NOAA's National Centers for Environmental Information (https://www.ncdc.noaa.gov/) has established climate divisions in the United States for areas that have similar temperature and precipitation characteristics. Oregon's latitude, topography, and proximity to the Pacific Ocean give the state diversified climates. Malheur County is in Climate Division 9, Southeast, as seen in Figure SW-1. Oregon Climate Service is the recognized American Association of State Climatologists (AASC) (https://www.stateclimate.org/about) climate office for Oregon. It is housed in the College of Earth, Ocean, and Atmospheric Science at Oregon State University (CEOAS)[12] which also houses the Oregon Climate Change Research Institute (OCCRI). OCCRI has provided climate change information for the Malheur County NHMP. In addition to the short description of climate change or future changing conditions in this Annex, see also Volume I Section 2 Risk Assessment and Appendix F for detailed information on climate change as it relates to natural hazards. Appendix C Community Profile also includes climate information for Malheur County.

Figure SW-1 Oregon's Climate Divisions



Source: NOAA, National Weather Service Climate Prediction Center, https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/CLIM_DIVS/oregon.gif

---

12 Oregon Climate Service, http://ocs.oregonstate.edu/.

Climate data such as precipitation, temperature, and sunshine provides a framework for understanding the climate in Malheur County - information for Ontario, Nyssa, and Vale is included - and how it relates to natural hazards and hazard events. The U.S. Climate Data website is https://www.usclimatedata.com/climate/ontario/oregon/united-states/usor0258.

According to the U.S. Climate Data website, Tables SW-1 and 2, and Figure SW-2 are based on the climate data for Ontario, OR 97914 - 1961-1990 normals.

Table SW-1 Ontario Weather Averages by Month

	Jan	Feb	Mar	Apr	May	Jun
Average high in °F:	34	43	56	65	74	84
Average low in °F:	18	24	31	37	44	51
Av. precipitation in inch:	1.3	0.87	0.87	0.67	0.94	0.63
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-
	Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Average high in °F:	93	92	81	66	47	36
Average low in °F:	57	54	44	34	26	20
Av. precipitation in inch:	0.31	0.28	0.47	0.55	1.18	1.42
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-

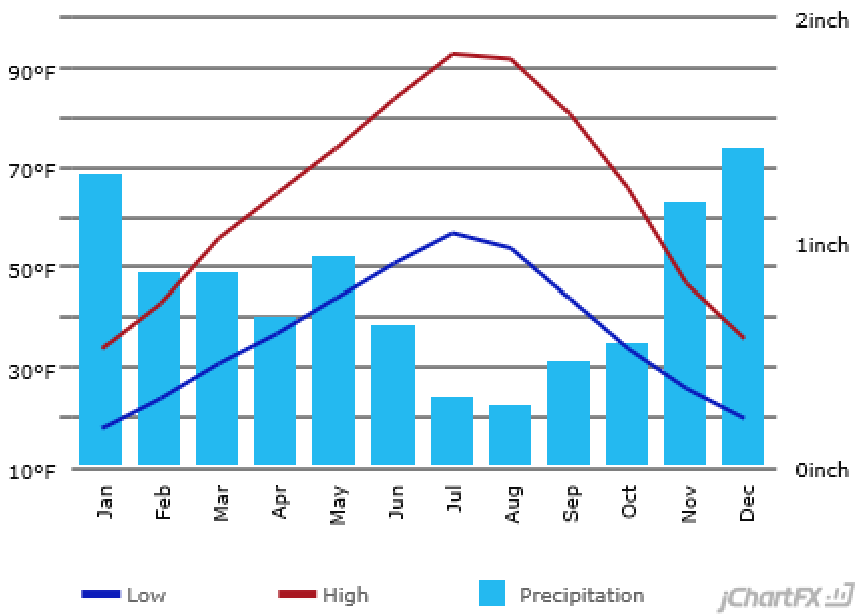
Source: U.S. Climate Data, https://www.usclimatedata.com/climate/ontario/oregon/united-states/usor0258

Table SW-2 Ontario Weather Averages by Year

Annual high temperature:	64.3°F
Annual low temperature:	36.7°F
Average temperature:	50.5°F
Average annual precipitation - rainfall:	9.49 inch
Days per year with precipitation - rainfall:	-
Annual hours of sunshine:	-
Av. annual snowfall:	-

Source: U.S. Climate Data, https://www.usclimatedata.com/climate/ontario/oregon/united-states/usor0258

Figure SW-2 Ontario Climate Graph



Source: U.S. Climate Data, https://www.usclimatedata.com/climate/ontario/oregon/united-states/usor0258

According to the U.S. Climate Data website, Tables SW-3 and 4, and Figure SW-3 are based on the climate data for Nyssa, OR 97913 - 1981-2010 normals.

Table SW-3 Nyssa Weather Averages by Month

	Jan	Feb	Mar	Apr	May	Jun
Average high in °F:	36	44	57	65	74	82
Average low in °F:	21	24	31	37	45	52
Av. precipitation in inch:	1.22	0.91	0.98	0.91	1.14	0.87
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-
Average snowfall in inch:	4	2	0	0	0	0
	Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Average high in °F:	92	91	80	66	48	36
Average low in °F:	58	56	46	35	27	21
Av. precipitation in inch:	0.24	0.28	0.47	0.71	1.14	1.5
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-
Average snowfall in inch:	0	0	0	0	1	5

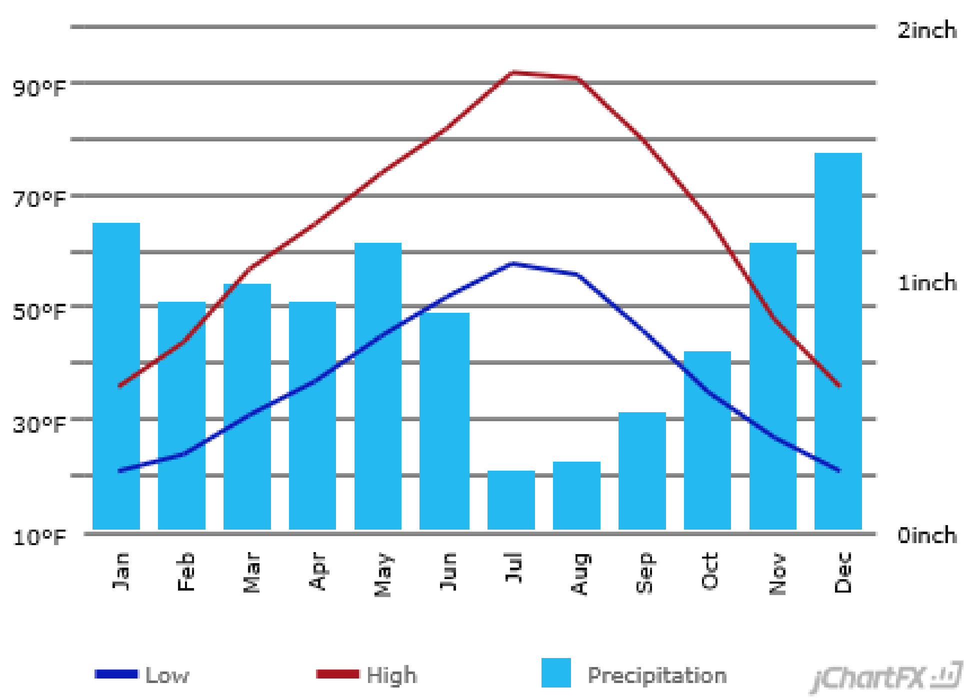
Source: U.S. Climate Data, https://www.usclimatedata.com/climate/nyssa/oregon/united-states/usor0252

Table SW-4 Nyssa Weather Averages by Year

Annual high temperature:	64.3°F
Annual low temperature:	37.8°F
Average temperature:	51.05°F
Average annual precipitation - rainfall:	10.37 inch
Days per year with precipitation - rainfall:	-
Annual hours of sunshine:	-
Av. annual snowfall:	12 inch

Source: U.S. Climate Data, https://www.usclimatedata.com/climate/nyssa/oregon/united-states/usor0252

Figure SW-3 Nyssa Climate Graph



Source: U.S. Climate Data, https://www.usclimatedata.com/climate/nyssa/oregon/united-states/usor0252

According to the U.S. Climate Data website, Tables SW-5 and 6, and Figure SW-4 are based on the climate data for Vale, OR 97918 - 1961-1990 normals.

Table SW-5 Vale Weather Average by Month

	Jan	Feb	Mar	Apr	May	Jun
Average high in °F:	35	44	57	66	75	84
Average low in °F:	18	24	30	35	44	51
Av. precipitation in inch:	1.22	0.94	0.98	0.87	1.06	0.75
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-

	Jul	Aug	Sep	Oct	Nov	Dec
Average high in °F:	93	92	80	66	48	37
Average low in °F:	56	53	42	33	26	18
Av. precipitation in inch:	0.47	0.39	0.51	0.63	1.1	1.34
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-

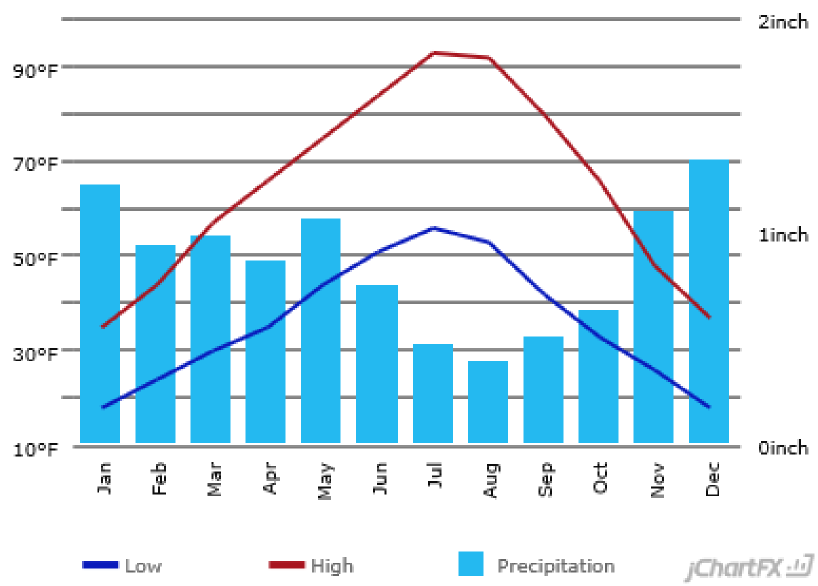
Source: U.S. Climate Data, https://www.usclimatedata.com/climate/vale/oregon/united-states/usor0362

Table SW-6 Vale Weather Averages by Year

Annual high temperature:	64.8°F
Annual low temperature:	35.8°F
Average temperature:	50.3°F
Average annual precipitation - rainfall:	10.26 inch
Days per year with precipitation - rainfall:	-
Annual hours of sunshine:	-
Av. annual snowfall:	-

Source: U.S. Climate Data, https://www.usclimatedata.com/climate/vale/oregon/united-states/usor0362

Figure SW-4 Vale Climate Graph



Source: U.S. Climate Data, https://www.usclimatedata.com/climate/vale/oregon/united-states/usor0362

History of Severe Weather in Malheur County

All of Malheur County is susceptible to severe weather. Elevation in the county varies from just above 2,000 feet above sea level (Ontario) to nearly 8,000 feet above sea level (the Trout Creek Mountains in the southern portion of the County). As such, severe weather varies by location. Table SW-7 includes a list of severe weather events that have occurred in Malheur County.

Table SW-7 Significant Severe Weather History

Date	Location	Type of Severe Weather	Description
Dec. 1861	Statewide	Snow	Snowfall 1-3 inches. Snow in Willamette Valley until late February 1862.
Dec. 1892	Northern counties in OR	Snow	15-30 inches of snow fell throughout the northern counties.
Jan. 1916	Statewide	Snow	Two snow storms, each dropped 5 inches or more.
Dec. 1924	Statewide	Cold	Coldest December on record at that time. Drewsey and Riverside set a state record for lowest temperature: -53 F.
Winter 1927, 1933, 1936, 1937, 1943, 1949	Portland area, W. Oregon, Statewide	Snow	Heavy snowfall. On January 20-25, 1927, the Harney Experiment Station reached -36 F. In February 1933, it was the coldest February to date for eastern Oregon. Ukiah and Seneca reached -54. Jan. 31 – Feb. 4 in 1937 had heavy snows statewide.
Apr. 1931	Western and central Oregon	Winter, wind, and dust storms	Unofficial wind speeds reported at 78 mph. Damaged fruit orchards and timber. Dust in the Santiam Canyon.
Mar. 1935	Central Oregon	Dust Storm	Dust storm reduced visibility to a few hundred yards over several counties. A fine county of dust on the fields and highways.
Jan. 1950	Statewide	Snow	Friday the 13th Storm. Heaviest snowfall since 1890. Freezing rain. Deep snowdrifts closed all highways west of the Cascades and through the Columbia Gorge. Roads and

Date	Location	Type of Severe Weather	Description
			schools closed. Downed power lines. Severed communication. Hundreds of thousands of dollars in property damage.
Nov. 1951	Statewide	Winter and wind storm	Nov. 10-11. Widespread damage. Transmission and utility lines damaged. Wind speeds were 40-60 mph and gusts 75-80 mph.
Dec. 1951	Statewide	Winter and wind storm	Statewide storm with wind speeds 60 mph in Willamette Valley. Widespread damage to buildings and utility lines.
Dec. 1955	Statewide	Winter and wind storm	Wind speeds 55-65 with 69 mph gust. Considerable damage to buildings and utility lines.
Nov. 1958	Statewide	Wind storm	Wind speeds at 51 mph with 71 mph gusts. Every major highway blocked by fallen trees.
Mar. 1960	Statewide	Snow	Snowfall amounts were 3-12 inches depending on location.
Oct. 1962	Statewide	Winter storm	DR-136. 1962 Columbus Day Storm. Most severe windstorm for Western Oregon due to sustained wind speeds and damage levels. Winds in the Willamette Valley up to 116 mph. 84 homes destroyed, 5,000 severely damaged. Killed 38 people and created $170-200 million in damages in the state.
Dec. 1964	Statewide	Heavy rains and flooding	DR-184. The statewide event occurred on December 24, 1964. Lake County was affected.
Aug. 1966	Malheur County	Tornado	The tornado was from Adrian to the Oregon border just north of Ontario. Several farm buildings were destroyed; trees uprooted; and telephone poles displaced.
Jun. 1967	Malheur County	Tornado	There were two tornadoes that occurred 13 miles west of Sheaville. They were limited in extent and duration; one was damaging and one was not.
Jun. 1967	Malheur County	Tornado	The tornado is listed as remote in location and some damage.
Jan. 1969	Statewide	Snow	On January. 25-30 there was record-breaking snowfalls. $3 to $4 million in property damage.
Jun. 1969	Malheur County	Tornado	The tornado occurred 40-60 miles west of Jordan Valley. Some grain fields were damaged.
Mar. 1971	Statewide	Winter storm	Great damage in the Willamette Valley; homes and power lines destroyed by falling trees.
Jan. 1972	W. Oregon	Storms and flooding	DR-319. Storm and flooding events on January 21, 1972.
Jan. 1974	W. Oregon	Rain on snow, flooding	DR-413. Flooding resulted from rain on snow events. Willamette River at Portland crested at 25.7 feet. Nine counties declared disasters.
Apr. 1974	Malheur County	Tornado	The tornado hit 10 miles SW of Nyssa; destroyed farm buildings.
Jan. 1980	Statewide	Winter storm	On January 9-11, there were a series of storms bringing snow, ice, wind, and freezing rain. Six fatalities.
Nov. 1981	Statewide	Winter storm	The strongest windstorm since the Columbus Day storm in 1962.
Dec. 1983	Malheur County	Winter Storm	There was $15,277 crop and property damage on December 19.
Nov. 1984	Malheur County	Thunderstorm and Winter storm	There was $14,027 crop and property damage on Nov. 1.
Feb. 1985	Statewide	Snow	Western valleys received 2-4 inches of snow. Massive power failures (tree limbs broke power lines). 2 feet of snow in northeast mountains. Event occurred on February 7-8.
Feb. 1986	Central and Eastern Oregon	Snow	Heavy snow in the Deschutes Basin and in eastern Oregon. Traffic accidents and broken power lines occurred.
Mar. 1988	Statewide	Winter storm	Strong winds. Heavy snow.
Feb. 1989	Statewide	Winter storm	Heavy snowfall. Record low temperatures. Event occurred February 1-8.
Jan. 1990	Statewide	Winter storm	Heavy rain with winds greater than 75 mph; significant damage; 1 death. Event occurred January 6-8. Snow in Cascades. On January 7 there was a thunderstorm in Malheur County with $152,776 crop damage.
Feb. 1990	Statewide	Snow	Average snowfall from one storm was about 4 inches in the Willamette Valley. The storm brought 24-35 inches of snow

Date	Location	Type of Severe Weather	Description
			to Cascade Locks and Hood River. Event occurred February 11-16.
Aug. 1990	Malheur County	Thunderstorm	There was a thunder storm with hail; $27,500 in crop and property damage.
Jan. 1991	Eastern Oregon	Winter storm	On January 6 and 7 there was a snow storm resulting in 1-6 inches of snow.
Jan. 1991	Most of Oregon	Severe wind storm	Severe wind storm impacts. Event occurred January 11-12.
Mar. 1991	Mid-Columbia/ NE Oregon	Severe wind storm	Severe wind storm impacts.
Jul. 1991	Malheur County	Thunderstorm	On July 13 there was a thunder storm with $50,000 in crop and property damage.
Dec. 1991	N. Central OR	Severe wind storm	Blowing dust. Event occurred December 12.
Dec. 1992	W. Oregon	Snow and wind	Heavy snow. Interstate 5 closed. Northeastern mountains had severe wind.
Jan. 1993	Northern OR	Wind storm	Severe wind storm. Damage to utilities.
Feb. 1993	W. Oregon	Snow	Record snowfalls.
Nov. 1993	Cascade Mountains, OR	Snow	Heavy snow throughout the region.
Feb. 1994	Southeastern Oregon	Snow	Heavy snow throughout the region. Event occurred Feb. 10.
Mar. 1994	Cascade Mountains, OR	Snow	Heavy snow throughout the region.
May 1994	Eastern Oregon	Wind storm	Strong winds in Treasure Valley area (Ontario); blowing dust caused car accidents. Event occurred May 15.
Dec. 1995	Statewide	Wind storm	DR-1107. Event occurred on December 10-12. Winds reached 62 mph in the Willamette Valley. Strongest windstorm since 1981.
Feb. 1996	Statewide	Storms, flooding, rain on snow	DR-1099. Winter storms with rain, snow, ice, floods, and landslides. Power outages, road closures and property damage. Warm temperatures, record breaking rains; extensive flooding in Multnomah County; widespread closures of major highways and secondary roads; 8 fatalities. 27 counties covered by the disaster declaration.
Sep. 1996	Malheur County	Hail	On September 15 there was ¾ inch hail in Vale; about $10,000 in property damage.
Dec. 1996	Statewide	Winter storm	DR-1160. Severe snow and ice. Up to 4 to 5 inches of ice in the Columbia Gorge. Interstate 84 closed for 4 days. Hundreds of downed trees and power lines. Lake County was impacted.
Apr. 1997	Malheur County	Tornado	On April 30 there was a F1 magnitude tornado in Ontario.
Jun. 1997	Malheur County	Tornado	On June 17 there was a F0 magnitude tornado in Ontario.
Jul. 1997	Malheur County	Thunderstorm and hail	On July 17, there was a thunderstorm with hail in Vale and Ontario with $3,000,000 in crop and property damage.
Jul. 1997	Malheur County	Hail	On July 30 there was .9 inch hail in Nyssa.
Nov. 1997	W. Oregon	Wind storm	Uprooted trees. Considerable damage to small airports. Winds up to 52 mph.
Jun. 1998	Malheur County	Thunderstorm, hail, flood	On June 12 there was dime size hail reported in Juntura. East of Juntura the storm triggered a flash flood onto Highway 21 near milepost 202. 6-12 feet of water, mud, and debris swept over the road. A car with 2 people was carried 150 feet. No injuries.
Jul. 1998	Malheur County	Thunderstorm and hail	On July 4 there was a thunderstorm with hail in Ironside and $1,000,000 crop and property damage.
Winter 1998-1999	Statewide	Snow	Series of storms. One of the snowiest winters in Oregon history. The snowfall at Crater Lake was 586 inches.
Feb. 1991	Malheur County	Wind storm	On February 8 there was a wind storm outside of Ontario in Cairo Junction; the roof of the elementary school gym was damaged.
Feb. 2000	Southeast Oregon	Winter and wind storm	February 14 had high winds associated with a winter storm; up to 80 mph. Significant damage to Southeastern Oregon.

Date	Location	Type of Severe Weather	Description
Apr. 2001	Near Klamath Falls, OR	Dust storms	US 97 about 5 miles north of Klamath Falls was closed for approximately 6 hours following 3 separate crashes. There were 11 cards involved, sending 9 people to the hospital. Crashes caused by limited visibility resulting from dust from a plowed field.
Nov. 2001	Malheur County	Winter storm	On November 24-28 there was 6-8 inches of snow; I-5 closed; numerous accidents.
Dec. 2001	Malheur County	Winter storm	On December 12 there was a winter storm with $25,000 in crop and property damage.
Feb. 2002	W. Oregon	Winter storm	Damages $6.14 million. Downed power lines and trees. Buildings damaged. Power outages caused some water supply problems.
Jul. 2003	Malheur County	Thunderstorm and hail	On July 26 there was a thunder storm with hail which resulted in $2.8 million in crop damage.
Summer 2003	Malheur County	Wind storm	The Treasure Valley are had a wind storm; the golf course clubhouse had $1,375 in damages.
Dec. 2003-Jan. 2004	Statewide	Snow and ice	DR-1510. Much of Portland area shut down. Twenty-six counties receive FEMA assistance. Malheur County was included.
Jul. 2004	Malheur County	Wind storm	On July 11 there was a wind storm in Ontario. Trees were uprooted across town.
May 2005	Malheur County	Thunderstorm and hail	On May 29 there was a thunderstorm with hail that resulted in $3,000 in damage to crops and property.
Sep. 2005	Statewide	Evacuation	EM 3228. On September 7, there was a declaration for the Hurricane Katrina evacuation.
May 2005	Malheur County	Wind storm	Hail storm caused $3,000 in crop damage.
May 2006	Statewide	Storms, flooding, landslides, mudslides	DR-1632. Statewide impacts from storms, floods, landslides, and mudslides. The winds ranged from 70-80 mph.
Jul. 2006	Statewide	Heatwave	Multiple days of temperatures over 100 degrees Farenheit.
Aug. 2006	Harney and Malheur Counties	Wind storm	Three high wind storms with winds measured at 67, 58, and 58 mph respectively. The storms occurred on August 10 in Diamond, on August 16 in Riley, and on August 28 at the Burns Airport.
Nov. 2006	W. Oregon	Winter storm, flooding, landslides	DR-1962. The events occurred November 6-8, 2006.
Dec. 2007-Jan. 2008	W. Oregon	Winter storm	DR-1824. Severe winter storm, record and near record snow, landslides and mudslides. January 4 high winds in Harney Co. On January 8 there was 8 in snow across Harney Co. On January 29 there was 4-7 in snow near Burns.
Dec. 2008	Statewide	Winter storms, heavy rain, flooding	DR-1824. Severe winter storm, flooding, winds, record and near record snow, landslides and mudslides. Gresham received, 26" of snow. Many roads closed. Significant damages to public infrastructure, homes and businesses. Event occurred Dec. 20-26. On December 22, 2008, over 22 inches of snow fell on Hood River in 22 hours. Up to 6 inches fell at Burns on December 21 and 60 in around Burns on December 25.
Dec. 2009	Statewide	Winter storm	Snow and freezing rain in Salem, and Portland to Hood River. I-84 closed for 22 hours. On December 14 there was 5 in snow across Harney County.
Aug. 2010	Malheur County	Thunder torm and hail	On August 6 there was a thunderstorm with hail in Harper, Ontario, and Vale. Crop damage was $10,000.
Nov. 2010	Statewide	Winter storm	Snow, freezing rain, and ice in Portland to Hood River. On November 21, Harney County had 4 in snow.
Jan. 2011	Statewide	Winter storm	DR-1956. Severe winter storm, flooding, mudslides, landslides, and debris flows.
Jan. 2012	W. Oregon	Winter storm	DR-4055. The incident period was January 12-21, 2012. Severe winter storm with flooding, landslides, and mudslides. Declaration involves 12 counties including Hood River County. Harney County had 5-8 in snow on January 24.
Aug. 2012	Harney and Malheur Counties	Dust storm	A massive dust storm due to 5-60 mph winds produced by thunderstorms eventually blew into Idaho. Some reports state the sky was dark for more than 2 hours.

Date	Location	Type of Severe Weather	Description
Mar. 2013	Malheur County	Dust storm	Dust from this storm is reported to have accelerated snow melt in a SW Idaho mountain range.
Sep. 2013	Malheur County	Hail	On September 5 there was hail size 1.75 inches in Jordan Valley.
Dec. 2015	Western Oregon	Winter storm	DR-4258. Severe winter storms, straight-line winds, flooding, landslides, and mudslides.
Jan. 2017	Statewide	Severe winter storms, flooding, landslides, mudslides	DR-4238. The event occurred January 7-10, 2017. Counties that were part of the disaster declaration: Hood River, Columbia, Josephine, and Deschutes. Other counties were also greatly impacted by this and other storms that occurred.

Sources: University of Oregon, Malheur County NHMP, May 2014; DLCD, Oregon NHMP, 2015; FEMA, Disaster Declarations for Oregon, retrieved 2017. Taylor and Hatton, 1999; NOAA Storm Events Database, http://www.ncdc.noaa.gov/stormevents/ (accessed 3/27/13).

Risk Assessment

How are Hazards Identified?

For these categories of severe weather, winter storms, wind storms, extreme temperatures, and dust storms, seasonal variability plays a role. Looking at Table SW 1, notice the substantial number of events, as well as the date and type of event. There are a lot of winter and wind storms.

Severe weather includes rain and thunderstorms. Rain might be freezing rain during winter and be classified as a winter storm. Thunderstorms can bring high winds to Malheur County during the warmer months (April to October).

Wind storms are year round events, though in Malheur County they usually occur from October to March. Their extent is determined by their track, intensity (the air pressure gradient they generate), and local terrain. The National Weather Service uses weather forecast models to predict oncoming wind storms, while monitoring storms with weather stations in protected valley locations throughout Oregon.[13] Tornadoes are the most violent of wind storms and are occasionally caused by intense local thunderstorms, which are more common during the warm season (April to October).

Extreme temperature events – both high and low temperatures - are experienced in all regions of Oregon. Some the most extreme temperatures can occur in Eastern Oregon.

Dust storms can occur year round, typically occurring with strong winds.

Winter storms typically occur between December and February, but can be as early as October and as late as March. Winter storms can occur all across Oregon, they are common in Eastern Oregon.

Hazard Risk Analysis

The Malheur County NHMP Steering Committee completed a Hazard Vulnerability Assessment/Analysis (HVA) on April 12, 2018. This was described in Section 2 Risk Assessment. The method used for the HVA was developed from a Federal Emergency Management Agency (FEMA) tool that has been refined by the Oregon Office of Emergency Management (OEM). It addresses and weights (shown as percent within parentheses) probability (29%), vulnerability (21%), maximum

[13] National Weather Service, Some of the Area's Windstorms, https://www.wrh.noaa.gov/pqr/paststorms/wind.php

threat (42%) and the history (8%) of each natural hazard and attributes a final hazard analysis score. The methodology produces scores that range from 24 to 240.

For local governments, conducting the HVA is a useful step in planning for hazard mitigation. The method provides the jurisdiction with a relative ranking from which to prioritize mitigation actions, but does not predict the occurrence of a particular hazard.

A recap of the changes for the severe weather hazards between the HVA done in 2013 and in 2018:

- In 2013 **severe weather** hazards had a risk score of 165 and a rank of 4 out of 11 natural hazards. In 2018 severe weather hazards had a risk score of 165 and a rank of 6 out of 11 natural hazards.

- In 2013 **winter storm** hazards had a risk score of 191 and a rank of 2 out of 11 natural hazards. In 2018 winter storms hazards had a risk score of 235 and a rank of 2 out of 11 natural hazards.

- In 2013 **wind storms** hazards had a risk score of 155 and a rank of 5 out of 11 natural hazards. In 2018 wind storms hazards had a risk score of 195 and a rank of 3 out of 11 natural hazards.

- In 2013 **extreme temperature hazards** had a risk score of 72 and a rank of 7 out of 11 natural hazards. In 2018 extreme temperature hazards had a risk score of 126 and a rank of 7 out of 11 natural hazards.

- In 2013 **dust storm hazards** had a risk score of 52 and a rank of 8 out of 11 natural hazards. In 2018 dust storms hazards had a risk score of 116 and a rank of 9 out of 11 natural hazards.

For more information on all the risk scores and ranks of the natural hazards for Malheur County, see Volume I Basic Plan, Section 2 Risk Assessment of this NHMP.

Probability of Future Occurrence

The History of Severe Weather in Malheur County section and Table SW-7 Significant Severe Weather History detail many weather related hazards that affect Malheur County and Cities. In the *2014 Malheur County NHMP*, the following probability statistics were included:

- There is an average of one wind storm or tornado every 1.8 years.

- The recurrence interval for winter storms throughout Oregon is about every 13 years; however, there can be many localized storms between these periods. Those included average out to one winter storm every 2.5 years.

- No approximate average of occurrence of extreme temperature or dust storm was included.

- Some included events are localized and do not affect large areas of the County or Cities.

Specific probability rates have not been calculated for each of these hazards in Malheur County. Of note, as has been described in Volume 1 Section 2 Risk Assessment, probability is one of the four factors that are included in the risk score. It is quite probable that severe weather, dust storms, extreme temperatures, wind storms, and winter storms will continue to occur. Storms and weather information are tracked by numerous agencies such as NOAA/National Weather Service (NWS), USGS, Oregon Climate Services, ODOT, and DOGAMI, and warnings are issued by NWS when certain thresholds are reached.

An example for the wind hazard, in terms of probability, is included below. Table SW-8 shows the wind speed probability intervals that structures 33 feet above the ground would expect to be exposed to within a 25-, 50- and 100- year period. The regions that experience the highest wind speeds are Regions 1 and 6. Structures in Malheur County, within Region 8, can expect to be exposed to lower wind speeds than most regions within the state.

Table SW-8 Probability of Severe Wind Events by Natural Hazard Region

	25-Year Event (4% annual probability)	50-Year Event (2% annual probability)	100-Year Event (1% annual probability)
Region 1: Oregon Coast	75 mph	80 mph	90 mph
Region 2: North Willamette Valley	65 mph	72 mph	80 mph
Region 3: Mid/Southern Willamette Valley	60 mph	68 mph	75 mph
Region 4: Southwest Oregon	60 mph	70 mph	80 mph
Region 5: Mid-Columbia	75 mph	80 mph	90 mph
Region 6: Central Oregon	60 mph	65 mph	75 mph
Region 7: Northeast Oregon	70 mph	80 mph	90 mph
Region 8: Southeast Oregon	55 mph	65 mph	75 mph

Source: *2015 Oregon Natural Hazard Mitigation Plan*, https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP_5_RAState.pdf

Vulnerability Assessment

The impacts of the hazards of severe weather, dust storms, extreme temperatures, wind storms, and winter storms happen at a range of levels. Communities are vulnerable in many ways such as, emergency services may be challenged to respond, critical facilities may be damaged, and economic vitality may be impacted.

Thunderstorms with hail are predominantly an economic concern for the County's agricultural community. If a storm occurs or a lightning strike happens during the growing season, damages to row crops can be economically devastating, especially to the uninsured. Microbursts have damaged buildings and have contributed to instances of several inches of rain falling in an hour or less. Severe thunderstorms occurring after a recent wildfire can wash out canals and waterways stripped of undergrowth by fire, which then exacerbate flood issues and can damage roads and irrigation infrastructure.

Extreme cold and heat can cause bodies to work harder to maintain themselves which stresses them and cause injury. Accidents can occur.

Dust storms can reduce visibility, which can cause traffic accidents. They can also exacerbate health conditions such as asthma or other respiratory illness. According to the *2015 Oregon NHMP*, Malheur County is considered one of the counties most vulnerable to dust storms in the state.

Snow and ice storms can block traffic; cause traffic accidents and block roads; damage crops, livestock, and agricultural buildings; and delay transportation of products. People may be stranded. Events and activities may be cancelled. Power outages and downed trees can happen. All of these cause economic disruptions, and pose a high risk for injuries and loss of life. The events can also be typified by a need to shelter and care for adversely impacted individuals.

Wind storms can also cause power outages, transportation, and economic disruptions. Structures most vulnerable to high winds and snow storms in Malheur County include insufficiently-anchored manufactured homes and older buildings with roof structures not designed for anticipated wind loads and snow loads.

Manufactured homes, multi-story retirement homes, and buildings in need of roof repair are structures that may be most vulnerable to wind storms. Buildings adjacent to open fields or adjacent to trees are also more vulnerable to wind storms than more protected structures. The effects of wind speed are shown in the table below.

Table SW-9 Effects of Wind Speed

Wind Speed (mph)	Wind Effects
25-31	Large branches will be in motion.
32-38	Whole trees in motion; inconvenience felt walking against the wind.
39-54	Twids and small branches may break off trees; wind generally impedes progress when walking; high profile vehicles such as trucks and motor homes may be difficult to control.
55-74	Potential damage to TV antennae; may push over shallow rooted trees, especially if the soil is saturated.
75-95	Potential for minimal structural damge, particularly to unanchored mobile homes; power lines, and signs; and tree branches may be blown down.
96-110	Moderate structural damage to walls, roofs, and windows; large signs and tree branches blown down; moving vehicles pushed off roads.
111-130	Extensive structural damage to walls, roofs, and windows; trees blow down; mobile homes may be destroyed.
131-155	Extreme damage to structures and roofs; trees uprooted or snapped.
Greater than 155	Catastrophic damage; structures destroyed.

Source: 2014 Malheur County NHMP cites Washington County, Office of Consolidated Emergency Mngt, Wind Effects.

Community Hazard Issues

What is susceptible to damage during a hazard event?

The impacts of the hazards of severe weather, dust storms, extreme temperatures, wind storms, and winter storms have been discussed in detail already. Listed below are some of the key severe weather issues for Malheur County:

- Buildings have sustained roof, window, and other damage from wind storms. Building codes are more stringent for new construction, but old buildings are vulnerable.
- Not all residents maintain 72-hour kits for emergency severe weather situations when they may be cut off from power, water, heat, or transportation resources for several days. Additional outreach is needed to encourage people to prepare these kits.
- Small businesses and nonprofits would benefit from outreach designed to help them plan and prepare for potential damages from a severe weather event and other natural hazards.
- Some open-air earthen irrigation canals in the County that have been weakened by gopher burrowing are especially vulnerable to washouts after thunderstorm activity.
- Some rural County roads are subject to washouts or blockage after a large storm event, which can affect residential and commercial traffic and limit residents' access to emergency resources.
- Hail during the growing season (spring-summer) can seriously damage row crops throughout the County and impact businesses such as car dealerships.
- Because of their lack of city resources and (often) geographic distance from resources, unincorporated communities are particularly vulnerable to road closures and lack of access to services after major storms.
- The County road department and special road districts have limited equipment and resources for major winter storm events. Much of the County's equipment is aging.

City Specific Damage

Ontario

Severe Weather: The City of Ontario's vulnerability is due to the concentration of infrastructure in the City and the resulting potential losses. The damage that severe thunderstorms and hail can inflict on agricultural fields and irrigation systems and the resulting economic impacts, is substantial. Of note, Ontario is home to most of the car dealerships in Malheur County, all of which are vulnerable to inventory damage from hail.

Dust Storm: Dust storms are locally associated with microbursts (described previously) and may include low-pressure and 60 mph winds. Although dust storms are relatively common, the NHMP Steering Committee asserts that the City is not that vulnerable. Generally dust storms affect visibility for a short duration but do not cause extensive, or long lasting, damages.

Extreme Temperature: The City of Ontario, similar to Malheur County, experiences both hot and cold events on an annual basis. The effects of the events tend to be on the vulnerable populations. To the extent that the City is able, the impacts are mitigated through existing capabilities of through the use of air conditioning and heat in buildings. Extreme cold events may also affect the freezing pipes and possibly power outages. Local inversions can cause freezing temperatures for more than a month at a time. During these periods, air quality is also a concern (due to increased wood burning). There is a financial impact to the community, which includes the cost of fixing utilities.

The City has provided insulation blankets for meters (400 meters froze in January 2013) and also provides information in utility bills to help decrease the risks associated with hot and cold events. Associated with cold weather events are ice jams on the Snake River.

Wind Storm: Wind storms impact the Ontario area (including Cairo Junction, which is an unincorporated community two miles outside of city limits). NHMP Steering Committee members recalled frequent past events wherein trees were uprooted, crops damaged, roofs and windows damaged, and power lines blown down. Wind storms have not caused disastrous local damage but are a persistent problem. Wind storms are often associated with microbursts (thunderstorms) and may include dust storms that affect visibility in the community.

Winter Storm: The City of Ontario sits at the lowest elevation point in Malheur County, and while major winter storms can and have occurred, they typically do not cause significant damage to the community. However, road closures on I-84 within an hour's drive of the City due to winter weather are a frequent occurrence and can interrupt commuter traffic. They also bring a large influx of stranded motorists and into the City, which can provide an economic boost to local motels and restaurants. The City budgets funds for seasonal winter storm needs, such as clearing roads. Among the largest concern for the City is finding a place for trucks to park off of the interstate when the passes north of the city are closed; action item SW #3 relates to this concern. The weight of snow can damage or collapse buildings.

Nyssa

Severe weather: Impacts to the City of Nyssa are similar to those described for Malheur County. One of the greatest impacts are to crops in the area and the economic impacts this can have. Microbursts are a frequent occurrence in the area, bringing brief, heavy rainstorms that can trigger flash flood conditions as well. See the Flood Annex for a description of flood impacts.

Dust Storm: The City of Nyssa does not consider dust storms to be a big vulnerability. See also the description for Ontario.

Extreme Temperature: The City of Nyssa, similar to Malheur County and the other Cities, experiences both hot and cold events on an annual basis. The effects of the events tend to be on the vulnerable populations. See Ontario for the impacts.

Wind Storm: The NHMP Steering Committee recalled frequent past events – group consensus was at least one windstorm each summer – wherein trees were uprooted, crops damaged, roofs and windows damaged, and power lines blown down. Winds storms have not caused disastrous local damage but are a persistent problem. Previous wind storms have blown off roofs at Fiesta Farms buildings and had 105 mph gusts.

Winter Storm: Historically, significant winter storms have caused power outages, road closures, and infrastructure damage, even necessitating National Guard assistance. Additionally, freezing fog has caused problems by damaging power lines, and water meters on the municipal water system have frozen in extreme cold. The City of Nyssa has three snowplows, one grader and two sanding trucks.

Vale

Severe Weather: Impacts to the City of Vale are similar to those described for Malheur County. One of the greatest impacts are to crops in the area and the economic impacts this can have. Microbursts are a frequent occurrence in the area, bringing brief, heavy rainstorms that can trigger flash flood conditions as well. See the Flood Annex for a description of flood impacts. NHMP Steering Committee members recalled no thunderstorm-induced flash floods in the city.

Dust Storm: The City of Vale does not consider dust storms to be a big vulnerability. See also the description for Ontario.

Extreme Temperature: The City of Vale, similar to Malheur County and the other Cities, experiences both hot and cold events on an annual basis. The effects of the events tend to be on the vulnerable populations. See Ontario for the impacts.

Wind Storm: Wind storms are a rare event in Vale, but they can and have occurred. Damage in the City has not extended beyond downed trees and debris.

Winter Storm: Historically, significant winter storms have caused power outages, road closures, and infrastructure damage, but these severe events are infrequent. Because of the infrequent nature of severe winter storms in Vale, the City does not maintain sufficient equipment to clear and maintain roads made impassable by snow or ice. This can have an impact on local businesses and schools, in addition to truck and passenger vehicle traffic on Highway 20.

Existing Hazard Mitigation Activities and Resources

Severe Weather Hazards

State Natural Hazard Risk Assessment

The risk assessment in the *2015 Oregon Natural Hazards Mitigation Plan* provides an overview of all the identified natural hazards in Oregon (in the State NHMP but not necessarily all the locally identified natural hazards) and identifies the most significant hazards in Oregon's recorded history. It has overall state and regional information, and includes mitigation actions for the entire state. https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP_5_RAState.pdf

Planning for Natural Hazards: Oregon Technical Resource Guide

This guide describes basic mitigation strategies and resources related to natural hazards, including examples from communities in Oregon. https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

Oregon State Building Code Standards

The Oregon Building Codes Division adopts statewide standards for building construction that are administered by the state and local municipalities throughout Oregon. The *2017 Oregon Residential Special Code* (*ORSC*) contains requirements for one- and two-family dwellings (https://codes.iccsafe.org/content/document/1018?site_type=public) and the *2014 Oregon Structural Special Code* (*OSSC*) (http://ecodes.biz/ecodes_support/free_resources/Oregon/14_Structural/14_ORStructural_main.html) contains provisions for grading and site preparation for the construction of building foundations.

Street/ Road/ Highway Maintenance

The Oregon Department of Transportation (ODOT) is responsible for performing precautionary measures to maintain the safety and operability of major roads during winter storm conditions. The road maintenance programs are designed to provide the best use of limited resources to maximize the movement of traffic within the community during winter weather.

During storm events, most agencies at the county and city level focus on clearing major arterial and collector streets first, and then respond to residential connector streets, school zones, transit routes, and steep residential streets as resources become available.

The state, counties, and cities, may have various agreements, including mutual aid agreements, about road maintenance responsibilities during day to day operations and who does what in storm situations. In general, highways receive more attention. Routes on the National Highway System network, primary interstate expressways and primary roads, will be cleared more quickly and completely than other roads.

Dust Storm

Malheur County is home to a branch of the OSU Extension Service and to the Malheur County Soil Water and Conservation District.

The OSU Extension Service in Malheur County offers "research-based information to strengthen communities, improve lives & manage resources wisely with programs in 4-H Youth Development, Family & Community Health, Field Crops, Forage Crops & Livestock & Rangeland Management. The staff and volunteers assist local residents through meetings, workshops, short courses, tours, demonstrations and publications" (https://extension.oregonstate.edu/malheur).

Malheur County SWCD objectives are to:

- "Maintain & improve water quality within Malheur County,
- Provide planning & technical service assistance to private landowners,
- Promote watershed enhancement projects within Malheur County,
- Promote soil & water conservation through information programs, and
- Properly administer SWCD programs efficiently and effectively" (http://malheurcoswcdorg.netfirms.com/swcd/).

Extreme Temperatures

FEMA has recommendations for extreme temperature mitigation activities for both hot and cold temperatures. For example, in extreme cold events, measures should be taken to ensure that vulnerable populations are protected. These can include: organizing outreach by establishing and promoting accessible heating centers within the communities; requiring minimum temperatures in housing codes; encouraging utility companies to offer special arrangement for paying heating bills; and creating a database to track vulnerable populations (e.g. elderly and homeless). These activities can include locating water pipes on the inside of the building insulation or keeping them out of attics, crawl spaces and vulnerable outside walls.[14]

Wind Storm

Oregon Building Codes (both residential and other codes) set standards to withstand 80 mph winds (https://www.oregon.gov/bcd/codes-stand/pages/index.aspx).

FEMA recommends having a safe room in homes or small businesses to prevent residents and workers from "dangerous forces" of extreme winds to avoid injury or death. (https://www.fema.gov/fema-p-320-taking-shelter-storm-building-safe-room-your-home-or-small-business).

Existing strategies and programs at the state level are usually performed by the Oregon Public Utility Commission (OPUC), Building Code Division (BCD), Oregon Department of Forestry (ODF), Oregon Emergency Management (OEM), and the Oregon Department of Transportation (ODOT).

The Oregon Emergency Response System (OERS) coordinates and manages state resources in response to natural and technological emergencies and civil unrest involving multi-jurisdictional cooperation between all levels of government and the private sector (https://www.oregon.gov/oem/emops/Pages/OERS.aspx).

OPUC ensures operators manage, construct and maintain their utility lines and equipment in a safe and reliable manner. These standards are listed on this website: http://www.puc.state.or.us/PUC/safety/index.shtml. OPUC promotes public education and requires utilities to maintain adequate tree and vegetation clearances from high voltage utility lines and equipment.

Winter Storm

Studded tires can be used in Oregon from November 1 to April 1. They are defined under Oregon law as a type of traction tire. Research shows that studded tires are more effective than all-weather tires on icy roads, but can be less effective in most other conditions. Winter storm is similar to wind storm in terms of strategies and programs at the state level.

Future Changing Conditions/ Climate Change

In the Malheur County NHMP, there are several locations that describe future changing conditions or climate change as it relates to the natural hazards that impact Malheur County. In the order of appearance in the NHMP: the Risk Assessment, the Hazards Annexes, and Appendix F contain this information. Within Appendix F there are two documents, the *Future Climate Projections: Malheur County* and the *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports.*

[14] FEMA, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, http://www.fema.gov/media-library-data/20130726-1904-25045-0186/fema_mitigation_ideas_final508.pdf

Severe Weather Mitigation Action Items

The severe weather mitigation actions have been identified by the Malheur County NHMP Steering Committee which includes the Cities of Nyssa, Ontario and Vale. See Table 3-3 Mitigation Actions Table 2019 NHMP and the action item worksheets in Appendix A for a more detailed description of the mitigation actions.

There are four severe weather specific mitigation actions. The mitigation actions have a high-medium priority because the Hazard Vulnerability Assessment (HVA) resulted in severe weather having a high-medium risk level.

There are seven multi-hazard mitigation actions for the NHMP and several of those include severe weather related mitigation actions, in conjunction with the other hazards. The multi-hazard mitigation actions are a high priority.

At the August 9, 2018 NHMP Steering Committee meeting, it was agreed that the risk level rankings from the HVA would be used as the way to prioritize the multi-hazard and hazard-specific mitigation actions. The risk level rankings are in Table 2-5 in Section 2 Risk Assessment.

Risk Score: 124

Risk Level: Medium

Volcanic Event Hazard Annex

A volcano is an opening in the Earth's crust that allows molten rock, gases, and debris to escape to the surface.[1] Volcanoes are present in Washington, Oregon, and California where volcanic activity is generated by continental plates moving against each other (see the Earthquake Annex). Because the population of the Pacific Northwest is rapidly expanding, and scientists have increased their knowledge about the threats from the volcanoes of the Cascade Mountain Range, more people are aware of the dangers of these mountains.[2] In the Cascade Range vicinity, the number of people at immediate risk during volcanic eruptions is greater than at any other volcanic area within the United States. The 2010 census states that more than 10 million people live in Washington and Oregon.[3]

Besides the hazards, volcanoes provide benefits such as fertile soil, valuable metallic minerals, geothermal resources, and scenic beauty. They produce volcanic products that are used as building or road-building materials, as abrasive and cleaning agents, and as raw materials for many chemical and industrial uses. Soil rich in mineral nutrients and beautiful scenery encourages humans to settle.[4]

Causes and Characteristics of Volcanic Eruption

Malheur County, and the Pacific Northwest, lie within the "ring of fire," an area of high volcanic activity surrounding the Pacific Basin. Volcanic eruptions occur regularly here, in part because of the movement of the Earth's tectonic plates. The Earth's outermost shell, the lithosphere, is broken into a series of slabs known as tectonic plates. These plates are rigid, but they float on a hotter, softer layer in the Earth's mantle. As the plates move about on the layer beneath them, they spread apart, collide, or slide past each other. Volcanoes occur most frequently at the boundaries of these plates and volcanic eruptions occur when the hotter, molten materials, or magma, rise to the surface.

The primary threat to lives and property from active volcanoes is from violent eruptions that unleash tremendous blast forces, generate mud and debris flows, and produce flying debris and ash clouds. The immediate danger area generally lies within a 10-mile radius of the blast site but lahars can inundate more than 50 miles downstream. Falling ash and drifting clouds can impact areas hundreds or thousands of miles away.[5] Scientists refer to proximal (close) and distal (farther) hazard zones. For example with Mt. Hood, the proximal zones includes the mapped hazards including lava

[1] FEMA, *Be Prepared for a Volcano*, https://www.fema.gov/media-library-data/1533576019429-bb1357b03a5a2993bd8ee37767e47d86/Volcano_InfoSheet_080118.pdf

[2] Dzurisin, Dan, Peter H. Stauffer, and James W. Hendley II, *Living with Volcanic Risk in the Cascades*, USGS Fact Sheet 165-97, https://pubs.usgs.gov/fs/1997/fs165-97/fs165-97.pdf

[3] USGS, *Volcano Hazards in the Cascade Range*, https://volcanoes.usgs.gov/observatories/cvo/hazards.html

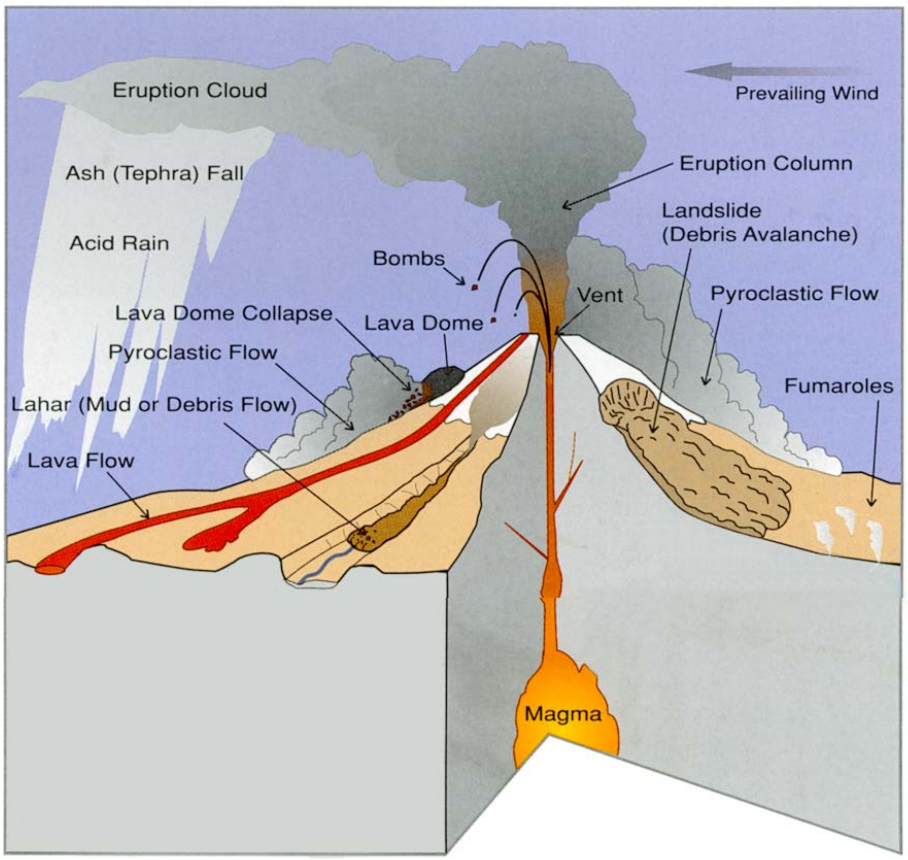
[4] USGS, *What are some Benefits of Volcanoes?* https://www.usgs.gov/faqs/what-are-some-benefits-volcanic-eruptions?qt-news_science_products=0#qt-news_science_products

[5] Dzurisin, Dan, Peter H. Stauffer, and James W. Hendley II, *Living with Volcanic Risk in the Cascades*, USGS Fact Sheet 165-97, https://pubs.usgs.gov/fs/1997/fs165-97/fs165-97.pdf

flows, pyroclastic flows, debris avalanches, and lahars while the distal zone mapped hazard is lahar. Estimated lahar travel times may also be included on the map.[6]

There are three types of volcanoes: cinder cones, composite or stratovolcanoes, and shield volcanoes. Volcanoes are commonly conical hills or mountains built around a vent that connect with reservoirs of molten rock below the surface of the earth.[7] Some younger volcanoes may connect directly with reservoirs of molten rock, while most volcanoes connect to empty chambers. Unlike most mountains, which are pushed up from below, volcanoes are built up by an accumulation of their own eruptive products: lava or ash flows and airborne ash and dust. When pressure from gases or molten rock becomes strong enough to cause an upsurge, eruptions occur. Gases and rocks are pushed through the opening and spill over, or fill the air with lava fragments. Figure VE-1 diagrams the basic features of a composite volcano.

Figure VE-1 Volcanic Hazard from a Composite Type Volcano



Source: Walder et al, *Volcano Hazards in the Mount Jefferson Region*, 1999, https://pubs.er.usgs.gov/publication/ofr9924; W.E. Scott, R.M. Iverson, S.P. Schilling, and B.J. Fischer, *Volcano Hazards in the Three Sisters Region, Oregon: U.S. Geological Survey Open-File Report 99-437*, 14p., 2007-1221, https://pubs.usgs.gov/of/1999/0437/.

---

[6] USGS, *Hazards, Mt. Hood Hazards Zonation Map*, https://volcanoes.usgs.gov/volcanoes/mount_hood/mount_hood_hazard_68.html

[7] Tilling, Robert I., *Volcanoes*, USGS General Interest Publication, (1985).

Volcanic Hazards

Ash / Tephra

Tephra consists of volcanic ash (sand-sized or finer particles of volcanic rock) and larger fragments. During explosive eruptions, tephra together with a mixture of hot volcanic gas are ejected rapidly into the air from volcanic vents. Larger fragments fall down near the volcanic vent while finer particles drift downwind as a large cloud. When ash particles fall to the ground, they can form a blanket-like deposit, with finer grains carried further away from the volcano. In general, the thickness of ash fall deposits decreases in the downwind direction.

Tephra hazards include impact of falling fragments, suspension of abrasive fine particles in the air and water, and burial of structures, transportation routes and vegetation.

During an eruption that emits ash, the ash fall deposition is controlled by the prevailing wind direction. The predominant wind pattern over the Cascades is from the west, and previous eruptions seen in the geologic record have resulted in most ash fall drifting to the east of the volcanoes. [8]

Earthquakes

Volcanic eruptions can be triggered by seismic activity or earthquakes can occur during or after a volcanic eruption. Earthquakes produced by stress changes are called volcano-tectonic earthquakes. These earthquakes, typically small to moderate in magnitude, occur as rock is moving to fill in spaces where magma is no longer present and can cause land to subside or produce large ground cracks.[9] In addition to being generated after an eruption and magma withdrawal, these earthquakes also occur as magma is intruding upward into a volcano, opening cracks and pressurizing systems.[10] Volcano-tectonic earthquakes do not indicate that the volcano will be erupting but can occur at anytime and cause damage to manmade structures or provoke landslides.

Lava flows

Lava flows are streams of molten rock that erupt relatively non-explosively from a volcano and move downslope, causing extensive damage or total destruction by burning, crushing, or burying everything in their paths. Secondary effects can include forest fires, flooding, and permanent reconfiguration of stream channels. [11]

Pyroclastic flows and surges

Pyroclastic flows are avalanches of rock and gas at temperatures of 600 to 1500 degrees Fahrenheit. They typically sweep down the flanks of volcanoes at speeds of up to 150 miles per hour. Pyroclastic surges are a more dilute mixture of gas and rock. They can move even more rapidly than a

[8] DLCD, *2015 Oregon Natural Hazard Mitigation Plan*, State Risk Assessment, https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP_5_RAState.pdf.

[9] Riley, Colleen M., *A Basic Guide to Volcanic Hazards*, Michigan Technological University: http://www.geo.mtu.edu/volcanoes/hazards/primer

[10] Scott, W. E., USGS Cascades Volcano Observatory, Personal Correspondence, (July 5, 2001).

[11] DLCD, *2015 Oregon Natural Hazard Mitigation Plan*, State Risk Assessment, https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP_5_RAState.pdf.

pyroclastic flow and are more mobile. Both generally follow valleys, but surges sometimes have enough momentum to overtop hills or ridges in their paths. Because of their high speed, pyroclastic flows and surges are difficult or impossible to escape. If it is expected that they will occur, evacuation orders should be issued as soon as possible for the hazardous areas. Objects and structures in the path of a pyroclastic flow are generally destroyed or swept away by the impact of debris or by accompanying hurricane-force winds. Wood and other combustible materials are commonly burned. People and animals may also be burned or killed by inhaling hot ash and gases. The deposit that results from pyroclastic flows is a combination of rock bombs and ash and is termed *ignimbrite.* These deposits may accumulate to hundreds of feet thick and can harden to resistant rock. [12]

Lahars and Debris Flows

Lahar is an Indonesian term that describes a hot or cold mixture of water and rock fragments flowing down the slopes of a volcano or river valley.[13] Lahars typically begin when floods related to volcanism are produced by melting snow and ice during eruptions of ice-clad volcanoes like Mount Shasta, and by heavy rains that may accompany eruptions. Floods can also be generated by eruption-caused waves that could overtop dams or move down outlet streams from lakes.

Lahars react much like flash flood events in that a rapidly moving mass moves downstream, picking up more sediment and debris as it scours out a channel. This initial flow can also incorporate water from rivers, melting snow and ice. By eroding rock debris and incorporating additional water, lahars can easily grow to more than ten times their initial size. But as a lahar moves farther away from a volcano, it will eventually begin to lose its heavy load of sediment and decrease in size.[14]

Lahars often cause serious economic and environmental damage. The direct impact of a lahar's turbulent flow front or from the boulders and logs carried by the lahar can easily crush, abrade, or shear off at ground level just about anything in the path of a lahar. Even if not crushed or carried away by the force of a lahar, buildings and valuable land may become partially or completely buried by one or more cement-like layers of rock debris. By destroying bridges and key roads, lahars can also trap people in areas vulnerable to other hazardous volcanic activity, especially if the lahars leave deposits that are too deep, too soft, or too hot to cross.[15]

Volcanic Landslides (debris avalanches)[16]

Volcanic landslides – or debris avalanches – are a rapid downhill movement of rocky material, snow, and (or) ice. Volcanic landslides range in size from small movements of loose debris on the surface of a volcano to massive collapses of the entire summit or sides of a volcano. Steep volcanoes are susceptible to landslides because they are built up partly of layers of loose volcanic rock fragments.

---

[12] DLCD, *2015 Oregon Natural Hazard Mitigation Plan*, State Risk Assessment, https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP_5_RAState.pdf.

[13] USGS, *Lahars Flow Rapidly down Valleys like Rivers of Concrete*, https://volcanoes.usgs.gov/vhp/lahars.html.

[14] Ibid.

[15] Ibid.

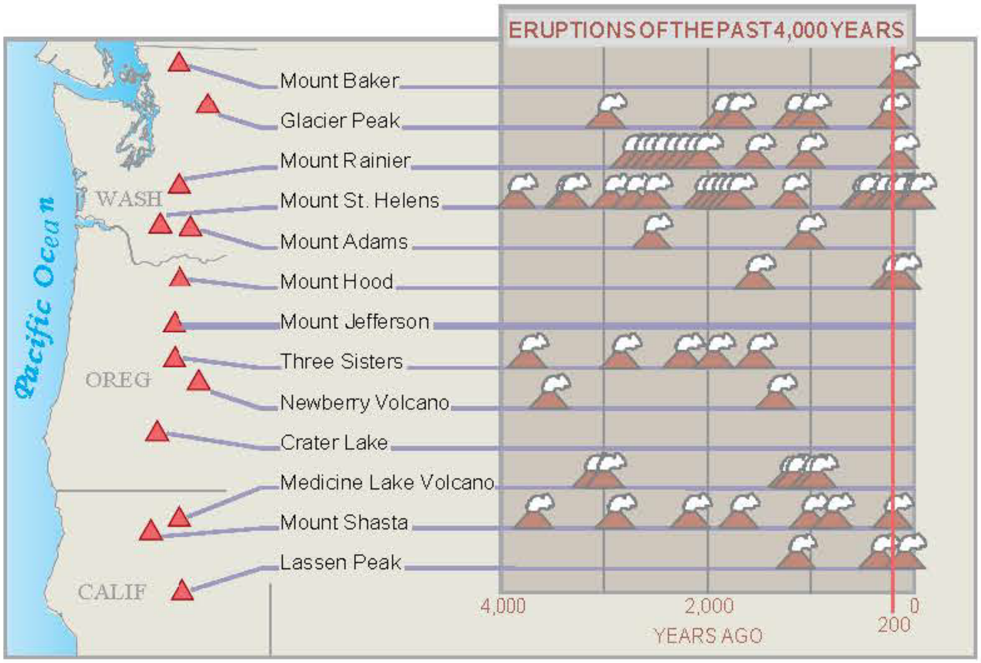
[16] USGS, *Landslides are Common on Tall, Steep, and Weak Volcanic Cones*, https://volcanoes.usgs.gov/vhp/landslides.html

Landslides on volcano slopes are triggered not only by eruptions, but also by heavy rainfall or large earthquakes that can cause materials to break free and move downhill.

History of Volcanic Events in Malheur County

Although there have been no recent volcanic events in the Malheur County area, it is important to note the volcanically active Cascade Mountain Range is nearby**.** Figure VE-2 displays the potentially active volcanoes of the western United States as identified by the USGS.

Figure VE-2 Potentially Active Volcanoes of the Western United States



Of the 13 potentially active volcanoes in the Cascade Range of the Pacific Northwest, 11 have erupted in the past 4,000 years. More than 100 eruptions, most of which were explosive, have occurred during that period, making the volcanoes of the Cascade Range some of the most hazardous in the United States. Each eruption symbol in the diagram represents from one to several eruptions closely spaced in time at or near the named volcano. Eruptions have also occurred from other vents (not shown) scattered throughout the Cascade Range, especially in central Oregon and southwestern Washington.

Source: Dzurisin, Dan, Peter H. Stauffer, and James W. Hendley II, *Living with Volcanic Risk in the Cascades*, USGS Fact Sheet 165-97, https://pubs.usgs.gov/fs/1997/fs165-97/fs165-97.pdf

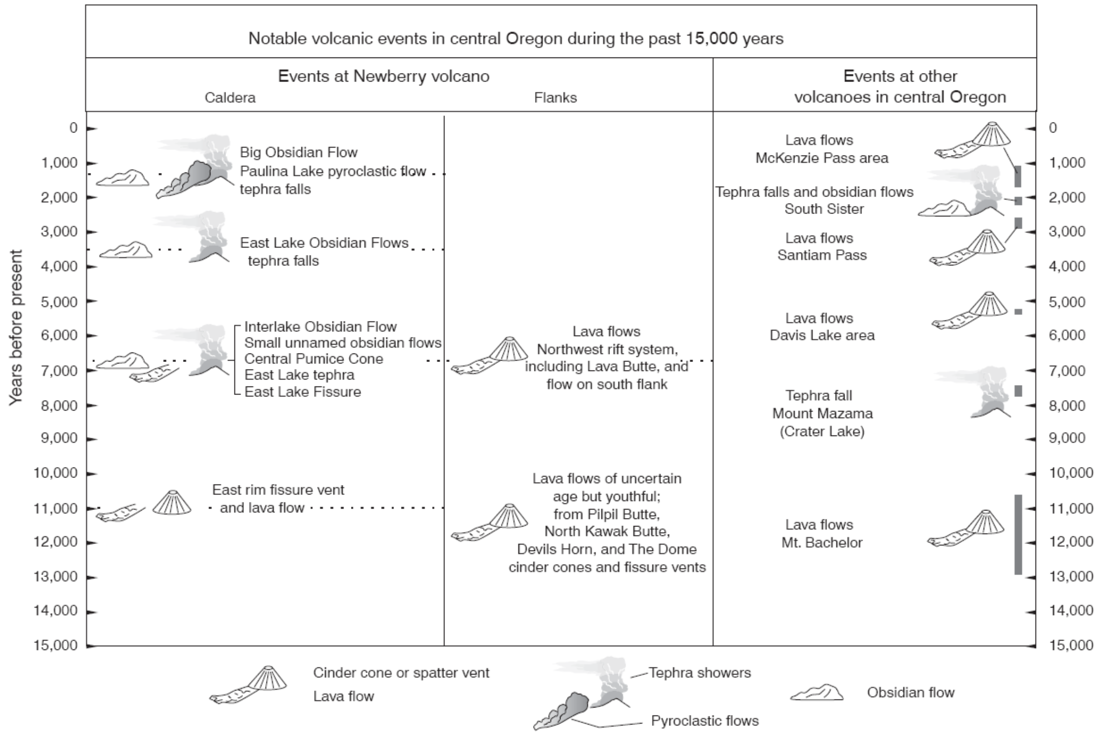
There are six active volcanic areas that could potentially impact Malheur County and the broader region. These include: Mt. Saint Helens, Mt. Hood, Newbery Volcano, Mt. Bachelor, Three Sisters and Mt. Broken Top, and Mt. Mazama/ Crater Lake. All of these are in the very high threat category except Mt. Bachelor which is a moderate threat.[17]

Volcanoes in the Cascade Mountain Range have been erupting for hundreds of thousands of years. Newberry Volcano, for example, has had many events in the last 15,000 years as shown Figure VE-3. The Three Sisters region has also had some activity during this time while the last major eruptive activity at Mt. Mazama occurred approximately 7,700 years ago, forming Crater Lake in its wake.

[17] USGS, *2018 Update to the U.S. Geological Survey National Volcanic Threat Assessment*, https://pubs.usgs.gov/sir/2018/5140/sir20185140.pdf.

Some of the most recent events include Big Obsidian Flow at Newberry Volcano. All of the Cascade volcanoes are characterized by long periods of quiescence and intermittent activity. And these characteristics make predictions, recurrence intervals, or probability very difficult to ascertain.

Figure VE-3 Notable Volcanic Events in Central Oregon during the Past 15,000 Years



Source: D.R. Sherrod, L.G. Mastin, W.E. Scott, and S.P. Schilling, 1997, *Volcano Hazards at Newberry Volcano, Oregon: U.S. Geological Survey Open-File Report 97-513*, https://pubs.er.usgs.gov/publication/ofr97513.

In addition to the many online sources of information, a detailed report of the Pacific Northwest's catastrophic hazards and history written by Rick Gore appears in the May 1998 National Geographic, Vol. 193, No. 5. Table VE-1 describes volcanic events in Oregon and Washington.

Table VE-1 Significant Historic Volcanic Events

Date	Location	Description
About 18,000 to 7,7000 YBP	Mount Bachelor, central Cascades	Cinder cones and lava flows.
About 20,000 to 13,000 years before present (YBP)	Polallie eruptive episode, Mount Hood	Lava dome, pyroclastic flows, lahars, and tephra.
About 13, 000 YBP	Lava Mountain, south central Oregon	Lava Mountain field and lava flows.
About 13,000 YBP	Devils Garden, south central Oregon	Devils Garden field and lava flows.
About 13,000 YBP	Four Craters, south central Oregon	Four Craters field and lava flows.
About 7,780 to 15,000YBP	Cinnamon Butte, Southern Cascades	Balsatic scaria cone and lava flows.

Date	Location	Description
About 7,700 YBP	Crater Lake Caldera	Formation of Crater Lake caldera, pyroclastic flows, and widespread ashfall.
About 7,7000 YBP	Parkdale, north central Oregon	Eruption of Parkdale lava flow.
About 7,000 YBP	Diamond Craters, eastern Oregon	Lava flows and tephra in Diamond Craters field.
About <7,700 YBP; 5,300 to 5,600 YBP	Davis Lake, southern Cascades	Lava flows and scoria cones in Davis Lake field.
About 10,000 to <7,7000 YBP	Cones south of Mount Jefferson; Forked Butte and South Cinder Peak	Lava flows.
About 4,000 to 3,000 YBP	Sand Mountain, central Cascades	Lava flows and cinder cones in Sand Mountain field.
About <3,2000 YBP	Jordan Craters, eastern Oregon	Lava flows and tephra in Jordan Craters field.
About 3,000 to 1,5000 YBP	Belknap Volcano, central Cascades	Lava flows and tephra.
About 2,000 YBP	South Sister Volcano	Rhyolite lava flow.
About 1,500 YBP	Timberline eruptive period, Mount Hood	Lava dome, pyroclastic flows, lahars, and tephra.
About 1,300 YBP	Newberry Volcano, central Oregon	Eruption of Big Obsidian flow.
About 1,300 YBP	Blue Lake Crater	Spatter cones and tephra.
1760–1810	Crater Rock/Old Maid Flat on Mount Hood	Pyroclastic flows in upper White River; lahars in Old Maid Flat; dome building at Crater Rock.
1859/1865	Crater Rock on Mount Hood	Steam explosions and tephra falls.
1907 (?)	Crater Rock on Mount Hood	Steam explosions.
1980	Mount St. Helens (Washington)	Mt. St. Helens erupts: Debris avalanche, ashfall, and flooding on Columbia River. 57 people died.
1981-1986	Mount St. Helens (Washington)	Lava dome growth, steam, and lahars.
1989-2001	Mount St. Helens (Washington)	Hydrothermal explosions.
2004-2008	Mount St. Helens (Washington)	Lava dome growth, steam, and ash.

Sources: USGS, n.d.; Wolfe and Pierson, 1995; Scott et al, 1997; University of Oregon, Malheur County NHMP, May 2014; DLCD, Oregon NHMP, 2015; FEMA, Disaster Declarations for Oregon, retrieved 2017.

Mount St. Helen's Case Study

On May 18, 1980, following two months of earthquakes and minor eruptions and a century of dormancy, Mount St. Helens in Washington, exploded in one of the most devastating volcanic eruptions of the 20th century. Although less than 0.1 cubic mile of magma was erupted, 58 people died, and damage exceeded 1.2 billion dollars. Fortunately, most people in the area were able to evacuate safely before the eruption because the U.S. Geological Survey (USGS) and other scientists had alerted public officials to the danger. As early as 1975, USGS researchers had warned that Mount St. Helens might soon erupt. Coming more than 60 years after the last major eruption in the Cascades (Lassen Peak), the explosion of St. Helens was a spectacular reminder that the millions of residents of the Pacific Northwest share the region with live volcanoes.[18]

[18] Dzurisin, Dan, Peter H. Stauffer, and James W. Hendley II, *Living with Volcanic Risk in the Cascades*, USGS Fact Sheet 165-97, https://pubs.usgs.gov/fs/1997/fs165-97/fs165-97.pdf

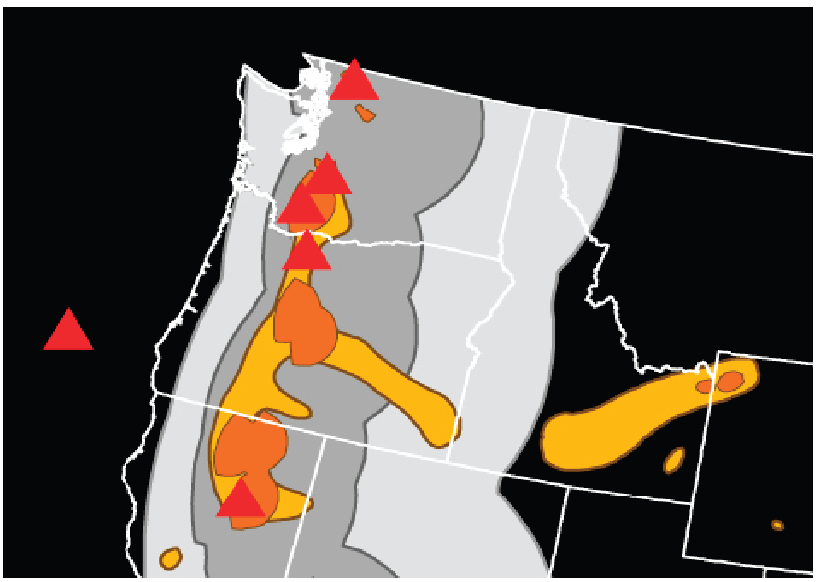
Risk Assessment

How are Hazards Identified?

Communities that are closer to volcanoes may be at risk to the proximal hazards – ash fall, debris avalanches, pyroclastic flows, lahars, and lava flows - as well as the distal hazards - lahars, lava flows, and ash fall. The communities that are farther away are most likely only at risk from the distal hazards, (mainly ash fall). Figure VE-4 shows the locations of some of the Cascade Range volcanoes (red triangles) with relative volcanic hazard zones. The dark orange areas have a higher volcanic hazard; light-orange areas have a lower volcanic hazard. Dark-grey areas have a higher ash fall hazard; light-grey areas have a lower ash fall hazard.

Geologic hazard maps have been created for most of the volcanoes in the Cascade Range by the USGS Volcano Program at the Cascade Volcano Observatory in Vancouver, WA and are available at http://vulcan.wr.usgs.gov/Publications/hazards_reports.html.

Figure VE-4 National Volcanic Hazard Map

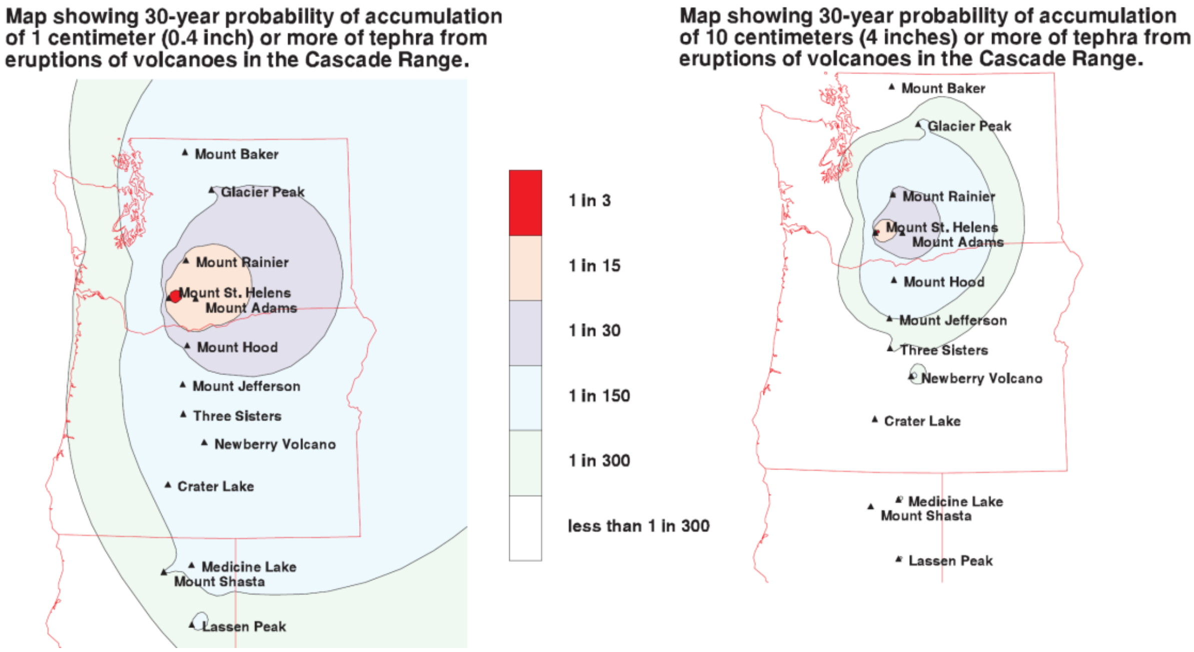


Note: The red triangles are volcano locations. Dark-orange areas have a higher volcanic hazard; light-orange areas have a lower volcanic hazard. Dark-gray areas have a higher ash fall hazard; light-gray areas have a lower ash fall hazard. Information is based on data during the past 10,000 years.

Source: Image modified from USGS, *Volcano Hazards – A National Threat, Fact Sheet 2006-3014*, https://pubs.usgs.gov/fs/2006/3014/2006-3014.pdf

Scientists also use wind direction to predict areas that might be affected by volcanic ash. During an eruption that emits ash, the ash fall deposition is controlled by the prevailing wind direction. The predominant wind pattern over the Cascades originates from the west, and previous eruptions seen in the geologic record have resulted in most ash fall drifting to the east of the volcanoes. Regional tephra fall shows the annual probability of ten centimeters or more of ash accumulation from Pacific Northwest volcanoes. Figure VE-5 depicts the potential and geographical extent of volcanic ash fall from several volcanoes in the Pacific Northwest.

Figure VE-5 Probable Geographic Extent of Volcanic Ashfall from Select Volcanic Eruptions in the Pacific Northwest



Source: Scott, W.E., Pierson, T.C., Schilling, S.P., Costa, J.E., Gardner, C.A., Vallance, J.W., & Major, J.J. (1997), *Volcano Hazards in the Mount Hood region (Hazard Zonation Map for Mt. Hood), Oregon: USGS Open-File Report 97-89*, Reston, VA, http://vulcan.wr.usgs.gov/Volcanoes/Hood/Hazards/ OFR97-89/OFR97-89.pdf

A useful resource has been published by USGS, most recently in 2018, which is called the *National Volcanic Threat Assessment*. The USGS assesses active and potentially active volcanoes in the U.S., focusing on history, hazards and the exposure of people, property and infrastructure to harm during the next eruption. They use 24 factors to obtain a score and threat ranking for each volcano that is deemed potentially eruptible.[19]

In a description found on the USGS website "the update names 18 very high threat, 39 high threat, 49 moderate threat, 34 low threat, and 21 very low threat volcanoes. The volcanoes are in Alaska, Arizona, California, Colorado, Hawaii, Idaho, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming, American Samoa and the Commonwealth of the Northern Mariana Islands. The threat ranking is not an indication of which volcano will erupt next. Rather, it indicates how severe the impacts might be from future eruptions at any given volcano."[20]

The website further states, "Since 1980, there have been 120 eruptions and 52 episodes of notable volcanic unrest at 44 U.S. volcanoes. When erupting, all volcanoes pose a degree of risk to people

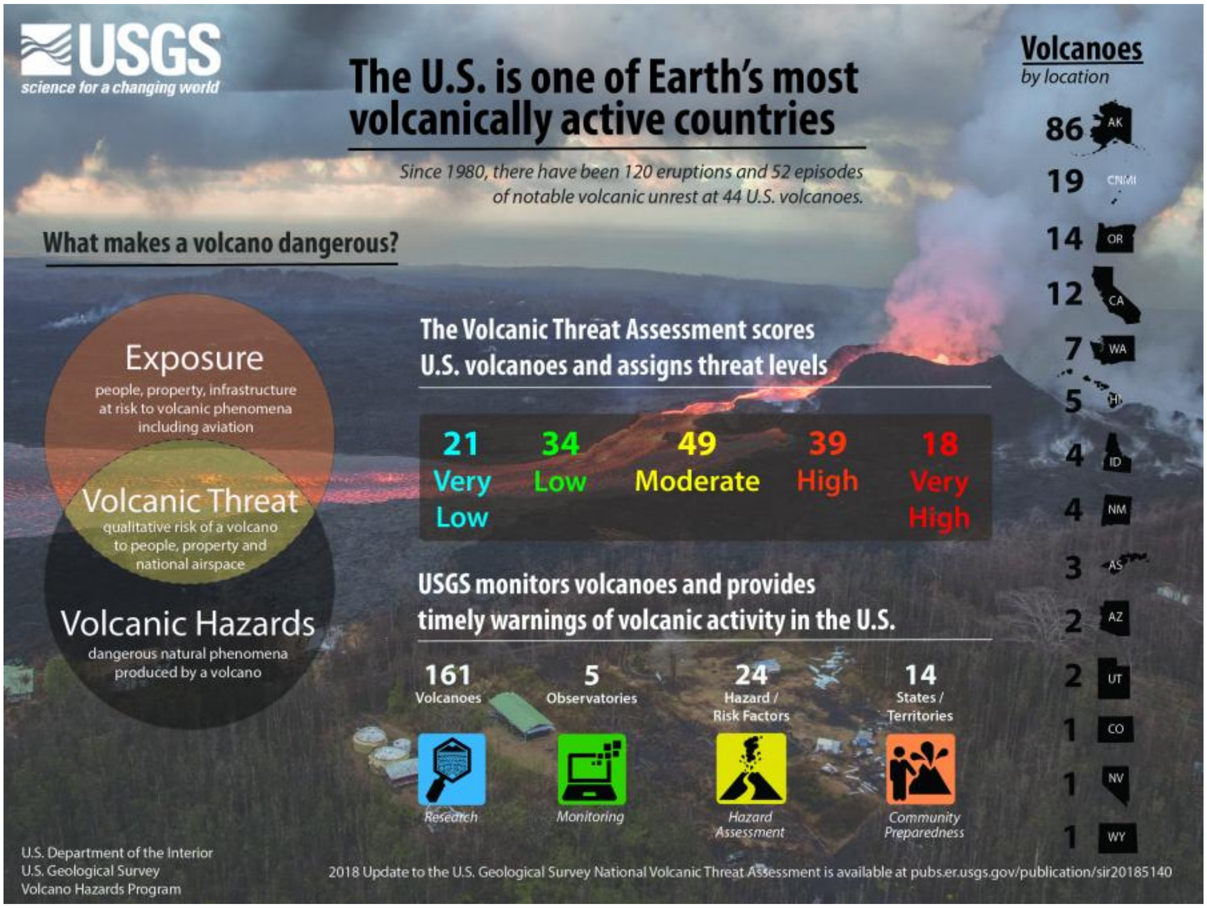
[19] USGS, *The U.S. is one of Earth's most Volcanically Active Countries*, https://volcanoes.usgs.gov/index.html

[20] Ibid.

and infrastructure. However, the risks are not equivalent from one volcano to another because of differences in eruptive style and geographic location."[21]

The USGS describes that the volcanic threat assessment "helps prioritize U.S. volcanoes for research, hazard assessment, emergency planning, and volcano monitoring. It is a way to help focus attention and resources where they can be most effective, guiding the decision-making process on where to build or strengthen volcano monitoring networks and where more work is needed on emergency preparedness and response."[22]

Figure VE-6 Volcanic Threat Assessment Statistics



Source: USGS, *The U.S. is one of Earth's most Volcanically Active Countries*, https://volcanoes.usgs.gov/index.html

Hazard Risk Analysis

The Malheur County NHMP Steering Committee completed a Hazard Vulnerability Assessment/Analysis (HVA) on April 12, 2018. This was described in Section 2 Risk Assessment. The method used for the HVA was developed from a Federal Emergency Management Agency (FEMA) tool that has been refined by the Oregon Office of Emergency Management (OEM). It addresses and weights (shown as percent within parentheses) probability (29%), vulnerability (21%), maximum

[21] Ibid.

[22] Ibid.

threat (42%) and the history (8%) of each natural hazard and attributes a final hazard analysis score. The methodology produces scores that range from 24 to 240.

For local governments, conducting the HVA is a useful step in planning for hazard mitigation. The method provides the jurisdiction with a relative ranking from which to prioritize mitigation actions, but does not predict the occurrence of a particular hazard.

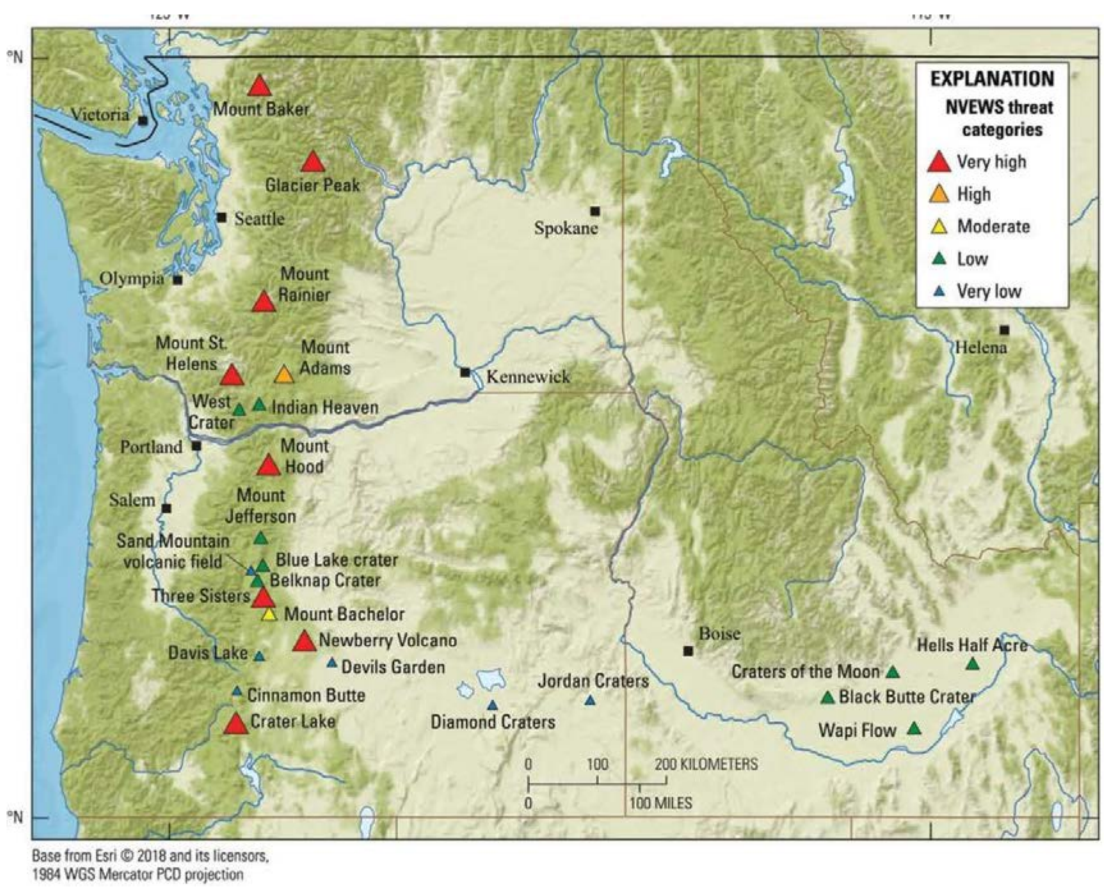
In 2013 volcanic hazards had a risk score of 134 and a rank of 6 out of 11 natural hazards. In 2018 earthquake hazards had a risk score of 124 and a rank of 8 out of 11 natural hazards.

For more information on all the risk scores and ranks of the natural hazards, see Volume I Basic Plan, Section 2 Risk Assessment of this NHMP.

Probability Assessment

As mentioned above, the USGS has a *National Volcanic Threat Assessment* report, most recently published in 2018. There are six active volcanic areas that could potentially impact Malheur County and the broader region. These include: Mt. Hood, Mt. Saint Helens, Newbery Volcano, Mt. Bachelor, Three Sisters and Mt. Broken Top, and Mt. Mazama/ Crater Lake. See Figure VE-7.

Figure VE-7 Map Showing Volcano Locations within the Area of Responsibility of the Cascades Volcano Observatory



Source: USGS, *2018 Update to the U.S. Geological Survey National Volcanic Threat Assessment*, https://pubs.usgs.gov/sir/2018/5140/sir20185140.pdf

Mt. St. Helens remains a probable source of air borne tephra as shown in the figures above. It has repeatedly produced voluminous amounts of this material and has erupted much more frequently in recent geologic time than any other Cascade volcano. It blanketed Yakima and Spokane, Washington during the 1980 eruption and again, in 2004.[23]

The eruptive history of the nearby Cascade volcanoes to this region can be traced to late Pleistocene times (approximately 700,000 years ago) and will no doubt continue. But the central question remains: When? The most recent series of events at Newberry Volcano, which occurred about 1,300 years ago, consisted of lava flows and tephra fall. Newberry Volcano's recent history also includes pyroclastic flows and numerous lava flows. Volcanoes in the Three Sisters region, such as Middle and South Sister, and Crater Lake have also erupted explosively in the past. These eruptions have produced pyroclastic flows, lava flows, lahars, debris avalanches, and tephra. Any future eruptions at these volcanoes would most likely resemble those that have occurred in the past.[24]

Geoscientists have provided some estimates of future activity in the vicinity of Newberry Caldera and its adjacent areas. They estimate a 1 in 3000 chance that some activity will take place in a 30-year period. The estimate for activity at Crater Lake for the same time period is significantly smaller at 0.003 to 0.0003. In the Three Sisters region, the probability of future activity is roughly 1 in 10,000 but any restlessness would greatly increase this estimate. [25]

The Malheur County NHMP Steering Committee noted that if the volcano in Yellowstone National Park goes "50,000 years past due" it could impact them. According to an April 2018 article, Yellowstone National Park sits squarely over a giant, active volcano. Yellowstone has been a national park since 1872. However, it was only in the 1960s that scientists realized the scale of the volcano — it's 44 miles across — and not until the 1980s did they grasp that this thing is fully alive and still threatens to erupt catastrophically. Yellowstone is capable of eruptions thousands of times more violent than the Mount St. Helens eruption of 1980. Experts refer to Yellowstone as a caldera or caldera forming volcano. The Yellowstone region has had three big eruptions, with the most recent one occurring 630,000 years ago. The article describes new research about the volcano and its magma chamber, which will provide more insight on the volcano. Experts note that smaller eruptions are more likely to happen, but that it remains possible that a large eruption could occur.[26]

Vulnerability Assessment

All of the Pacific Northwest is vulnerable to impacts from volcanic activity. Like the rest of Eastern Oregon, Malheur County has some risk of being impacted by volcanic activity in the Cascade Range. The principal sources are Mt. Hood, Mt. Saint Helens, Newbery Volcano, Mt. Bachelor, Three Sisters and Mt. Broken Top, and Mt. Mazama/ Crater Lake. Because of its geographic distance from these volcanic sites, Malheur County is not at risk for proximal hazards such as lava flows. However, it is at

[23] *2014 Malheur County Natural Hazards Mitigation Plan*, https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf

[24] Ibid.

[25] Ibid.

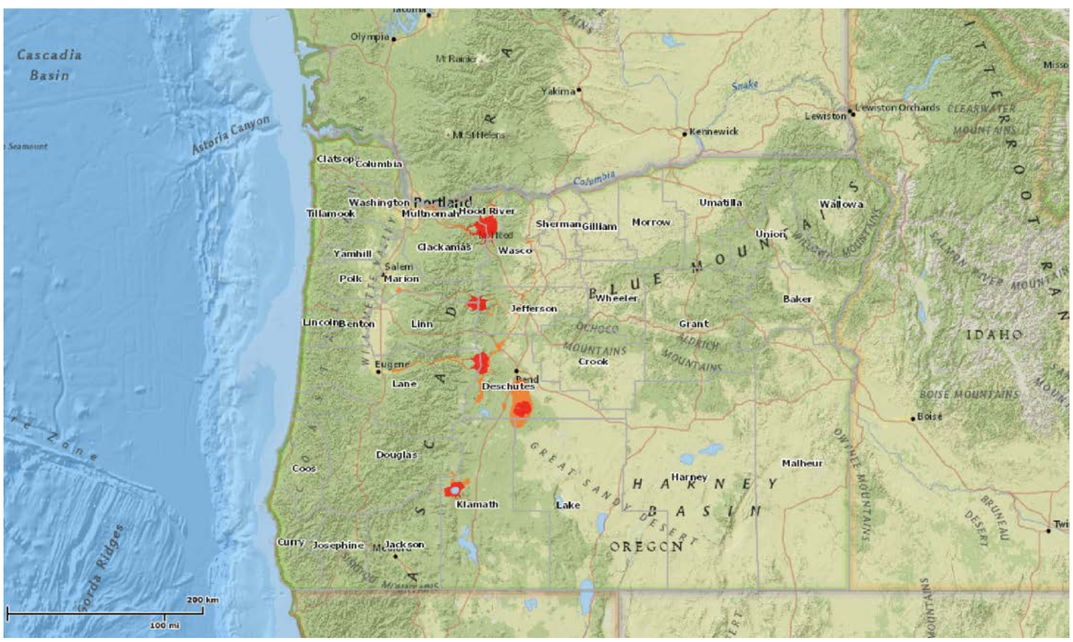
[26] The Washington Post, *The Yellowstone Supervolcano is a Disaster Waiting to Happen*, https://www.washingtonpost.com/news/speaking-of-science/wp/2018/04/20/the-yellowstone-supervolcano-is-a-disaster-waiting-to-happen/?noredirect=on&utm_term=.2031212ebc19

risk for distal hazards, primarily ash fall (tephra). The location, size, and shape of the area affected by tephra fall is determined by both the vigor and duration of the eruption and the wind direction at the time of eruption, making prediction of the area to be affected impossible more than a few hours in advance. The vulnerability to ash fallout is multi-pronged; for example ash can disrupt the engines of motor vehicles, reduce visibility, and exacerbate or induce respiratory illnesses.

While a quantitative vulnerability assessment - an assessment that describes number of lives or amount of property exposed to the hazard - has not yet been conducted for Malheur County volcanic eruption events, there are many qualitative factors - issues relating to what is in danger within a community - that point to potential vulnerability.

Figure VE-8 shows that that Malheur County is not within an identified high or moderate volcanic event hazard zone. DOGAMI used data from the USGS Cascades Volcano Observatory (CVO) for this web application. CVO maintains proximal and distal hazard zone data for volcanic areas in the Western Cascades of Oregon. These areas include but are not limited to Mount St. Helens, Mount Hood, Crater Lake, Newberry, Mount Jefferson, and the Three Sisters.[27] HazVu shows two hazard zones: the high hazard zone (proximal zone) and moderate hazard zone (distal zone). Mt. Bachelor, which is listed as a moderate threat by the USGS,[28] is a dormant volcano monitored by the Jaffe Group at the University of Washington at Bothell.[29]

Figure VE-8 Map of Generalized Vulnerability of the Region



Source: DOGAMI, HazVu: Statewide Geohazards Viewer, https://www.oregongeology.org/hazvu/hazards-assets.htm

[27] USGS, *Cascades Volcano Observatory*, https://volcanoes.usgs.gov/observatories/cvo/cascade_volcanoes.html.

[28] USGS, *2018 Update to the U.S. Geological Survey National Volcanic Threat Assessment*, https://pubs.usgs.gov/sir/2018/5140/sir20185140.pdf

[29] University of Washington, *INTEX-B 2006: Mount Bachelor Observatory*, https://atmos.washington.edu/~thornton/MBO.html

Community Hazard Issues

What is susceptible to damage during a hazard event?

Volcanic eruptions can send ash airborne, spreading the ash for hundreds or even thousands of miles. An erupting volcano can also trigger flash floods, earthquakes, rockfalls, and mudflows. It can destroy forests and damage buildings and infrastructure. Volcanic ash can contaminate water supplies, cause electrical storms, and collapse roofs.[30]

Businesses and individuals can make plans to respond to volcano emergencies. Once an emergency begins, public resources can often be overwhelmed, and citizens may need to provide for themselves and make informed decisions. Knowledge of volcano hazards can help citizens make a plan of action based on the relative safety of areas around home, school, and work.[31]

Building and Infrastructure Damage

Buildings and other property in the path of a flash flood, debris flow, or tephra fall can be damaged. Thick layers of ash can weaken roofs and cause collapse, especially if wet. Clouds of ash often cause electrical storms that start fires or damp ash can short-circuit electrical systems and disrupt radio communication.

Pollution and Visibility

Tephra fallout from an eruption column can blanket areas within a few miles of the vent with a thick layer of pumice. High-altitude winds may carry finer ash tens to hundreds of miles from the volcano, posing a hazard to flying aircraft, particularly those with jet engines. In an extreme situation, airports would need to close to prevent the detrimental effect of fine ash on jet engines and for pilots to avoid total impaired visibility. Fine ash in water supplies will cause brief muddiness and chemical contamination.

Death and Injury

Inhalation of volcanic ash can cause respiratory discomfort, damage or result in death for sensitive individuals miles away from the cone of a volcano. Likewise, emitted volcanic gases such as fluorine and sulfur dioxide can kill vegetation for livestock or cause a burning discomfort in the lungs. Hazards to human life from debris flows are burial or impact by boulders and other debris.

Economic Impacts

Volcanic eruptions can disrupt the normal flow of commerce and daily human activity without causing severe physical harm or damage. Ash a few millimeters thick can halt traffic, possibly up to one week, and cause rapid wear of machinery, clog air filters, block drains and water intakes, and can kill or damage agriculture.

[30] Dzurisin, Dan, Peter H. Stauffer, and James W. Hendley II, *Living with Volcanic Risk in the Cascades*, USGS Fact Sheet 165-97, https://pubs.usgs.gov/fs/1997/fs165-97/fs165-97.pdf

[31] Scott, W.E. et al, *Volcano Hazards in the Three Sisters Region, Oregon*, USGS Open-File Report 99-437, (2001), https://pubs.er.usgs.gov/publication/ofr99437

Transportation of goods between Malheur County and nearby communities and trade centers could be deterred or halted. Subsequent airport closures can disrupt airline schedules for travelers. Fine ash can cause short circuits in electrical transformers, which in turn cause electrical blackouts. Volcanic activity can also force nearby recreation areas to close for safety precautions prior to an eruption. The interconnectedness of the region's economy would be disturbed after a volcanic eruption due to damages to buildings and infrastructure, pollution and visibility, disruptions to transportation, and health impacts.

City Specific Damage

Ontario, Nyssa, and Vale

Were a volcanic event to occur in the Cascades region of Oregon, Mt. St. Helens in Washington, or elsewhere, Ontario, Nyssa, Vale and unincorporated areas of Malheur County could be at risk for ash fall, depending on the severity of the event and the direction of the wind. Like the unincorporated areas of Malheur County, these Cities has an approximately 1 in 5,000 chance annually of experiencing ash fall from a volcanic event.

Existing Hazard Mitigation Activities and Resources

USGS and DOGAMI

A major existing strategy to address volcanic hazards is to publicize and distribute volcanic hazard maps and information through DOGAMI and USGS.

The volcanoes most likely to constitute a hazard to Oregon communities have been the subject of USGS research. Open-file reports (OFR) address the geologic history of these volcanoes and lesser-known volcanoes in their immediate vicinity. These reports also cover associated hazards, the geographic extent of impacts, and possible mitigation strategies. They are available for the active volcanoes near Malheur County: Mount Saint Helens, Three Sisters, Newberry Volcano, and Crater Lake. While there is not an OFR for Mt. Bachelor, there are other resource materials that provide considerable information. Malheur County is only at risk for tephra (ash) fall from these sites, should these volcanoes become active enough to raise concerns.

Of note, after the 1980 eruption of Mount St. Helens, Congress provided increased funding that enabled the USGS to establish a volcano observatory for the Cascade Range. Located in Vancouver, Washington, the David A. Johnston Cascades Volcano Observatory (CVO) was named for a USGS scientist killed at a forward observation post by the May 18, 1980, eruption (https://pubs.usgs.gov/fs/1997/fs165-97/fs165-97.pdf).

USGS, https://volcanoes.usgs.gov/index.html

DOGAMI, https://www.oregongeology.org/volcano/volcanoes.htm

State Natural Hazard Risk Assessment

The risk assessment in the *2015 Oregon Natural Hazards Mitigation Plan* provides an overview of volcanic hazards in Oregon and identifies the most significant volcanic eruptions in Oregon's recorded history. It has overall state and regional information, and includes volcano related mitigation actions for the entire state. https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP_5_RAState.pdf

Future Changing Conditions/ Climate Change

In the Malheur County NHMP, there are several locations that describe future changing conditions or climate change as it relates to the natural hazards that impact Malheur County. In the order of appearance in the NHMP: the Risk Assessment, the Hazards Annexes, and Appendix F contain this information. Within Appendix F there are two documents, the *Future Climate Projections: Malheur County* and the *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports.*

Volcanic Event Mitigation Action Items

The volcanic events mitigation actions have been identified by the Malheur County NHMP Steering Committee which includes the Cities of Nyssa, Ontario and Vale. See Table 3-3 Mitigation Actions Table 2019 NHMP and the action item worksheets in Appendix A for a more detailed description of the mitigation actions.

There are no volcanic events specific mitigation actions. The mitigation actions would have a medium priority because the Hazard Vulnerability Assessment (HVA) resulted in volcanic events having a medium risk level.

There are seven multi-hazard mitigation actions for the NHMP and several of those include volcanic related mitigation actions, in conjunction with the other hazards. The multi-hazard mitigation actions are a high priority.

At the August 9, 2018 NHMP Steering Committee meeting, it was agreed that the risk level rankings from the HVA would be used as the way to prioritize the multi-hazard and hazard-specific mitigation actions. The risk level rankings are in Table 2-5 in Section 2 Risk Assessment.

Risk Score: 175

Risk Level: High-Medium

Wildfire Hazard Annex

Causes and Characteristics of Wildfire

A wildfire is a strong and often uncontrollable burning of forest, brush, or rangeland (includes grassland). Fire has always been a part of high desert Western ecosystems and can have both beneficial and devastating effects. Eastern Oregon has a lengthy history (see Table WF-2 Significant Historic Wildfires) of wildfire in both wildlands and in wildland-urban interface (WUI) areas. WUI areas are where the human developed areas meet the undeveloped areas; it is a transition area.

In contrast to other parts of this region, Malheur County is notable for a relative lack of forested land and the predominance of high desert rangelands. The only forested area is in the northwestern corner of the County near the unincorporated community of Ironside, in addition to the scattered small patches in the southern portion of the County. Both the forests and rangelands are highly susceptible to wildfire. Many of the County's cities and unincorporated communities, in addition to rangelands and agricultural lands, are vulnerable to its effects. Wildfires are an annual occurrence in the County and have varied in size from under 10 acres to over 100,000 acres.

Wildfires threaten the limited but valued forest, agricultural land and rangelands, and individual home sites. State and federal wildland firefighters protect state and federal lands. While they fight to protect structures, they do not fight fires once they become structural and equipment fires. Notably, once a fire has started, homes and development in wildland and WUI settings complicate firefighting activities and stretch available human and equipment resources.

The loss of property and life, however, can be minimized through cooperation, preparedness, and mitigation activities. State and federal wildland firefighters can provide wildfire suppression service on non-state and non-federal areas through formal agreements. There are also Rural Fire Protection Associations (RFPA) that provide fire protection in Malheur County, and the Cities of Ontario, Nyssa, and Vale have fire departments. There are many agreements between local, State, and federal organizations to assist one another throughout Malheur County

There are nearly two million acres in Malheur County that make up the WUI, which is susceptible to wildfire.[1] Less forested areas and grassland (which is typically included as part of rangeland) are also susceptible. As the population in this region grows, development in the WUI increases, posing a larger threat to life and property.

The hilly or mountainous topography of much of the County, and the lack of accessibility exacerbates wildfire hazards. Wildfire can spread rapidly and burn larger areas in a shorter period of time, and it is difficult to get fire-fighting equipment to these areas. Wildfire has been known to move at speeds of 30 mph or higher on grasslands in Malheur County.

[1] *Malheur County Community Wildfire Protection Plan* (CWPP), 2009, https://www.oregon.gov/ODF/Documents/Fire/CWPP/MalheurCounty.pdf

To reduce the impact of wildfire, Malheur County adopted the *Malheur County Community Wildfire Protection Plan* (*2009 Malheur County CWPP*) in 2009. The CWPP provides detailed information on the vulnerability and history of wildfire in the County, and provides a series of mitigation actions the County can implement to reduce the impact of wildfire. It is further described in the Risk Assessment section of this Wildfire Hazard Annex. Of note, one of the wildfire mitigation actions of this NHMP is "Coordinate the wildfire mitigation action items in the NHMP with those in the Malheur County Community Wildfire Protection Plan (CWPP)." See Table 2-5 for mitigation actions.

The impact on communities from wildfire can be huge. Statewide in 2018, according to the Northwest Interagency Coordination Center, the cost of fighting wildfires in Oregon was $514.6 million, which was a substantial increase from the $447 million it cost in 2017.[2] In 2012, the Long Draw Fire in Malheur County affected hundreds of thousands of acres and cost more than a million dollars to suppress.[3] The History of Wildfires in Malheur County section in this Wildfire Annex includes a description of documented wildfires; it is likely that not all the wildfires that have occurred are included on this list.

See Figures WF-4 through WF-9 for countywide maps illustrating wildfire hazards.

Wildfire can be divided into four categories: interface fires, wildland fires, firestorms, and prescribed fires.[4] These descriptions are provided for a brief but comprehensive understanding of wildfire.

Interface Fires

An interface fire occurs where wildland and developed areas come together with both vegetation and structural development combining to provide fuel. The WUI can be divided into categories.

- The **classic wildland-urban interface** exists where well-defined urban and suburban development presses up against open expanses of wildland areas.
- The **mixed wildland-urban interface** is more typical of the problems in areas of exurban or rural development: isolated homes, subdivisions, resorts and small communities situated in predominantly in wildland settings.
- The **occluded wildland-urban interface** where islands of wildland vegetation exist within a largely urbanized area.[5]

[2] Salem Statesmen-Journal, *Oregon Wildfire Costs Hit Record High of $514 million in 2018*, October 10, 2018, https://www.statesmanjournal.com/story/news/2018/10/10/oregon-wildfire-costs-hit-record-high-2018/1581132002/.

[3] InciWeb: Incident Information System, *Long Draw Fire Information*, http://inciweb.nwcg.gov/photos/ORVAD/2012-07-11-08:03-long-draw/related_files/ftp-20120716-100631.pdf, accessed March 26, 2013.

[4] Federal Emergency Management Agency, *Multi-hazard, Identification and Risk Assessment Report*, 1997, Washington, D.C., https://www.fema.gov/media-library/assets/documents/7251.

[5] Ibid.

Wildland Fires

A wildland fire's main fuel source is natural vegetation. Often referred to as forest or rangeland fires, these fires occur in national forests and parks, private timberland, and on public and private rangeland. A wildland fire can become an interface fire if it encroaches on developed areas.

Firestorms

Firestorms are events of such extreme intensity that effective suppression is virtually impossible. Firestorms often occur during dry, windy weather and generally burn until conditions change or the available fuel is consumed. In 1987, widespread dry lightning in late August ignited fires throughout northern California and southwest Oregon. Two of these were over 10,000 acres, and according to the Oregon Department of Forestry, this series of events fits the definition of a firestorm. Resources were brought in from other states and Canada to fight them.[6] Five of the fires listed in Table WF-1 are firestorms: the Jackson Fire, the Long Draw Fire; the Owyhee River Fire; the Soda Fire, and the Owyhee Canyon Fire.[7]

Prescribed Fires

Prescribed fires are intentionally set or are select natural fires that are allowed to burn for beneficial purposes. Before humans suppressed forest fires, small, low intensity fires cleaned the underbrush and fallen plant material from the forest floor while allowing the larger plants and trees to live through the blaze. These fires were only a few inches to two feet tall and burned slowly. Forest managers now realize that a hundred years of prevention has contributed to the unnatural buildup of plant material that can flare up into tall, fast moving wildfires. These can be impossible to control and can leave a homeowner little time to react.

Conditions Contributing to Wildfires

Ignition of a wildfire may occur naturally from lightning or from human causes such as debris burns, arson, careless smoking, recreational activities, equipment, or an industrial accident. According to BLM staff, in Malheur County, approximately 30% of fires are caused by humans, and the trend is increasing in recent years. Many of the equipment caused fires occur as a result of transportation or creation.[8] See Figure WF-4 for a map of fire locations and an indication of the fire's origins as either human or lightning caused.

Once started, four main conditions affect the fire's behavior: fuel, topography, weather and development. Of note, a fire's flame length is commonly used as a visual indication of fire intensity, and is a primary factor to consider for firefighter safety and for gauging potential impacts to resources and assets. A higher flame length may indicate a higher fire intensity, and a lower flame length may indicate a lower fire intensity. A more detailed discussion of flame length and fire intensities is better suited to the CWPP than the NHMP and can be found there. Fire conditions, which affect the fire's behavior, vary widely with topography, fuels, and weather – especially winds.

---

[6] Wolf, Jim, ODF, personal communication, May 8, 2001.

[7] Al Crouch, BLM, personal communication, March 4, 2019.

[8] Ibid.

Fuel

Fuel is the material that feeds a fire. Fuel is classified by volume and type. Forested lands provide a larger fuel source to wildfires than other vegetated lands due to the presence of large amounts of timber and other dense vegetation in these areas. Malheur County is notable for a relative lack of forested land. In Malheur County, the BLM lands are approximately 3% timber and 97% rangeland. Of the 3% timber, approximately 2% is juniper and 1% is classic forested timber. Grassland are included in the rangeland areas.[9] Grasslands, which naturally cover most of the region, are highly susceptible to wildfire. According to BLM staff, there is an increasing amount of invasive grasses in the grasslands; these invasive grasses are more susceptible to burn. The variability of the fire likelihood is great, as the factors of soil moisture, soil temperature, and amount of and nature of grass there varies. Vegetation such as agricultural lands and rangelands also provides fuel for wildfires.[10] See Figure WF-10 Active Vegetation Management.

Topography

Topography influences the movement of air and directs a fire's course. Slope and hillsides are key factors in fire behavior. Hillsides with steep topographic characteristics are often also desirable areas for residential development. In this region, much of the topography is hilly or mountainous which also can induce wildfire hazards. These areas can cause a wildfire to spread rapidly and burn larger areas in a shorter period of time, especially, if the fire starts at the bottom of a slope and migrates uphill as it burns. Wildfires tend to burn more slowly on flatter lying areas but this does not mean these areas are exempt from a rapidly moving or spreading fire. Hazards that can affect these areas after the fire has been extinguished include landslides (debris flows), floods, and erosion.

Weather

Weather is the most variable factor affecting wildfire behavior. High-risk areas in Oregon share a hot, dry season in late summer and early fall with high temperatures and low humidity. Figure WF-1 Malheur County Average Annual Precipitation, shows the mean annual precipitation and the geographic distribution in Malheur County.

The natural ignition of wildfires is largely a function of weather and fuel; human caused fires add another dimension to the probability. Lightning strikes in areas of forest or rangeland combined with any type of vegetative fuel source will always remain as a source for wildfire. Thousands of lightning strikes occur each year throughout much of the region. Fortunately, not every lightning strike causes a wildfire, though they are a major contributor. Figure WF-4 Local Fire History shows the fire locations from 2008-2017 and the cause as either human or lightning.

Development

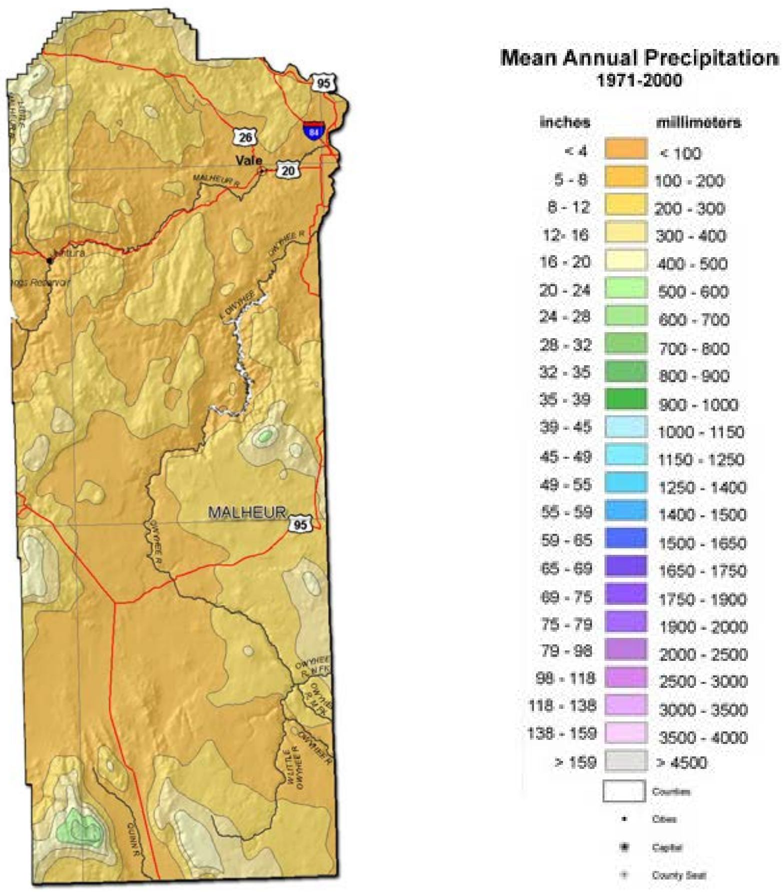
The increase in residential development in interface areas has resulted in greater wildfire risk. Fire has historically been a natural wildland element and can sweep through vegetation that is adjacent to a combustible home. New residents in remote locations are often surprised to learn that in moving away from urban areas, they have left behind readily available fire services providing

[9] Ibid.

[10] *Malheur County Community Wildfire Protection Plan*, 2009, https://www.oregon.gov/ODF/Documents/Fire/CWPP/MalheurCounty.pdf

structural protection. Rural locations may be more difficult to access and or simply take more time for fire protection services to get there. There is general observation, and BLM staff concur, that these wildland and WUI fires are increasing in severity and size.[11] Looking at the future climate projections described in Appendix F, it is likely these situations are already and will continue to be exacerbated by changes in the climate. In Figure WF-1, Malheur County Average Annual Precipitation, it is clear that mean annual precipitation is low and this contributes to wildfire impacts and other natural hazards impacts in Malheur County.

Figure WF-1 Malheur County Average Annual Precipitation



Source: PRISM Group and Oregon Climate Service, Oregon State University, Oregon Average Annual Precipitation (1971-2000), http://www.ocs.orst.edu/prism/index.phtml.

History of Wildfire in Malheur County

The ecosystems of most forest and wildlands depend upon fire to maintain functions. These benefits can include, depending upon location and other circumstances, reduced fuel load, disposal of slash and thinned tree stands, increased forage plant production, and improved wildlife habitats, hydrological processes and aesthetic environments. The effects of fire on ecosystem resources can

[11] Al Crouch, BLM, personal communication, March 4, 2019.

include damages, benefits, or some combination of both. Despite these potential benefits, fire has historically been suppressed for years because of its effects on rangelands, grasslands, recreation areas, agricultural operations, and the significant threat to property and human life.

Recall that Malheur County is largely comprised of grasslands, rangelands, agricultural lands, and primarily small communities, with a few larger cities. Recognizing the economic, human, and environmental impacts, the state and federal agencies have typically sought to alleviate fire-related problems through a controlled burning program.[12] BLM staff stated that controlled burning happens in limited fashion, while other techniques such as making fuel breaks, invasive weed management, and mechanical treatments are more commonly used.[13]

The effects of a wildfire on the built environment, particularly in the face of a major wildfire event, can be devastating to people, homes, businesses and communities. For example, in Malheur County, where the majority of BLM land is leased for ranching operations, large wildfires can have significant economic impacts on ranchers' stock and range allotments, as burned land is unfit for grazing use for several years after a fire.

The Steering Committee recognized that wildfires can cause poor air quality and that people and animals can suffer detrimental impacts as a result. They determined, after extended discussion, that air quality should be further examined as a natural hazard for Malheur County and that it would be added in the next update of the NHMP. BLM staff stated that while some smoke comes from Malheur County situations, much of the smoke comes from elsewhere; it typically comes from the north (Washington and Canada), the west, and northern California.[14]

Table WF-1 Significant Historic Wildfires

Date	Location	Description
1994	Malheur County	The Ironside/ Little Baldy Fire burned 10,385 acres; it was caused by lightning.
1996	Malheur County	The fire started in the Vale District due to lightning strike. It burned 26,000 acres.
1998	Malheur County	The Ontario fire burned in Malheur County; the # acres is not listed.
2000	Malheur County	The Jackson Fire was started by humans and burned 108,000 acres. It threatened the Snake River Correctional Institution. There was $800,000 in damages, several buildings destroyed. The Farm Service Agency made a disaster declaration (EO 00-07). It was a firestorm.
2001	Malheur County	Jackie's Butte Fire started by dry lightning and burned rangeland in south central Malheur County. 67,000 acres burned.
2002	Malheur County	The Mahogany Mountain Fire burned 41,000 acres. The fire suppression cost $1 million.
2002	Malheur County	The Malheur Complex/ Flagtail Fire was caused by lightning and burned 21,641 acres. Grant County and Malheur Forest were impacted. There were two disaster declarations (EO 02-09 and FEMA 2448 FMAGP).
2006	Malheur County	The Happy Valley Fire started north of Burns Junction and burned 66,518 acres. It was started by lightning.
2011	Malheur County	The Clarks Creek Fire burned 13,260 acres. It was public land and was 16 miles west of Jordan Valley.
2012	Malheur County	The Iron Fire/ Bonita Complex burned 9,868 acres northwest of Ontario.

[12] *Malheur County Community Wildfire Protection Plan*, 2009, https://www.oregon.gov/ODF/Documents/Fire/CWPP/MalheurCounty.pdf.

[13] Al Crouch, BLM, personal communication, March 4, 2019.

[14] Ibid.

Date	Location	Description
2012	Malheur County	The Long Draw Fire burned 558,198 acres. It closed Us Highway 95 for nearly two days. It was a firestorm.
2012	Harney and Malheur County	The Hollaway Fire burned 461,107 acres in Oregon and Nevada. It started on August 5 by lightning. It burned approximately 245,000 acres in Oregon (170,000 in Malheur County) and 215,000 acres in NV.
2013	Malheur County	The Cedar Mountain Fire burned 23,934 acres. It was mostly public land and was located 35 miles north of Burns Junction.
2013	Malheur County	The Crowley Creek Fire burned 12,935 acres; it was mostly BLM land and 2,568 acres of private land. It occurred 36 miles north of Burns Junction.
2013	Malheur County	The Curry Canyon Fire burned 2,800 acres and occurred northwest of Juntura.
2013	Malheur County	The Grassy Mountain Fire burned 15,721 acres and was located southeast of Burns Junction.
2013	Malheur County	The Owyhee River Fire burned 46,501 acres with 45,439 acres of that on public land. It was 4 miles southwest of Adrian. It was a firestorm.
2013	Malheur County	The Stockade fire burned 6,614 acres; of that 2,561 was BLM; 937 was state land; and 3,116 acres of private land. It occurred 36 miles north of Burns Junction.
2014	Malheur and Harney County	The Saddle Draw Fire torched 280,141 acres of BLM and private ground south of Juntura
2014	Malheur County	The Brogan Hill Fire burned 10,909 acres of BLM and private ground northwest of Vale
2015	Malheur County	The Jaca Reservoir Fire burned 14,909 acres
2015	Malheur County	The Leslie Gulch Fire burned 8,688 acres of BLM and private ground in a high use recreation and environmentally sensitive area
2015	Owyhee County, Idaho and Malheur County	The Soda Fire ravaged 53,179 BLM and private acres in Malheur County. It was a firestorm.
2015	Malheur County	The Bendire Complex (2 fires) burned 49,612 acres northwest of Juntura
2016	Malheur County	The Owyhee Canyon Fire scorched 22,323 BLM, private and State acres and burned into Lake Owyhee State Park, causing evacuations in the entire canyon. It was a firestorm.
2016	Malheur County	The Sheep Rock Fire burned 12,761 acres of BLM north of Juntura.
2016	Malheur County	The Simmons Gulch Fire burned 11,352 acres of BLM and private ground southwest of Harper

Sources: University of Oregon, Malheur County NHMP, May 2014; DLCD, Oregon NHMP, 2015; FEMA, Disaster Declarations for Oregon, retrieved 2017; InciWeb, retrieved 10/10/17, 5203, https://inciweb.nwcg.gov/incident/5584/; NICC Incident Management Report, August 11, 2005, http://cidi.org/wildfire/0508/ixl10.html, accessed August 8, 2007, Al Crouch, BLM, personal communication, March 5, 2019

Figure WF-4 Local Fire History is a map that shows the fire locations from 2008-2017 and the cause as either human or lightning.

The map also provides statistics (see data sources listed on the map) for fires from 2008-2017:

Total acres burned: 1,321,631

Total number of fires: 295

Average acres burned per year: 132,163

Average number of fires per year: 30

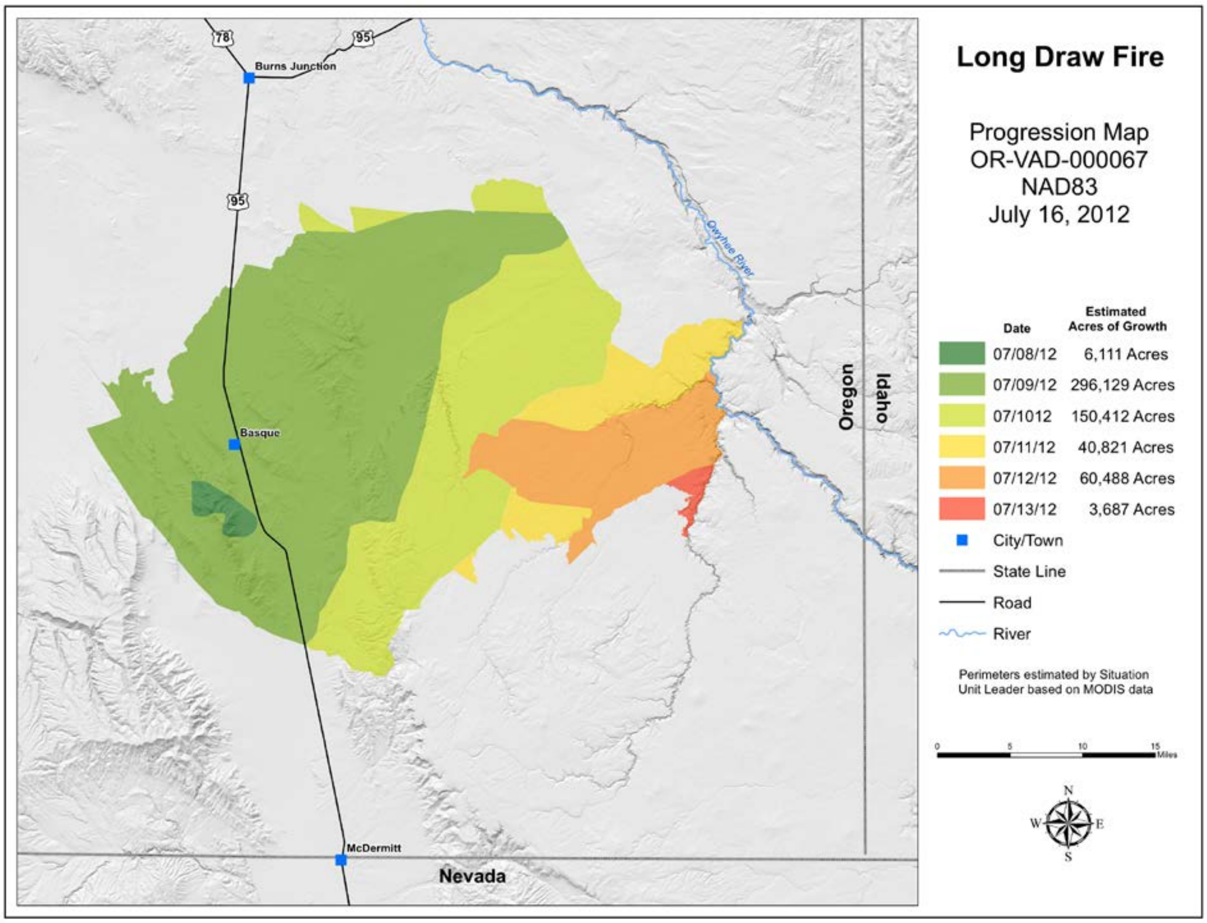
Percent lightning caused: 77%

Percent human caused: 23%

The Long Draw Fire in and the Holloway Fire both occurred in 2012, and are described here as examples of how fires impact Malheur County. In 2013 there were several sizable fires including the Owyhee River Fire, Cedar Mountain Fire, and the Stockade Fire.

Long Draw Fire (July 2012): This lightning caused wildfire ignited on July 8, 2012 and burned 582,313 acres primarily within Malheur County; it also affected Nevada and an area south of Burns Junction in Harney County.[15] The fire spread more than 200,000 acres in one day; it became the biggest fire in Oregon history since 1865. Five crews, five helicopters, 29 engines, seven dozers, thirteen water tenders and 505 personnel were deployed to fight this fire. The fire destroyed range buildings, scorched much-needed grass and destroyed cattle on the perimeter of the fire. It hopped U.S. 95, took out a power line and moved east into the Owyhee Canyon.[16]

Figure WF-2 Long Draw Fire Progression Map



Source: *2014 Malheur County NHMP* (InciWeb: Incident Information System, http://www.inciweb.org/incident/3004/) (no longer accessible).

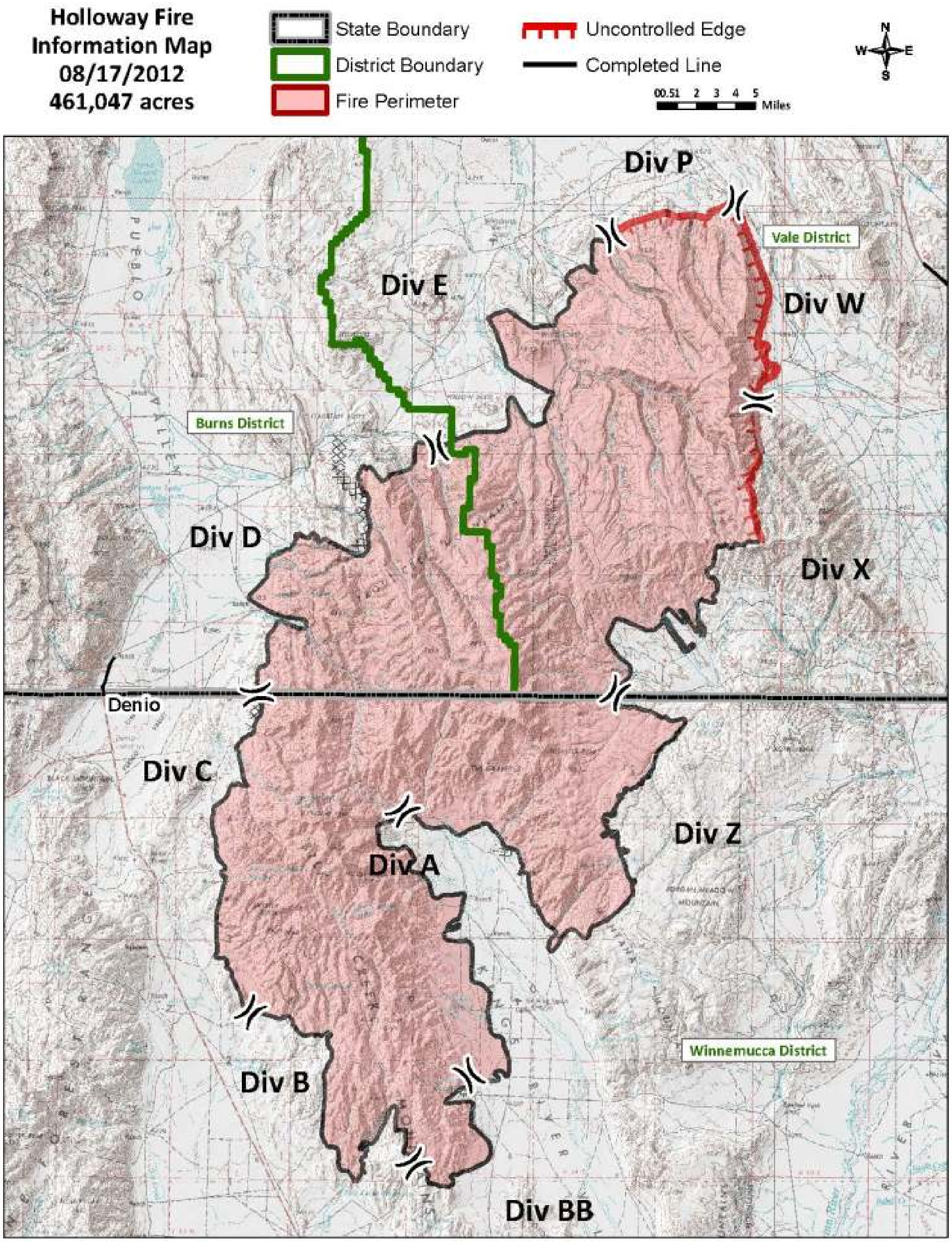
---

15 Capital Press, *Bigger Wildfires Ahead, Researchers Warn*, https://www.capitalpress.com/state/oregon/bigger-wildfires-ahead-researchers-warn/article_8abe005a-cbf7-5528-b153-84b3dbae01a9.html, accessed February 2013.

16 InciWeb: Incident Information System, *Long Draw Fire Information*, http://inciweb.nwcg.gov/photos/ORVAD/2012-07-11-08:03-long-draw/related_files/ftp-20120716-100631.pdf, accessed March 26, 2013.

Holloway Fire (August 2012): The Holloway Fire, this lightning caused fire ignited on August 5, 2012 and originated 25 miles east of Denio, Nevada. It burned approximately 170,000 acres within Malheur County (75,000 acres in Harney County ; 461,047 acres total). Thirteen crews, four helicopters, 69 engines, 27 dozers, 16 water tenders and 826 personnel were deployed.

Figure WF-3 Holloway Fire Information Map



Source: *2014 Malheur County NHMP* (InciWeb: Incident Information System, http://www.inciweb.org/incident/3113/) (no longer accessible).

Risk Assessment

How are Hazards Identified?

This NHMP builds upon previously collected data and information, including the *2014 Malheur County NHMP* and the *2009 Malheur County Community Wildfire Protection Plan* (CWPP). The CWPP was created with the intention of addressing wildfires within the WUI and affecting the communities of Adrian, Jordan Valley, Nyssa, Ontario, Vale, Arock, Brogan, Danner, Juntura, McDermitt, Rome and other communities.[17] The purpose of the CWPP was for communities to take advantage of opportunities offered under the Healthy Forests Restoration Act (HFRA) of 2003.[18] The CWPP "is the result of analysis, professional cooperation and collaboration, assessments of wildfire risks and other factors considered with the intent to reduce the potential wildfires that threaten people, structures, infrastructure, and values in Malheur County"[19]

Table WF-2 Communities at Risk to Wildfire shows areas within Malheur County that are considered to have high or moderate risk to wildfire; the wildland urban interface community name is shown followed by its score (out of a possible 23) in parentheses.

Table WF-2 Communities at Risk to Wildfire

High	Moderate
Ontario Heights (19)	Crowley (16)
Riverside (19)	Rockville (16)
Vale (19)	Burns Junction (16)
Owyhee Reservoir (18)	McDermitt (16)
Harper (17)	Rome (16)
Juntura (17)	Nyssa (15)
Adrian (17)	Basque Station (15)
Jordan Valley (17)	Annex (15)
	Ironside (14)

Source: *Malheur County CWPP*, 2009, https://www.oregon.gov/ODF/Documents/Fire/CWPP/MalheurCounty.pdf

The contributing factors for the hazard ratings included:

- Likelihood of fire occurring,
- Topographic hazard,
- Total fuel hazard,
- Overall fire protection capability,
- Weather factor, and
- Values at risk.

---

17 *Malheur County Community Wildfire Protection Plan* (CWPP), 2009. https://www.oregon.gov/ODF/Documents/Fire/CWPP/MalheurCounty.pdf

18 Ibid

19 Ibid

In 2002, the Vale BLM office completed the Communities at Risk (CAR) wildland fire risk assessments for these WUI areas in Malheur County: Arock, Adrian, Jordan Valley, McDermitt, Rome, Ontario Heights, Ontario Slope, and Vale. These CAR reports contain documentation on each community's risk for wildfire and list mitigation actions as determined by BLM, its contractors, and the local communities. These reports provide valuable information to the communities.

According to *Oregon's Communities at Risk Assessment, "*A Community at Risk includes the geographic area within and surrounding the populated areas - adjacent landscapes that contain vegetation creating a risk to the community, generally a sixth field watershed, and municipal watersheds. It is based upon a "fire shed" concept, including the area surrounding the community where economic, social, cultural, and visual values important to the community exist, and where strategic fuel reduction planning needs to occur to protect the community from large catastrophic wildfires. The statewide process identified areas within two km of populated jurisdictions, as well as the adjacent sixth field watershed(s), not exceeding 8 km. NOTE: This is a significant change from the 2001 Community at Risk (CAR) map for Oregon, which primarily identified populated areas."[20]

Malheur County GIS has created six maps with wildfire information for this NHMP. Each map identifies the source of the information used and are included at the end of this Hazard Annex.

- Figure WF-4 Malheur County Local Fire History,
- Figure WF-5 Malheur County Wildfire Annual Burn Probability Map,
- Figure WF-6 Malheur County Overall Wildfire Risk by Watershed,
- Figure WF-7 Malheur County Overall Wildfire Risk,
- Figure WF-8 Malheur County Burn Hazard to Potential Structures, and
- Figure WF-9 Malheur County Wildfire Burn Hazard to Assets.

Hazard Risk Analysis

The Malheur County NHMP Steering Committee completed a Hazard Vulnerability Assessment/Analysis (HVA) during this NHMP update. This was described in Section 2 Risk Assessment. The method used for the HVA was developed from a Federal Emergency Management Agency (FEMA) tool that has been refined by the Oregon Office of Emergency Management (OEM). It addresses and weights (shown as percent within parentheses) probability (29%), vulnerability (21%), maximum threat (42%) and the history (8%) of each natural hazard and attributes a final hazard analysis score. The methodology produces scores that range from 24 to 240.

For local governments, conducting the HVA is a useful step in planning for hazard mitigation. The method provides the jurisdiction with a relative ranking from which to prioritize mitigation actions, but does not predict the occurrence of a particular hazard.

In 2013 wildfire hazards had a risk score of 165 and a rank of 4 out of 11 natural hazards. In 2018 wildfire hazards had a risk score of 175 and a rank of 5 out of 11 natural hazards.

For more information on all the risk scores and ranks of the natural hazards in Malheur County, see Volume I Basic Plan, Section 2 Risk Assessment of this NHMP.

---

[20] ODF, *Oregon's Communities at Risk Assessment*, September 12, 2006, http://library.state.or.us/repository/2007/200710150832491/index.pdf.

Probability Assessment

In Oregon, especially in Malheur County, wildfires are inevitable. Although usually thought of as being a summer occurrence, wildland fires can occur during any month of the year. The vast majority of wildfires burn during June to October time period, though the wildfire season has expanded over recent years. Dry spells during the winter months, especially when combined with winds and dead fuels, may result in fires that burn with intensity and a rate of spread that surprises many people. Wildfire risk to human welfare and economic and ecological values is more serious today than in the past because of the buildup of flashy fuels, changes in vegetation composition over time, construction of houses in proximity to forests and rangelands, increased outdoor recreation, and a lack of public appreciation of wildfire.[21]

As has been described, the natural ignition of forest fires is largely a function of weather and fuel; human-caused fires add another dimension to the probability. Dry and diseased forests can be mapped and some statement can be made about the probability of lightning strikes. Each forest is different and consequently has different probability and recurrence estimates.

The intensity and behavior, again as has been described, of wildfire depends on a number of factors including fuel, topography, weather, and density of development. There are a number of often-discussed strategies to reduce the negative impacts of these phenomena. They include land use regulations, management techniques, site specific standards, and building codes. In 1997 the Oregon Forestland-Urban Interface Fire Protection Act (aka Senate Bill or SB 360) passed. SB 360 requires property owners to comply with its provisions; these provisions are implemented by property owners and monitored by ODF. All of these have a bearing on a community's ability to prevent, withstand, and recover from a wildfire event. Figure WF-5 Malheur County Wildfire Annual Burn Probability Map shows the annual likelihood of occurrence of a large wildfire greater than 250 acres, considering weather, topography, fire history, and fuels (vegetation).

Vulnerability Assessment

Each year a significant number of people build homes within or on the edge of the WUI, thereby increasing the exposure of people and property to wildfire hazards. Many Oregon communities (incorporated and unincorporated) are within or abut areas subject to serious wildfire hazards, complicating firefighting efforts and significantly increasing the cost of fire suppression. The maps included in Figures WF-5 to WF-9 provide visual illustration of wildfire vulnerabilities. Figure WF-10 Malheur County Average Flame Lengths is a visual indication of fire intensity and is a primary factor to consider for firefighter safety and for gauging potential impacts to resources and assets.

The *2009 Malheur County CWPP* used an assessment of factors to determine communities' vulnerability to the wildfire hazard. The assessment used factors that contribute to large wildfire events that seriously impact communities. Malheur County used three guidance documents to assess the communities-at-risk and the WUI areas:

1. *Field Guidance: Identifying and Prioritizing Communities at Risk*. National Association of State Foresters. June 27, 2003 (http://www.stateforesters.org/).

[21] *Malheur County CWPP*, 2009, https://www.oregon.gov/ODF/Documents/Fire/CWPP/MalheurCounty.pdf.

2. *Concept for Identifying and Assessment of Communities at Risk in Oregon*. Draft prepared by Jim Wolf, Fire Behavior Analyst, Oregon Department of Forestry. July 19, 2004.
3. *Wildland Urban Interface Communities-at-Risk Program*, Final Mitigation Recommendations. Reports provided for BLM by Dynamac Corporation, 2002.

The assessment used a scoring matrix with six factors: likelihood of fire occurring, topographic hazard, total fuel hazard, overall fire protection capability, weather factor, and values at risk[22].

Below is a list of issues considered in the *2009 Malheur County CWPP* process, the *2014 Malheur County NHMP* update, and again in the *2019 Malheur County NHMP*:

- Road access: Some County roads and remote bridges are unsuitable for fire vehicle access. No full inventory of these roads exists. With an inventory, the County could prioritize these roads for upgrades.
- Road access: Many privately owned driveways and bridges are unsuitable for fire vehicle and equipment access, which raises residents' fire risk considerably. BLM has done some community outreach and conducted free home inspections on this issue, but some residents remain unaware of their risk.
- Not all County and City offices have fire safety information available for residents seeking to build or move into the area. Offices such as the County Planning Department could have information to hand out to residents.
- Fuel reduction and alternation on BLM and private lands is an ongoing mitigation task. After fires, BLM will reseed with native grasses, non-native but not invasive plants, and less flammable plants. They also spray cheat grass, one of the most prevalent invasive grasses.[23]
- While most of Malheur County is covered with fire protection, there are still several parts of unincorporated Malheur County that lack fire service protection.
- Access to water is needed.

These concerns remain and are retained as part of this Malheur County NHMP update.

Community Hazard Issues

What is susceptible to damage during a hazard event?

Threat to Life and Property

The interface between urban and suburban areas and these resource lands are producing increased exposure to life and property from wildfire. In many cases, existing fire protection services cannot

[22] ibid.

[23] Al Crouch, BLM, personal communication, March 4, 2019.

adequately protect new development. Wildfires that also involve structures and utilities present complex and dangerous situations to firefighters.

Personal Choices

There is increasing development in the WUI, as more people and property are choosing to live in the WUI; thus the vulnerabilities increase. Two maps help illustrate vulnerabilities in Malheur County both within and outside of the WUI: Figure WF-8 Wildfire Burn Hazard to Potential Structures and WF-9 Wildfire Burn Hazard to Assets. Both maps involve consequences to structures if a wildfire occurs, with a range from low to very high impacts.

Private Lands

Private development in Malheur County may be located within urban and rural areas. In some areas, fire equipment cannot negotiate steep grades, poor road surfaces, narrow roads, flammable or inadequately designed bridges, or traffic attempting to evacuate the area. Limited water availability during the fire season, and severe fuel loading problems add to the list of concerns. In some areas, current protection resources are stretched thin, thus both property in the WUI, outside the WUI, and in communities are at greater risk from fire. While local, state, and federal programs about wildfire risk has increased knowledge of wildfire risk, many property owners are not aware of the wildfire threats that they face, and some property owners in some areas have done little to manage or offset fire hazards or risks on their own property.

Drought

Recent concerns about the effects of climate change, particularly drought, are contributing to concerns about wildfire vulnerability. Unusually dry winters and hot summers increase the likelihood of a wildfire event, and place importance on mitigating the impacts of wildfire before an event takes place. See the Drought Annex for more information on drought in Malheur County.

City Specific Damage

Ontario

The City of Ontario experiences the effects of wildfire frequently, but events threatening the City on a major scale are rare. Agricultural fields and irrigation canals surrounding the City act as natural fire breaks, and City officials said they feel that WUI areas near Ontario (Oregon Slope and Ontario Heights, both just out of city limits) are adequately protected.

Nyssa

The City of Nyssa and its surrounding area is considered a WUI area by BLM (see the *2009 Malheur County CWPP*), but fires occurring within city limits or threatening the City itself are very infrequent to nonexistent.

There was a fire near the City in 2012; a fire occurred in the hills to the east but could not enter the City due to the Snake River. Prior to that fire, the last event was several decades ago (the exact date is unavailable; local officials' best estimate was 1968 or 1969), when a fire near Lytle Boulevard west of city limits came within approximately 1.5 miles of the City.

There are parcels of private and BLM land outside of the City which have historically burned frequently, but these events generally do not significantly negatively impact the city itself. BLM fires can negatively impact the activities of local ranchers and farmers, which can thus have an economic impact on the City. City officials note that Nyssa is bordered by natural fire breaks on all sides – the Snake River to the east and south, and agricultural lands to the south, west, and north.

Vale

The City of Vale and its surrounding area is considered a WUI area by BLM (see the *2009 Malheur County CWPP*), but fires occurring within city limits or threatening the City itself are infrequent.

Vale does have a high probability because fires on rangeland hills outside of city limits occur frequently. These events do not generally threaten the City itself, but they can be a risk for people living within 3-5 miles outside of city limits, many of whom work or do business in Vale.

Vale has a volunteer fire department, which can be stretched thin because Vale also assists several surrounding rural unincorporated communities through mutual aid agreements, including Harper, Brogan, and Ironside.

Existing Hazard Mitigation Activities and Resources

Ordinances

People proposing to construct new buildings in the WUI in Malheur County, and the Cities of Ontario, Nyssa, and Vale are given instructions from the appropriate fire district to ensure fire access for their structure. The instructions are not a binding ordinance, but are based on recommended state standards. Contact the respective jurisdiction with authority.

Malheur County, https://www.malheurco.org/

City of Ontario, http://www.ontariooregon.org/

City of Nyssa, https://www.nyssacity.org/

City of Vale, https://www.cityofvale.com/

Building Code

On January 24, 2019 new language went into effect related to the Oregon Residential Specialty Code Section R327 Wildfire Hazard Mitigation. This language adds to the scope portion of R327. The provisions of this section shall apply to all dwellings required to be protected against wildfire by a jurisdiction which has adopted wildfire zoning regulations. The additional provisions of Section R327.4 shall apply when a municipality has an adopted a local ordinance specifically recognizing Section R327.4 and consistent with Sections R327.4 through R327.4.8.[24]

[24] Oregon Residential Specialty Code (ORSC), *Section R327 Wildfire Hazard Mitigation*, https://www.oregon.gov/bcd/codes-stand/Documents/17orsc-wildfire-mitigation-insert-pages.pdf

Studies/Reports

BLM's 2002 Community-at-Risk (CAR) reports for key WUI areas in Malheur County provide the best currently available information on wildfire vulnerability at the local level, in addition to the 2009 *Malheur County CWPP* and this NHMP.

State Natural Hazard Risk Assessment

The risk assessment in the *2015 Oregon Natural Hazards Mitigation Plan* provides an overview of wildfires risk in Oregon and identifies the most significant wildfires in Oregon's recorded history. It has overall state and regional information, and includes wildfire mitigation actions for the entire state. https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP_5_RAState.pdf

Planning for Natural Hazards: Oregon Technical Resource Guide

This guide describes basic mitigation strategies and resources related to wildfires and other natural hazards, including examples from communities in Oregon.
https://scholarsbank.uoregon.edu/xmlui/handle/1794/1909

Emergency Operations Plan

Malheur County's *Emergency Operations Plan* (EOP) was prepared in 2017; that was an update to the 2009 EOP. The EOP describes how the County will organize and respond to emergencies and disasters; it includes the Emergency Support Function section called ESF 4 – Firefighting. In the Basic Plan portion of the EOP it includes the hazards flooding, severe weather, drought, hazardous material, earthquakes, nuclear attack, and volcanoes. The EOP also mentions the NHMP, though that reference is outdated and needs to be made more current.

https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/MALHEUR%20EOP.pdf

Bureau of Land Management (BLM)

The Bureau of Land Management (BLM) is responsible for "managing public lands for a variety of uses such as energy development, livestock grazing, recreation, and timber harvesting while ensuring natural, cultural, and historic resources are maintained for present and future use." According to their website, the BLM manages 1/10 of the nation's surface area and 30% of the nation's mineral and soils (https://www.blm.gov/about/our-mission).

In Oregon, BLM is responsible for fire protection for all federal agencies. They also provide fire protection on Department of State Lands (DSL) land and on Oregon State Parks' lands. BLM has a memorandum of agreement with Oregon to provide support to the Rangeland Fire Protection Associations (RFPA).[25]

There is a new program through the BLM, called the Rural Fire Readiness Program. It's a separate cooperative agreement that a RFPA can sign with BLM; it removes them from the statewide

[25] Al Crouch, BLM, personal communication, March 4, 2019.

memorandum of agreement with Oregon. The cooperative agreement provides more money to the RFPAs for training and equipment.[26]

Rangeland Fire Protection Associations (RFPA)

Rangeland Fire Protection Associations (RFPAs) provide wildfire protection of private land within Malheur County. RFPAs (formed under ORS 477.315) protect over 3.2 million acres of private land in eastern Oregon with support from ODF. RFPAs operate as independent associations of landowners that provide their own protection with the support of the ODF (chiefly technical support for grants, grant writing, procurement of equipment and fire-fighting training)[27].

A statewide agreement between the Bureau of Land Management and Oregon exists. The ODF provides a small source of funding for the RFPAs, however, the majority of funds come from federal grants (primarily Volunteer Fire Assistance and Rural Fire Assistance). Additional fees are collected from voluntary membership dues. As noted above, BLM also supports the RFPAs.

The RFPA has a responsibility to protect private lands of members and non-members alike pursuant the agreement formed with ODF when the RFPA is created. These all-volunteer crews of ranchers have training and legal authority to respond to fires on private and state lands where there had been no existing fire protection, and can become authorized to respond on federal lands as well.

The following RFPAs are active within Malheur County[28]:

- Ironside RFPA (established 1964),
- Juntura RFPA (established 2007),
- Jordan Valley RFPA (established 2008),
- Vale RFPA (established 2008), and
- Blue Mountain RFPA (established 2013).

RFPAs are an increasingly popular model of community fire-based management. The RFPA model harness the benefits: members can respond quickly; members possess local knowledge; and members have a strong desire and culture around helping neighbors and protecting livelihoods.[29]

Oregon Department of Forestry (ODF)

ODF does not have a fire suppression presence in Malheur County, except through the RFPAs.[30] According to the website, under the About the Fire Program page, "As Oregon's largest fire department, ODF's Fire Protection program protects 16 million acres of forest, a $60 billion asset. These lands consist of privately owned forests as well as some public lands, including state-owned

---

[26] Ibid.

[27] Foster, Gordon. Oregon Department of Forestry, *Status of Rangeland Fire Protection Associations*, 2011, http://library.state.or.us/repository/2011/201112200820542/index.pdf, accessed March 2013 and January 2019.

[28] *Malheur County Community Wildfire Protection Plan,* 2009.

[29] Davis, Emily Jane "EJ," *Fire Adapted Communities on the Range: Why Rangeland Fire Protection Districts Matter*, June 21, 2018, https://fireadaptednetwork.org/fire-adapted-communities-on-the-range-why-rangeland-fire-protection-associations-matter/.

[30]All Crouch, BLM, personal communication, March 4, 2019.

forests and, by contract, Bureau of Land Management forests in western Oregon. ODF is also part of an extensive fire protection network that includes landowner resources, contract crews and aircraft, inmate crews, and agreements with public agencies across Oregon, the US and British Columbia.

ODF's firefighting policy is straightforward: Put out fires quickly at the smallest possible size. Most of the lands protected by the agency are working forests that produce revenue and support jobs. It is crucial to prevent fire damage to the timber resource that is an essential element of Oregon's economy. This aggressive approach to firefighting also safeguards ecosystem values such as fish and wildlife habitats (https://www.oregon.gov/odf/fire/pages/default.aspx).

U.S. Forest Service (USFS)

The USFS does not have land in Malheur County.[31] The USFS has a fuel-loading program to assess fuels and reduce hazardous buildup on U.S. forestlands. The USFS is a cooperating agency and, it has an interest in preventing fires in the WUI, as fires often burn up the hills and into the higher elevation U.S. forestlands.

The USFS and other federal, tribal, state, and local government agencies work together to respond to tens of thousands of wildfires annually. Each year, an average of more than 73,000 wildfires burn about 7 million acres of federal, tribal, state, and private land and more than 2,600 structures[32].

The USFS recognizes the wildland fire management environment has profoundly changed. Longer fire seasons; bigger fires and more acres burned on average each year; more extreme fire behavior; and wildfire suppression operations in the WUI have become the norm. To address the challenges, the USFS and its federal, tribal, state, and local partners have developed and are implementing a *National Cohesive Wildland Fire Management Strategy* that has three key components: Resilient Landscapes, Fire Adapted Communities, and Safe and Effective Wildfire Response.[33]

https://www.fs.fed.us/managing-land/fire

Firewise Communities

Malheur County has limited participation in the Firewise program. None of the communities in Malheur County are actually identified as a Firewise community.[34]

The Firewise program was developed by the National Fire Protection Association; it is a national program that emphasizes community involvement and provide important information for residents to the risk of wildland fire igniting homes and other residential structures. The resource rich website is full of free materials. Malheur County provides educational materials to homeowners and alerts residents of wildfire risks on their Facebook page and with other methods.

https://www.nfpa.org/Public-Education/By-topic/Wildfire/Firewise-USA

[31] Ibid.

[32] USFS, *Wildland Fire*, https://www.fs.fed.us/managing-land/fire

[33] Ibid.

[34] Al Crouch, BLM, personal communication, March 4, 2019.

2009 Malheur County CWPP Identified Actions[35]

The primary focus of the *2009 Malheur County CWPP* is within the WUI. Human life, critical infrastructure, and the environment are the main assets at risk to wildfire. This is because of the buildup of hazardous fuels around communities and structures, poor emergency vehicle and equipment ingress and egress, a large area to cover with the fire authorities, and inadequately trained and/or equipped fire suppression authorities.

Throughout the County, there are scattered small communities and ranches with houses and out-buildings that are under protected with structural fire protection because they are outside municipal fire districts. There are a few that are not protected. Economic values at risk include businesses, farmland, ranchland, grazing land, hunting and other recreational land, historic and cultural sites, and critical infrastructure.

https://www.oregon.gov/ODF/Documents/Fire/CWPP/MalheurCounty.pdf

Future Changing Conditions/ Climate Change

In the Malheur County NHMP, there are several locations that describe future changing conditions or climate change as it relates to the natural hazards that impact Malheur County. In the order of appearance in the NHMP: the Risk Assessment, the Hazards Annexes, and Appendix F contain this information. Within Appendix F there are two documents, the *Future Climate Projections: Malheur County* and the *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports.*

Wildfire Mitigation Action Items

The wildfire mitigation actions have been identified by the Malheur County NHMP Steering Committee which includes the Cities of Nyssa, Ontario and Vale. See Table 3-3 Mitigation Actions Table 2019 NHMP and the action item worksheets in Appendix A for a more detailed description of the mitigation actions in this NHMP. These mitigation actions are separate from the mitigation actions in the *Malheur County CWPP*. Together, the mitigation actions from these two plans form a strong approach to risk reduction of wildfire in Malheur County.

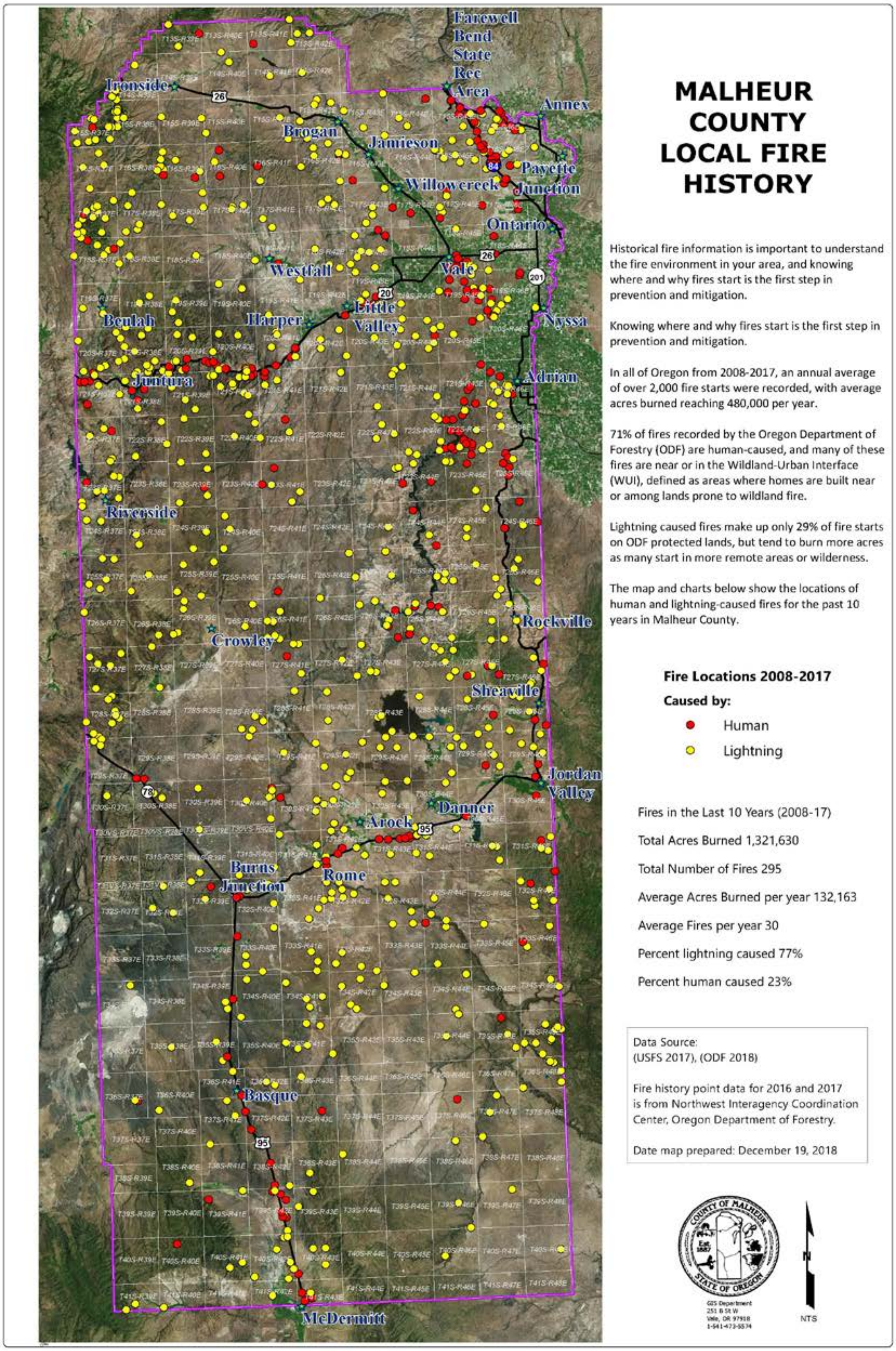
In the NHMP, there are three wildfire specific mitigation actions. The mitigation actions have a high-medium priority because the Hazard Vulnerability Assessment (HVA) resulted in wildfires having a high-medium risk level.

There are seven multi-hazard mitigation actions for the NHMP and several of those include wildfire related mitigation actions, in conjunction with the other hazards. The multi-hazard mitigation actions are a high priority.

At the August 9, 2018 NHMP Steering Committee meeting, it was agreed that the risk level rankings from the HVA would be used as the way to prioritize the multi-hazard and hazard-specific mitigation actions. The risk level rankings are in Table 2-5 in Section 2 Risk Assessment.

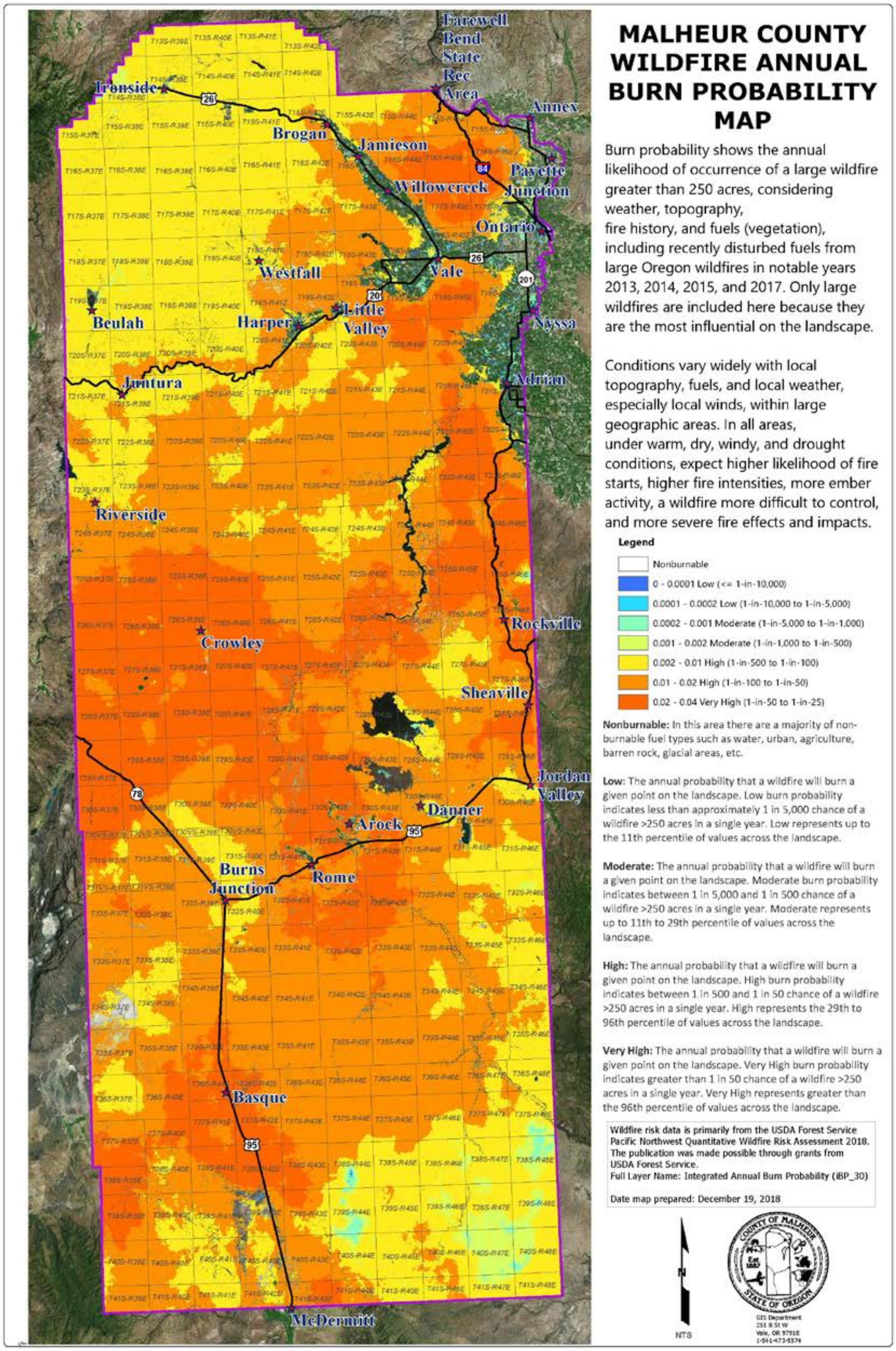
[35] *Malheur County CWPP*, 2009, https://www.oregon.gov/ODF/Documents/Fire/CWPP/MalheurCounty.pdf.

Figure WF-4 Malheur County Local Fire History



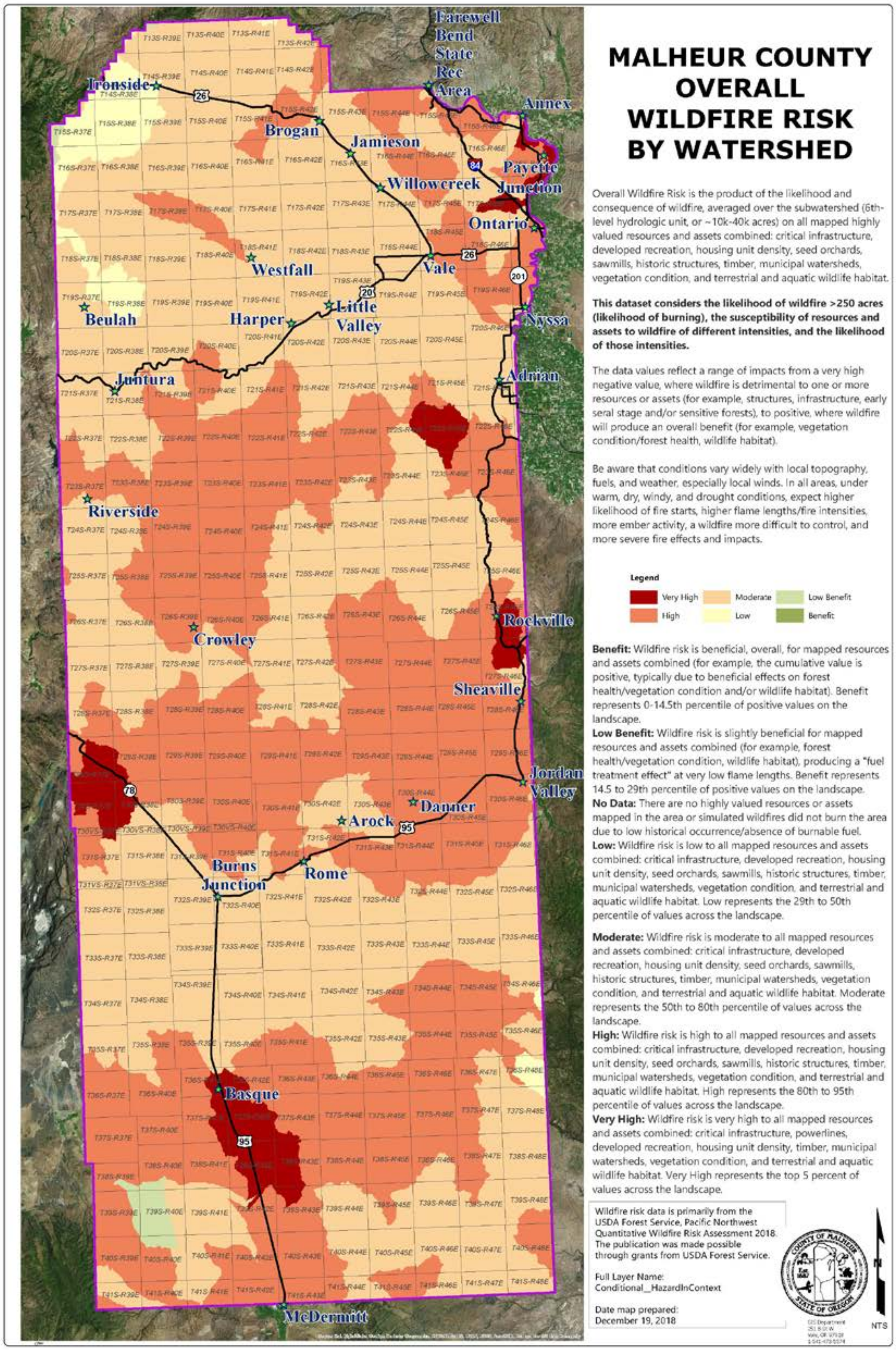
Source: Gina Lewis, Malheur County, December 21, 2018

Figure WF-5 Malheur County Wildfire Annual Burn Probability Map



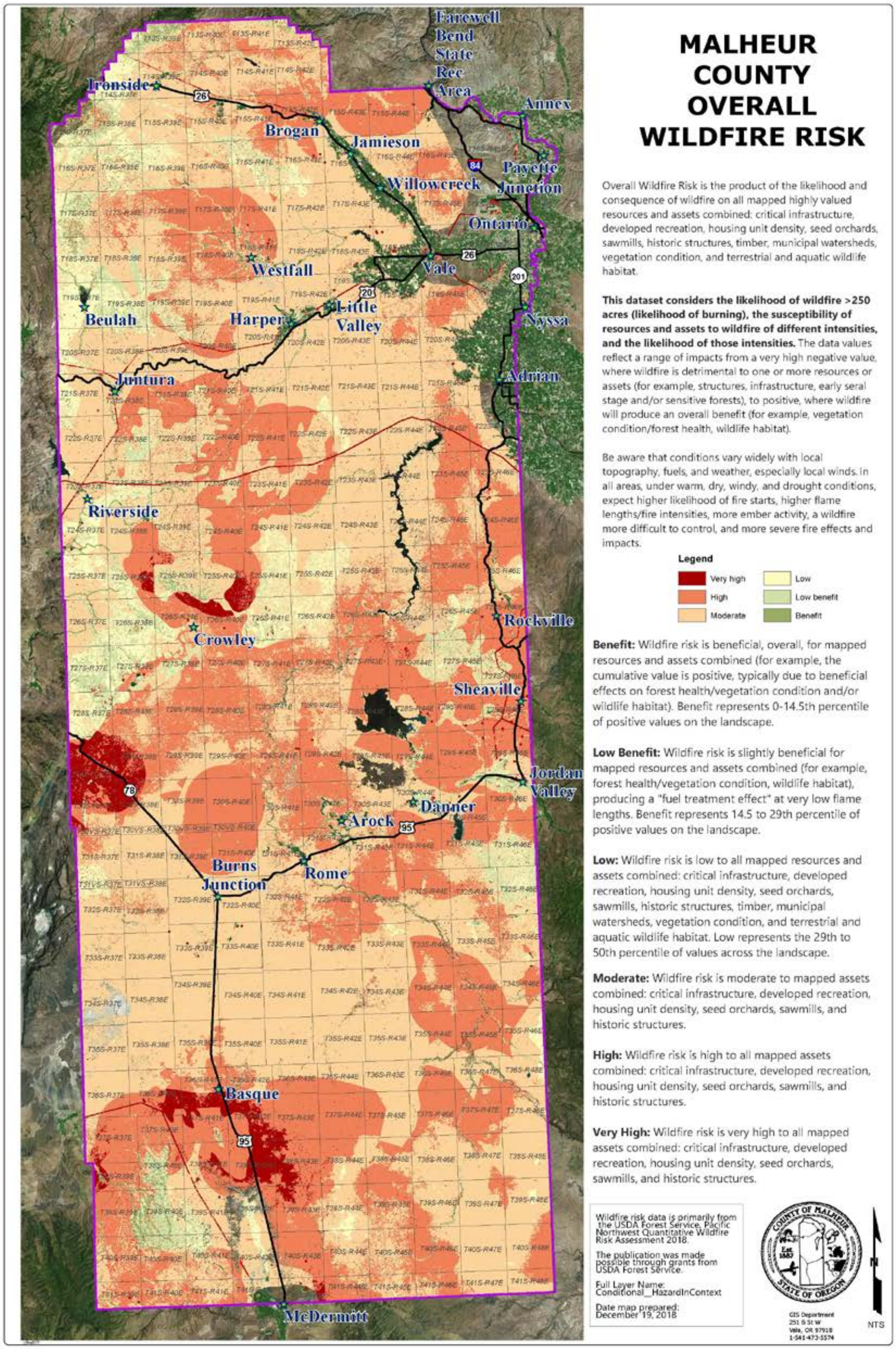
Source: Gina Lewis, Malheur County, December 21, 2018

Figure WF-6 Malheur County Overall Wildfire Risk by Watershed



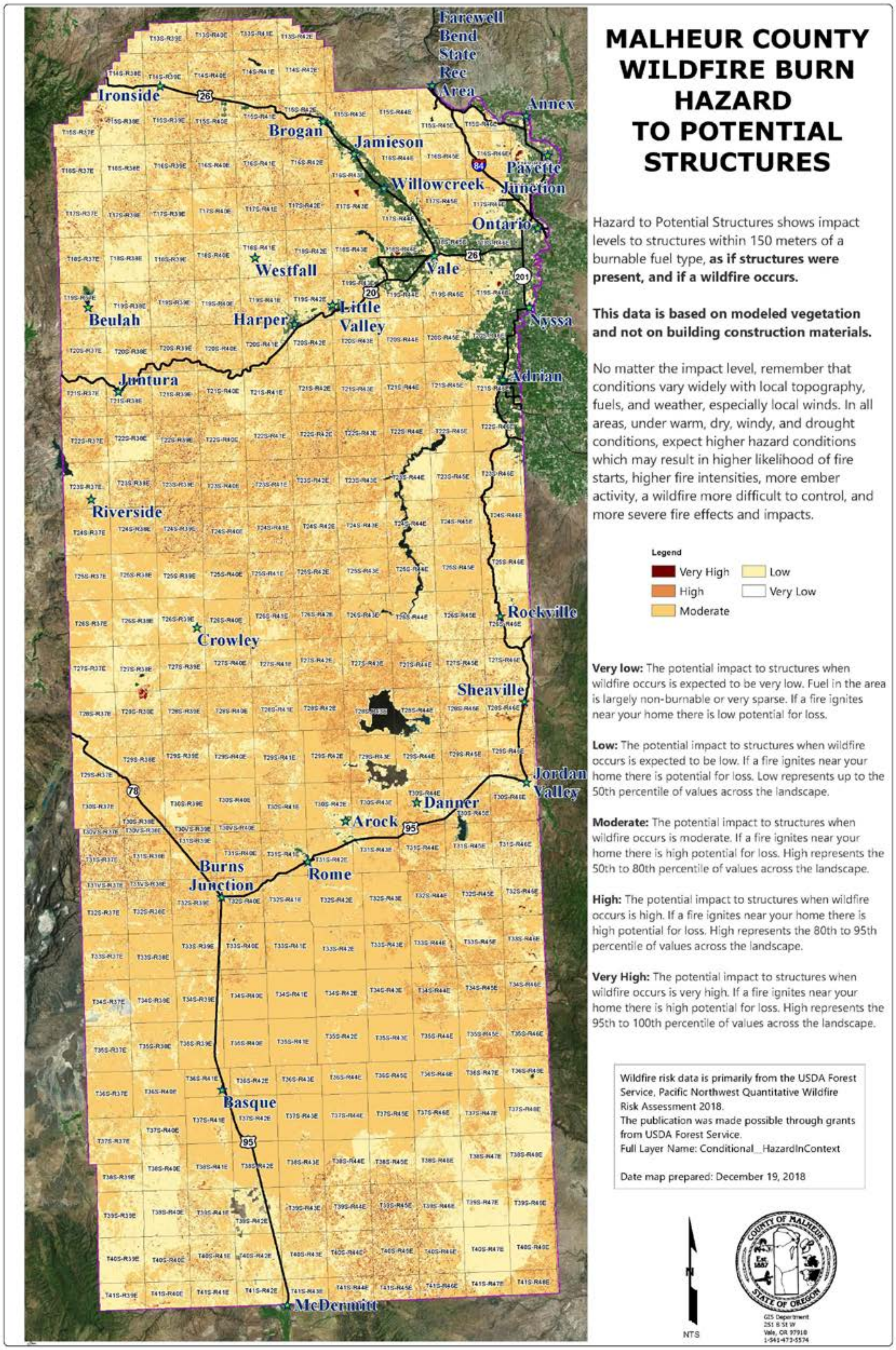
Source: Gina Lewis, Malheur County, December 21, 2018

Figure WF-7 Malheur County Overall Wildfire Risk



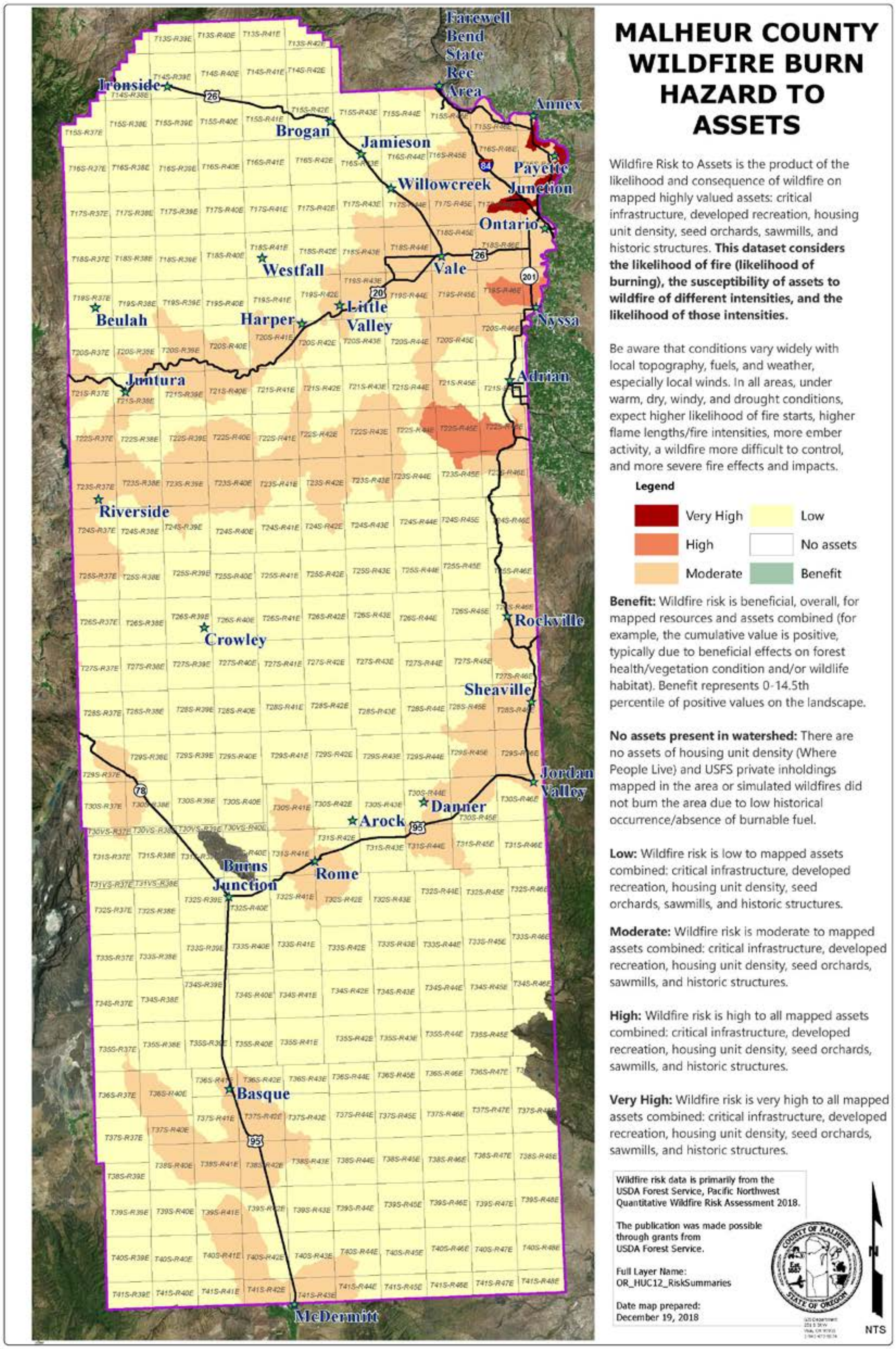
Source: Gina Lewis, Malheur County, December 21, 2018

Figure WF-8 Malheur County Wildfire Burn Hazard to Potential Structures



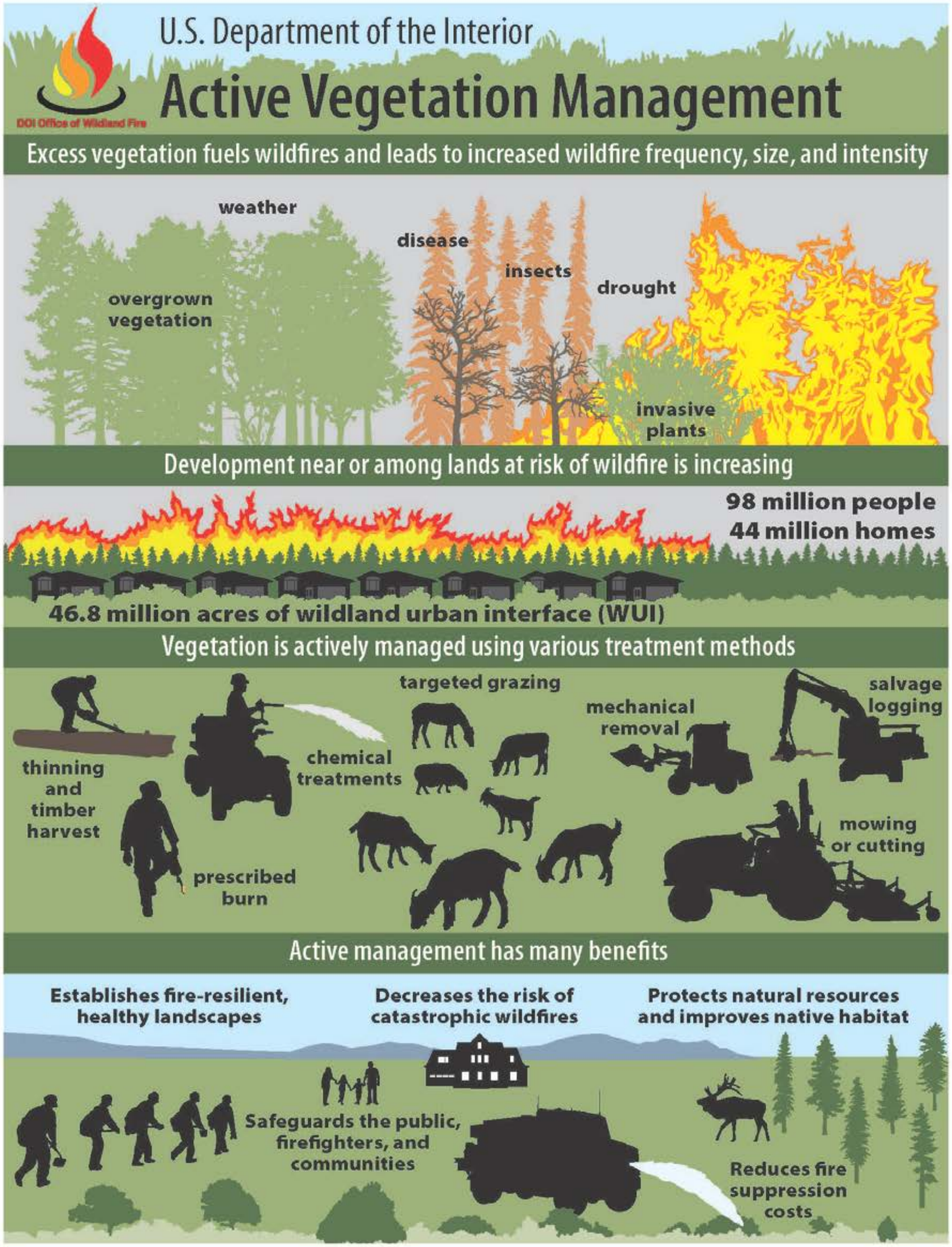
Source: Gina Lewis, Malheur County, December 21, 2018

Figure WF-9 Malheur County Wildfire Burn Hazard to Assets



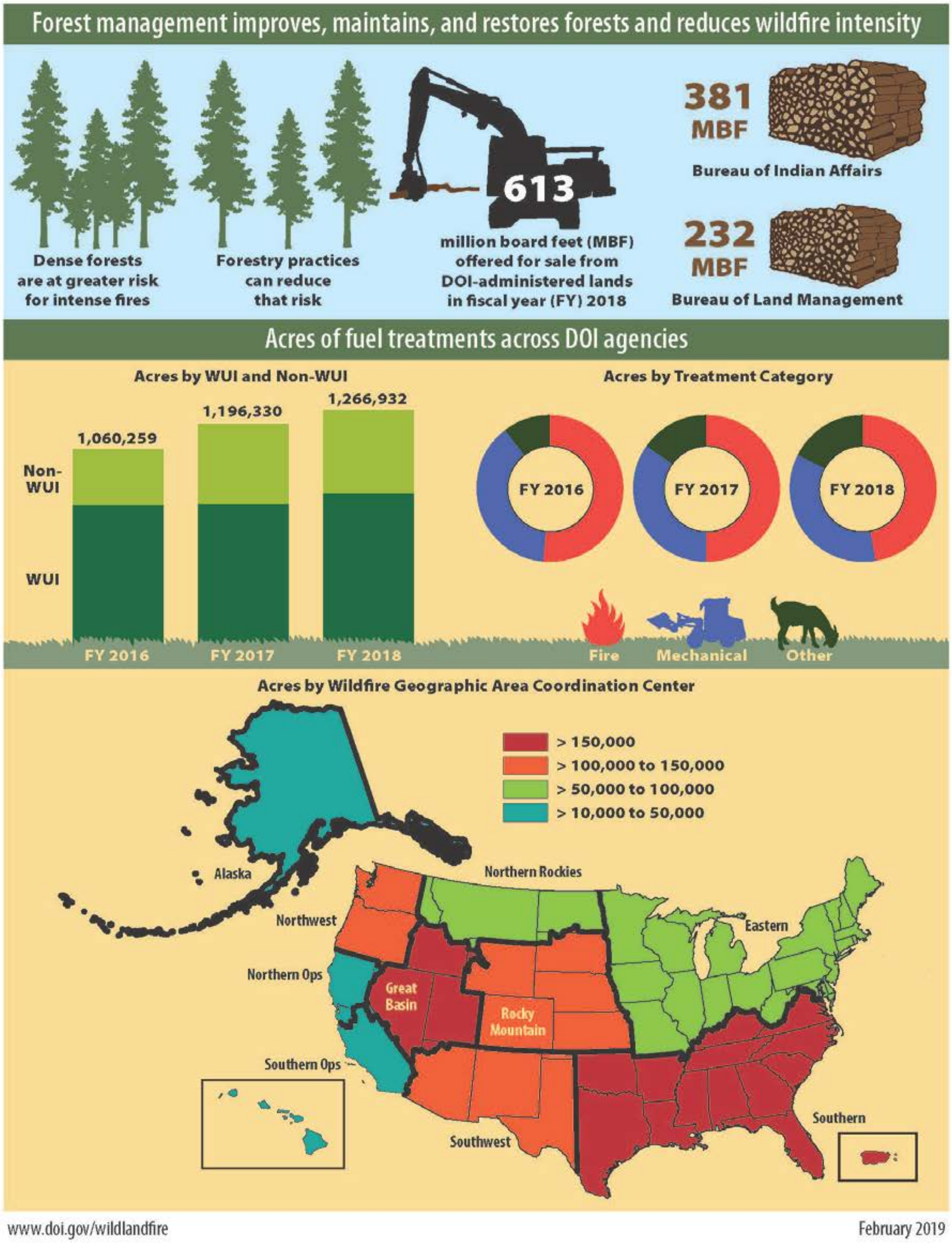
Source: Gina Lewis, Malheur County, December 21, 2018

Figure WF-10 Active Vegetation Management (Page 1)



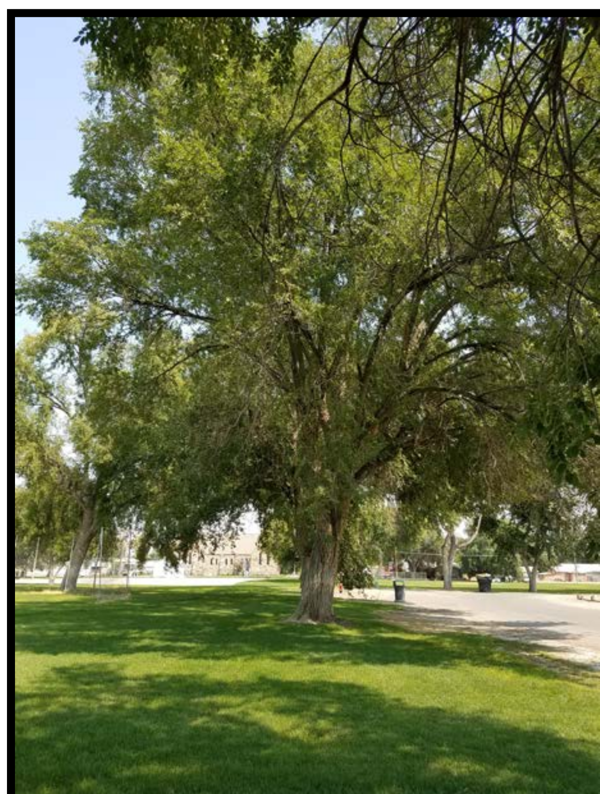
Source: Al Crouch, BLM, personal communication, March 4, 2019

Figure WF-10 Active Vegetation Management (Page 2)



Source: Al Crouch, BLM, personal communication, March 4, 2019

Volume III: Mitigation Resources



Source: Vale levee system along the Malheur River in Vale and a city park in Nyssa photos, Tricia Sears, DLCD, August 9, 2018.

This page left intentionally blank.

APPENDIX A: ACTION ITEM FORMS

In Volume I Section 3 Mitigation Strategy, Table 3-2 Malheur County Mitigation Actions – Status of 2014 NHMP and Table 3-3 Malheur County Mitigation Actions 2019 NHMP were included. The following pages list each mitigation action from Table 3-3 by mitigation action number, and includes details such as the affected jurisdictions and the rationale for the mitigation action. Each action also includes the timeline and status for the jurisdiction affected by the action. There are 25 total mitigation actions for the *2019 Malheur County Multi-Jurisdictional NHMP*.

At the August 9, 2018 Steering Committee meeting, it was agreed that the risk level rankings from the Hazard Vulnerability Assessment (HVA) would be used as a way to prioritize the multi-hazard and hazard-specific mitigation actions. All the multi-hazard (MH) actions are high priority. The hazard-specific actions are high, high-medium, and low. The risk scores and risk level rankings are found in Section 2 Risk Assessment in Table 2-5 and the risk scores and risk level rankings are further described in the Risk Assessment section.

Malheur County and the Cities of Ontario, Nyssa, and Vale are included in this Appendix A and are not in a separate addenda like they were in previous Malheur County NHMPs.

A list of the specific existing plans for Malheur County and the Cities is included in Section 4 Implementation in Table 4-1 Existing Plans and in the Community Profile in Table C-24 Existing Plans.

Table A-1 Multi-Hazard Mitigation Action #1

<table>
<tr><th colspan="2">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="2">MH #1 – Conduct Business Continuity Plan Development information sharing through presentations, workshops, and other methods for small businesses, local nonprofits, governments, and human services organizations.</td><td>Goals 1, 2, 3</td><td>☒ Malheur
☒ Ontario</td><td>☒ Nyssa
☒ Vale</td></tr>
<tr><th colspan="5">Affected Jurisdictions:</th></tr>
<tr><td>☒ Malheur County</td><td>☒ Nyssa</td><td>☒ Ontario</td><td colspan="2">☒ Vale</td></tr>
<tr><th colspan="5">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="5">Comprehensive Plans, Development Codes, Emergency Operations Plan, Economic Development Plans, and Transportation Systems Plans for the County and the Cities are examples of plans that relate to the resilience and recovery, and link the community together.</td></tr>
<tr><th colspan="5">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="5">
• The local economy is dependent on small business; most business owners do not have disaster plans in place. Similarly, many local nonprofits and human service providers do not have plans in place and are crucial support systems for vulnerable community populations.
• According to Daniel Alesch from the Public Entity Risk Institute, business continuity plans assist businesses in planning for future recovery efforts. In addition, research has shown that most small businesses are unable to recover after a disaster. Business continuity plans allow businesses and their employees to be better prepared for a disaster. Having plans in place may reduce the impact on the business, allowing employees to continue to work or get back to work faster.
• Business continuity plans and Continuity of Operations Plans establish policy and guidance to ensure the execution of the organization’s most essential functions in any event that requires the relocation of selected personnel and functions to an alternate facility.
Source: Oregon Natural Hazards Workgroup (ONHW). Cannon Beach Case Study Report. July 2006. Community Service Center, University of Oregon. Eugene, OR.
• Research has shown that staff turnover is likely to occur after a disaster, and veteran staff is critical after a disaster. Developing a business continuity/ continuity of operations plan will help prevent turnover so that existing personnel do not have to take on extra responsibilities during an already stressful time. In addition, continuity planning can help lessen turnover by ensuring competitive salaries and benefits and by reducing the amount of stress that staff will have to endure.
Source: Oregon Natural Hazards Workgroup (ONHW). Cannon Beach Case Study Report. July 2006. Community Service Center, University of Oregon. Eugene, OR.
• All the multi-hazard (MH) actions are high risk-level and hence high priority.
</td></tr>
<tr><th colspan="5">Ideas for Implementation:</th></tr>
<tr><td colspan="5">
• Use Institute for Business and Home Safety toolkit materials
• Work with Chamber of Commerce for small businesses, Malheur Community Services committee for human services nonprofits.
• Recommend that public sector employees take the FEMA Independent Study Program: Continuity of Operations Course (online). The course provides a fundamental understanding of continuity of operations plans, terms, objectives, and benefits to public sector departments and agencies. It also provides information on how an event might affect employees, the department/agency and an employee's family.
</td></tr>
</table>

<table>
<tr><td colspan="3">

- Distribute the FEMA continuity of operations self-assessment tool to cities throughout the region.
- Review existing COOP plans and begin to establish county benchmarks for increasing recovery potential.
- Seek assistance from the OEM COOP toolkit available on the Oregon Emergency Management website found here: http://www.oregon.gov/omd/oem/pages/plans_train/coop.aspx

</td></tr>
<tr><td>Coordinating Organization:</td><td colspan="2">Malheur County Emergency Services Manager</td></tr>
<tr><td>Internal Partners:</td><td colspan="2">External Partners:</td></tr>
<tr><td>Chambers of Commerce, Emergency Management Preparedness Team, Incorporated cities</td><td colspan="2">Institute for Business and Home Safety</td></tr>
<tr><td>Potential Funding Sources:</td><td>Estimated cost:</td><td>Timeline:</td></tr>
<tr><td></td><td></td><td>Ongoing</td></tr>
<tr><td>Form Submitted by:</td><td colspan="2">2008 NHMP Steering Committees; revised and confirmed in 2013, revised and confirmed in 2019</td></tr>
<tr><td>Action Item Status:</td><td colspan="2">Ongoing</td></tr>
</table>

Table A-2 Multi-Hazard Mitigation Action #2

<table>
<tr><th colspan="4">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="4">MH #2 – Work with Southeast Oregon Regional Food Bank to develop a plan/system for stocking and distributing emergency food boxes at all county food pantry locations for disaster situations.</td><td>Goals 2 and 3</td><td>☒ Malheur
☒ Ontario</td><td>☒ Nyssa
☒ Vale</td></tr>
<tr><td colspan="7">Affected Jurisdictions:</td></tr>
<tr><td>☒ Malheur County</td><td colspan="2">☒ Nyssa</td><td colspan="2">☒ Ontario</td><td colspan="2">☒ Vale</td></tr>
<tr><td colspan="7">Alignment with Existing Plans/Policies:</td></tr>
<tr><td colspan="7">Emergency Operations Plans, mutual aid agreements,</td></tr>
<tr><td colspan="7">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="7">• The local low income population depends on food banks for food security; many do not keep 72-hour kits or extra food supplies on hand for emergencies.
• The Disaster Mitigation Act of 2000 requires communities to identify a comprehensive list of actions that reduce the impacts of natural hazards on the community [201.6(c)(3)(ii)]. Developing a plan with the Southeast Oregon Regional Food Bank for stocking and distributing emergency food boxes to food pantry locations will provide a continued service to families in need and may help the larger community in a potential disaster situation.
• Nyssa: Formalize relationships and identify needed food stocks. Utilize existing food pantry at Main/ 5th streets.
• Vale: Existing pantry currently coordinates with the regional food bank.
• Each City in the County has access to a food pantry [Adrian shares with Nyssa].
• All the multi-hazard (MH) actions are high risk-level and hence high priority.</td></tr>
<tr><td colspan="7">Ideas for Implementation:</td></tr>
<tr><td colspan="7">• Work with SE Oregon Regional Food Bank and partner agencies to determine what kind of system would work best for their respective pantries and programs, as each has different storage and usage capabilities.</td></tr>
<tr><td colspan="2">Coordinating Organization:</td><td colspan="5">Southeast Oregon Regional Food Bank</td></tr>
<tr><td colspan="3">Internal Partners:</td><td colspan="4">External Partners:</td></tr>
<tr><td colspan="3">Emergency Management Team</td><td colspan="4">Four Rivers Hunger Awareness and Prevention Coalition</td></tr>
<tr><td colspan="3">Potential Funding Sources:</td><td colspan="2">Estimated cost:</td><td colspan="2">Timeline:</td></tr>
<tr><td colspan="3"></td><td colspan="2"></td><td colspan="2">Ongoing</td></tr>
<tr><td colspan="2">Form Submitted by:</td><td colspan="5">2008 NHMP Steering Committee; revised and confirmed in 2013, confirmed in 2019</td></tr>
<tr><td colspan="2">Action Item Status:</td><td colspan="5">Ongoing</td></tr>
</table>

Table A-3 Multi-Hazard Mitigation Action #3

<table>
<tr><th colspan="3">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="3">MH #3 – Develop an education program for Malheur County to raise awareness of natural hazards and potential mitigation activities.</td><td>Goals 2 and 3</td><td>☒ Malheur
☒ Ontario</td><td>☒ Nyssa
☒ Vale</td></tr>
<tr><th colspan="6">Affected Jurisdictions:</th></tr>
<tr><td>☒ Malheur County</td><td>☒ Nyssa</td><td colspan="2">☒ Ontario</td><td colspan="2">☒ Vale</td></tr>
<tr><th colspan="6">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="6">County and City outreach and education, Emergency Operations Plans, Comprehensive Plans, Natural Hazards Mitigation Plans,</td></tr>
<tr><th colspan="6">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="6">
• Local residents are often unaware of how to reduce their hazard risks, and could benefit from the availability of educational materials and workshops, especially residents in vulnerable areas (WUIs, floodplains, etc.). Rather than take a piecemeal, ad-hoc approach, the county could benefit from an organized effort to present mitigation and preparedness activities that businesses and the public can implement to reduce the impact of those hazards
• The Disaster Mitigation Act of 2000 requires communities to identify comprehensive actions that will reduce the impact of a natural hazard [201.6(c)(3)(ii)]. Developing education programs for Malheur County will help raise awareness of natural hazards and potential mitigation actions residents can implement to reduce the impact of those hazards.
• All the multi-hazard (MH) actions are high risk-level and hence high priority.
</td></tr>
<tr><th colspan="6">Ideas for Implementation:</th></tr>
<tr><td colspan="6">
• Work with local public safety committee
• Research ways to create and disseminate a message that will cause people to act to reduce individual risk to natural hazards. Target education and outreach actions to reach marginalized or especially vulnerable populations. Potential dissemination strategies: county website, mailings, public workshops, newspaper articles.
• Utilize already available mitigation materials from IBHS, BLM, NFIP and other organizations:
o Encourage implementation of non-structural earthquake retrofits in homes, businesses, and medical and care facilities. (IBHS Homeowners Guide to Non-structural Retrofit materials)
o Encourage fire-resistant building and landscaping for property owners. (Firewise materials)
o Encourage water conservation and drought resistance strategies for property owners and farmers. (materials from USDA Farm Service Agency and other offices)
o Encourage flood protection measures for homes and businesses (NFIP materials)
o Identify local government department offices as locations for educational material distribution.
o Potential sites: Malheur Co Planning Department, Vale City Hall, Nyssa City Hall, Jordan Valley City Hall, Ontario City Hall, Adrian City Recorder's Office
</td></tr>
<tr><th colspan="2">Coordinating Organization:</th><td colspan="4">Malheur County Emergency Services Manager and Malheur County Health Department Emergency Coordinator</td></tr>
<tr><th colspan="3">Internal Partners:</th><th colspan="3">External Partners:</th></tr>
</table>

<table>
<tr><td colspan="2">County, Incorporated cities, local public safety committee (law enforcement)</td><td colspan="2">Snake River Fire Chiefs Association</td></tr>
<tr><td colspan="2">Potential Funding Sources:</td><td>Estimated cost:</td><td>Timeline:</td></tr>
<tr><td colspan="2"></td><td></td><td>Ongoing</td></tr>
<tr><td>Form Submitted by:</td><td colspan="3">2008 NHMP Steering Committee; revised and confirmed in 2013, revised and confirmed in 2019</td></tr>
<tr><td>Action Item Status:</td><td colspan="3">Ongoing</td></tr>
</table>

Table A-4 Multi-Hazard Mitigation Action #4

<table>
<tr><th colspan="3">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="3">MH #4 – Update the mission of the Malheur County Emergency Management Team (EMT) to include the maintenance and review of the Natural Hazard Mitigation Plan.</td><td>Goal 3</td><td>☒ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><td colspan="6">Affected Jurisdictions:</td></tr>
<tr><td>☒ Malheur County</td><td>☐ Nyssa</td><td>☐ Ontario</td><td colspan="3">☐ Vale</td></tr>
<tr><td colspan="6">Alignment with Existing Plans/Policies:</td></tr>
<tr><td colspan="6">Emergency Operations Plans, Comprehensive Plans, Natural Hazards Mitigation Plans, Community Wildfire Protection Plans</td></tr>
<tr><td colspan="6">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="6">• The Malheur County Emergency Management Preparedness Team (EMT), which also serves as the NHMP Steering Committee, and as the Local Emergency Planning Committee (LEPC) will oversee NHMP maintenance once the plan is adopted. The EMT will provide continuity to the process and an avenue for other stakeholders to provide input on the plan.
• The Disaster Mitigation Act of 2000 requires Mitigation Plans to include provisions for describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle [201.6(c)(4)(i)]. Updating the mission of the Malheur County Emergency Management Team will ensure that procedures are in place for maintaining and reviewing the plan and action items.
• All the multi-hazard (MH) actions are high risk-level and hence high priority.</td></tr>
<tr><td colspan="6">Ideas for Implementation:</td></tr>
<tr><td colspan="6">• See Volume I, Section 4, Plan Implementation and Maintenance, for details on how plan maintenance will be managed.
• Gain official County Court recognition (via resolution or other means) of the EMPT as the body that will maintain and update the NHMP.</td></tr>
<tr><td>Coordinating Organization:</td><td colspan="5">Emergency Management Team</td></tr>
<tr><td colspan="2">Internal Partners:</td><td colspan="4">External Partners:</td></tr>
<tr><td colspan="2">County Court, Incorporated cities</td><td colspan="4">FEMA, Cities of Ontario, Nyssa, and Vale</td></tr>
<tr><td colspan="2">Potential Funding Sources:</td><td colspan="2">Estimated cost:</td><td colspan="2">Timeline:</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td colspan="2">Short Term</td></tr>
<tr><td>Form Submitted by:</td><td colspan="5">2008 NHMP Steering Committee; revised and confirmed in 2013, revised and confirmed in 2019</td></tr>
<tr><td>Action Item Status:</td><td colspan="5">Short Term</td></tr>
</table>

Table A-5 Multi-Hazard Mitigation Action #5

<table>
<tr><th colspan="4">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="4">MH #5 – Identify historic structures that represent a significant cultural resource for the community. Use information from the Oregon State Historic Preservation Office and the National Register of Historic Places.</td><td>Goals 1, 4, 5</td><td>☒ Malheur
☒ Ontario</td><td>☒ Nyssa
☒ Vale</td></tr>
<tr><td colspan="7">Affected Jurisdictions:</td></tr>
<tr><td>☒ Malheur County</td><td colspan="2">☒ Nyssa</td><td colspan="2">☒ Ontario</td><td colspan="2">☒ Vale</td></tr>
<tr><td colspan="7">Alignment with Existing Plans/Policies:</td></tr>
<tr><td colspan="7">Comprehensive Plans, Development Codes, and Economic Development Plans for the Counties and the Cities.</td></tr>
<tr><td colspan="7">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="7">

The County has several historic structures that are culturally significant and potentially vulnerable to hazards, especially unreinforced masonry buildings. A list may be found in Section 2, Community Sensitivity and Resilience. These could be prioritized for retrofits and renovations.
Because several of the cities in Malheur County are located along the historic Oregon Trail, tourism is a component of Malheur County's economy. Identifying mitigating actions to help preserve these historic and cultural resources from damaging hazard events will preserve the cultural heritage of the county and maintain heritage tourism as a component in the County's economy.
The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(ii)]. Inventorying important historic and cultural resources and identifying their vulnerability to natural hazards will help to develop mitigation actions that reduce their overall vulnerability to natural hazards.
All the multi-hazard (MH) actions are high risk-level and hence high priority.

</td></tr>
<tr><td colspan="7">Ideas for Implementation:</td></tr>
<tr><td colspan="7">

Identify significant cultural and historic resources, whether on the national register or not, that are worthy of additional protection
Determine vulnerabilities of these resources to natural hazards
Identify appropriate mitigation measures to help preserve historic and cultural resources.

</td></tr>
<tr><td colspan="2">Coordinating Organization:</td><td colspan="5">Malheur County Planning Department</td></tr>
<tr><td colspan="3">Internal Partners:</td><td colspan="4">External Partners:</td></tr>
<tr><td colspan="3">Emergency Management, GIS</td><td colspan="4">Oregon State Historic Preservation Office</td></tr>
<tr><td colspan="3">Potential Funding Sources:</td><td colspan="2">Estimated cost:</td><td colspan="2">Timeline:</td></tr>
<tr><td colspan="3"></td><td colspan="2"></td><td colspan="2">Long Term</td></tr>
<tr><td>Form Submitted by:</td><td colspan="6">2008 NHMP Steering Committee; revised and confirmed in 2013, revised and confirmed in 2019</td></tr>
<tr><td>Action Item Status:</td><td colspan="6">Long Term</td></tr>
</table>

Table A-6 Multi-Hazard Mitigation Action #6

<table>
<tr><th colspan="3">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="3">MH #6 – Incorporate the Natural Hazards Mitigation Plan into the Comprehensive Plan (in particular Goal 7).</td><td>Goals 1, 4, 5</td><td>☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><th colspan="6">Affected Jurisdictions:</th></tr>
<tr><td>☒ Malheur County</td><td>☒ Nyssa</td><td colspan="2">☒ Ontario</td><td colspan="2">☒ Vale</td></tr>
<tr><th colspan="6">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="6">Comprehensive Plans and Development Codes for the County and the Cities.</td></tr>
<tr><th colspan="6">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="6">• The vision, goals, and policies of the comprehensive plan are routinely implemented through other local planning instruments such as zoning ordinances, subdivision regulations, and capital improvement programs. Integrating hazard mitigation into the local comprehensive plan thereby establishes resilience as an overarching value of a community and provides the opportunity to continuously manage development in a way that does not lead to increased hazard vulnerability.
Source: FEMA
• The Natural Hazards Mitigation Plan’s mitigation actions have no regulatory or statutory requirements for compliance. Requiring the incorporation would give the plan ‘teeth.’
• The Disaster Mitigation Act of 2000 requires that mitigation plans provide a comprehensive range of actions and projects to mitigate against natural hazards [201.6(c)(3)(ii)], such as actions that protect natural resources. Encouraging the implementation of existing action items with the Comprehensive Plan will help to ensure that the actions are implemented.
• All the multi-hazard (MH) actions are high risk-level and hence high priority.</td></tr>
<tr><th colspan="6">Ideas for Implementation:</th></tr>
<tr><td colspan="6">• The Natural Hazards Mitigation Plan will be adopted as an amendment to the Comprehensive Plan Goal 7 elements for the County and the Cities.</td></tr>
<tr><th colspan="2">Coordinating Organization:</th><td colspan="4">County and City Planning Departments</td></tr>
<tr><th colspan="2">Internal Partners:</th><th colspan="4">External Partners:</th></tr>
<tr><td colspan="2"></td><td colspan="4">Department of Land Conservation and Development, Oregon Office of Emergency Management, Federal Emergency Management Agency</td></tr>
<tr><th colspan="2">Potential Funding Sources:</th><th colspan="2">Estimated cost:</th><th colspan="2">Timeline:</th></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td colspan="2">Long Term</td></tr>
<tr><th>Form Submitted by:</th><td colspan="5">2013 County NHMP Steering Committees, revised and confirmed in 2019</td></tr>
<tr><th>Action Item Status:</th><td colspan="5">Long Term</td></tr>
</table>

Table A-7 Multi-Hazard Mitigation Action #7

Proposed Action Item:		Alignment with Plan Goals:	High Priority Action Item?
MH #7 – Continue to work on the Malheur County Continuity of Operations Plan (COOP)		Goals 1, 2, 3, 4	☒ Malheur ☒ Nyssa ☒ Ontario ☒ Vale
Affected Jurisdictions:			
☒ Malheur County	☒ Nyssa	☒ Ontario	☒ Vale
Alignment with Existing Plans/Policies:			
Emergency Operations Plans, Economic Development Plans, Comprehensive Plans, and Development Codes for the County and the Cities.			
Rationale for Proposed Action Item:			
• The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(ii)]. Preparing and keeping the COOP updated will strengthen the resilience of Malheur County and the Cities. • All the multi-hazard (MH) actions are high risk-level and hence high priority.			
Ideas for Implementation:			
• Use email, newspaper, and social media announcements that this COOP is necessary, is a priority to Malheur County, and needs input and cooperation from internal and external partners. • Coordinate with OEM and FEMA to identify funding sources.			
Coordinating Organization:	Malheur County Emergency Services Manager		
Internal Partners:		**External Partners:**	
All Malheur County departments		Emergency Management Team, OEM, FEMA	
Potential Funding Sources:		**Estimated cost:**	**Timeline:**
			Short Term
Form Submitted by:	Established by the 2019 NHMP Steering Committee		
Action Item Status:	New		

Table A-8 Drought Hazard Mitigation Action #1

<table>
<tr><th colspan="4">Proposed Action Item:</th><th colspan="2">Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="4">DR #1 – Cooperate and help the Malheur County Soil and Water Conservation District (SWCD) in its countywide water assessment project.</td><td colspan="2">Goals 1, 3, 5</td><td>☒ Malheur
☒ Ontario</td><td>☒ Nyssa
☒ Vale</td></tr>
<tr><th colspan="8">Affected Jurisdictions:</th></tr>
<tr><td colspan="2">☒ Malheur County</td><td colspan="2">☒ Nyssa</td><td colspan="2">☒ Ontario</td><td colspan="2">☒ Vale</td></tr>
<tr><th colspan="8">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="8">Emergency Operations Plans, Economic Development Plans, Natural Hazards Mitigation Plans, Comprehensive Plans, and Development Codes for the County and the Cities.</td></tr>
<tr><th colspan="8">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="8">• The Malheur County SWCD is currently working to secure funding for a countywide irrigation water system assessment; this project will help county irrigation districts increase efficiency, reduce vulnerability to drought, and prioritize improvements/repairs.
• The Disaster Mitigation Act of 2000 requires communities to develop comprehensive actions to reduce the impacts of natural hazards on their community [201.6(c)(3)(ii)]. Supporting the Malheur County SWCD in their countywide water assessment project will help to increase efficiency for county irrigation districts and reduce vulnerability to drought.
• All the drought-hazard (DR) actions are high risk-level and hence high priority.</td></tr>
<tr><th colspan="8">Ideas for Implementation:</th></tr>
<tr><td colspan="8">• - Work with Malheur County Soil and Water Conservation District.
• - Supply drought hazard information as needed.
• - Seek potential FEMA funding sources for water assessment project.</td></tr>
<tr><th colspan="2">Coordinating Organization:</th><td colspan="6">Emergency Management Team</td></tr>
<tr><th colspan="3">Internal Partners:</th><th colspan="5">External Partners:</th></tr>
<tr><td colspan="3">Irrigation Districts, Malheur County SWCD, Malheur Watershed Council, Owyhee Watershed Council</td><td colspan="5">FEMA, USDA-Farm Services Division</td></tr>
<tr><th colspan="3">Potential Funding Sources:</th><th colspan="3">Estimated cost:</th><th colspan="2">Timeline:</th></tr>
<tr><td colspan="3"></td><td colspan="3"></td><td colspan="2">Ongoing</td></tr>
<tr><th>Form Submitted by:</th><td colspan="7">2008 NHMP Steering Committee; revised and confirmed in 2013, revised and confirmed in 2019</td></tr>
<tr><th>Action Item Status:</th><td colspan="7">Ongoing</td></tr>
</table>

Table A-9 Drought Hazard Mitigation Action #2

<table>
<tr><th colspan="4">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="4">DR #2 – Support the Malheur, Owyhee and Vale Irrigation Districts' ongoing efforts to convert dirt irrigation canals into pipes.</td><td>Goals 1, 3, 5</td><td>☒ Malheur
☒ Ontario</td><td>☒ Nyssa
☒ Vale</td></tr>
<tr><th colspan="7">Affected Jurisdictions:</th></tr>
<tr><td colspan="2">☒ Malheur County</td><td colspan="2">☒ Nyssa</td><td>☒ Ontario</td><td colspan="2">☒ Vale</td></tr>
<tr><th colspan="7">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="7">Emergency Operations Plans, Economic Development Plans, Natural Hazards Mitigation Plans, Water Quality Plans, and NRCS Natural Resources Long Range Strategy in Malheur County, OR.</td></tr>
<tr><th colspan="7">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="7">

Both the Malheur and Owhyee Watershed Councils, which together oversee the two major watersheds in the County, are working on projects to convert aging, inefficient dirt irrigation canals into pipes.
Dirt canals typically have a 20-30% inefficiency rate of delivery due to evaporation, seepage, and damages from gophers and debris. Converting these canals into closed pipes removes the inefficiency and thus increases the amount of water available to farmers in the event of a water shortage or drought.
The Disaster Mitigation Act of 2000 requires communities to develop comprehensive actions to reduce the impacts of natural hazards on their community [201.6(c)(3)(ii)]. Project will help to increase efficiency for county irrigation districts and reduce vulnerability to drought. This project may also have water quality benefits for the region by reducing agricultural runoff.
All the drought-hazard (DR) actions are high risk-level and hence high priority.

</td></tr>
<tr><th colspan="7">Ideas for Implementation:</th></tr>
<tr><td colspan="7">

Work with irrigation districts to identify and prioritize key canals for piping.
Work with Malheur Watershed Council and Owyhee Watershed Council to determine organizational priorities for piping.

</td></tr>
<tr><th colspan="2">Coordinating Organization:</th><td colspan="5">Emergency Management Team</td></tr>
<tr><th colspan="3">Internal Partners:</th><th colspan="4">External Partners:</th></tr>
<tr><td colspan="3">Irrigation Districts, Soil and Water Conservation District, Malheur Watershed Council, Owyhee Watershed Council</td><td colspan="4">OEM, Oregon Department of Agriculture, FEMA</td></tr>
<tr><th colspan="3">Potential Funding Sources:</th><th colspan="2">Estimated cost:</th><th colspan="2">Timeline:</th></tr>
<tr><td colspan="3"></td><td colspan="2"></td><td colspan="2">Ongoing</td></tr>
<tr><th>Form Submitted by:</th><td colspan="6">2008 NHMP Steering Committee; revised and confirmed in 2013, revised and confirmed in 2019</td></tr>
<tr><th>Action Item Status:</th><td colspan="6">Ongoing</td></tr>
</table>

Table A-10 Earthquake Hazard Mitigation Action #1

<table>
<tr><th colspan="4">Proposed Action Item:</th><th colspan="2">Alignment with Plan Goals:</th><th colspan="3">High Priority Action Item?</th></tr>
<tr><td colspan="4">EQ # 1 – Review Critical Infrastructure List prepared for the 2019 NHMP. Evaluate the list and determine the priority buildings for seismic retrofits or replacements. Include the Critical Infrastructure List in the strategic plans for the County and the Cities.</td><td colspan="2">Goals 1 and 4</td><td colspan="2">☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><th colspan="9">Affected Jurisdictions:</th></tr>
<tr><td colspan="2">☒ Malheur County</td><td colspan="2">☒ Nyssa</td><td colspan="2">☒ Ontario</td><td colspan="3">☒ Vale</td></tr>
<tr><th colspan="9">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="9">Emergency Operations Plans, Comprehensive Plans, Strategic Plans, and Natural Hazards Mitigation Plans.</td></tr>
<tr><th colspan="9">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="9">• Oregon Senate Bill 2 (2005) directed DOGAMI to develop a statewide seismic needs assessment that includes a FEMA 154 Rapid Visual Screening survey of specific critical facilities, including schools.
• The Steering Committee identified critical infrastructure for Malheur County and the Cities of Ontario, Nyssa, and Vale.
• Retrofitting of vital infrastructure provides important improvements that reduce hazard exposure and the cost and time associated with recovery (Source: American Planning Advisory Service Report Number 483/484).
• The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community, particularly to buildings and infrastructure [201.6(c)(3)(ii)]. Implementing structural and non-structural retrofitting programs will reduce the seismic vulnerability of public buildings, historically important structures, and critical facilities and infrastructure, and assist a community in reducing its overall earthquake risk
• All the earthquake-hazard (EQ) actions are low risk-level and hence low priority.</td></tr>
<tr><th colspan="9">Ideas for Implementation:</th></tr>
<tr><td colspan="9">• Inventory existing facilities to determine future demands for maintenance, repair, rehabilitation or replacement; and to determine adequacy of existing facilities to meet future needs.
• Identify historic structures that represent a significant cultural resource for the community, focusing especially on un-reinforced masonry buildings.
• Evaluate and prioritize structures for retrofits or replacement.
• Coordinate with OEM, Business Oregon and FEMA to determine funding for conducting seismic retrofit of buildings</td></tr>
<tr><th colspan="2">Coordinating Organization:</th><td colspan="7">Emergency Management Team</td></tr>
<tr><th colspan="3">Internal Partners:</th><th colspan="6">External Partners:</th></tr>
<tr><td colspan="3">County/ City Building and Public Works Departments, Cities,</td><td colspan="6">DOGAMI, OEM, Business Oregon, SHPO</td></tr>
<tr><th colspan="3">Potential Funding Sources:</th><th colspan="3">Estimated cost:</th><th colspan="3">Timeline:</th></tr>
<tr><td colspan="3"></td><td colspan="3"></td><td colspan="3">Long Term</td></tr>
<tr><th colspan="2">Form Submitted by:</th><td colspan="7">Established by the 2019 NHMP Steering Committee</td></tr>
<tr><th colspan="2">Action Item Status:</th><td colspan="7">New</td></tr>
</table>

Table A-11 Flood Hazard Mitigation Action #1

<table>
<tr><th colspan="3">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="3">FL #1 – Update County and City floodplain ordinances.</td><td>Goals 1, 4, 5</td><td>☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><th colspan="6">Affected Jurisdictions:</th></tr>
<tr><td>☒ Malheur County</td><td>☒ Nyssa</td><td colspan="2">☒ Ontario</td><td colspan="2">☒ Vale</td></tr>
<tr><th colspan="6">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="6">County and Cities floodplain ordinances, and Natural Hazards Mitigation Plans.</td></tr>
<tr><th colspan="6">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="6">
• A stronger floodplain ordinance would help the County and Cities manage floodplain areas to reduce flood risks.
• The current County floodplain ordinance is outdated and insufficient for flood protection for new construction. The same goes for Vale, Nyssa, Adrian, and Jordan Valley. The City of Ontario has completed a revised floodplain ordinance as of summer 2007.
• The Disaster Mitigation Act of 2000 requires that communities identify actions and projects that reduce the impact of a natural hazard on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Updating County and city floodplain ordinances will provide more accurate floodplain information that will reduce the impact of flooding on new buildings.
• Flood is a high-medium risk level and hence a high-medium priority for this mitigation action.
</td></tr>
<tr><th colspan="6">Ideas for Implementation:</th></tr>
<tr><td colspan="6">
• Ontario’s floodplain ordinance regulations and standards could serve as a model for the other Cities and the County. The County and/or Ontario could provide technical assistance to the smaller cities.
• Use other county floodplain ordinances to serve as a model ordinance for Malheur County.
• Contact the State of Oregon NFIP Coordinator, Celinda Adair, for assistance and model ordinances.
• The County will need to determine the extent of the update; whether funding and community support allows for updated text only or updated text and maps.
• Reference “Oregon Model Flood Damage Prevention Ordinance.”
</td></tr>
<tr><th colspan="2">Coordinating Organization:</th><td colspan="4">Malheur County Planning Department and Cities Planning Departments</td></tr>
<tr><th colspan="2">Internal Partners:</th><th colspan="4">External Partners:</th></tr>
<tr><td colspan="2">Ontario, Nyssa, Vale, Adrian, Jordan Valley</td><td colspan="4">DLCD, FEMA</td></tr>
<tr><th colspan="2">Potential Funding Sources:</th><th colspan="2">Estimated cost:</th><th colspan="2">Timeline:</th></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td colspan="2">Short Term</td></tr>
<tr><th>Form Submitted by:</th><td colspan="5">2008 NHMP Steering Committee; revised and confirmed in 2013, revised and confirmed in 2019</td></tr>
<tr><th>Action Item Status:</th><td colspan="5">Short Term</td></tr>
</table>

Table A-12 Flood Hazard Mitigation Action #2

<table>
<tr><th colspan="4">Proposed Action Item:</th><th colspan="2">Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="4">FL #2 – Explore the potential for Malheur County to participate in the Community Rating System (CRS) of the National Flood Insurance Program (NFIP)</td><td colspan="2">Goals 1, 2, 3, 4, 5</td><td>☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><th colspan="8">Affected Jurisdictions:</th></tr>
<tr><td colspan="2">☒ Malheur County</td><td colspan="2">☒ Nyssa</td><td>☒ Ontario</td><td colspan="3">☒ Vale</td></tr>
<tr><th colspan="8">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="8">County and Cities floodplain ordinances, Comprehensive Plans, and Development Codes.</td></tr>
<tr><th colspan="8">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="8">County and City homeowner participation in NFIP is currently spotty. There are no designated repetitive-loss properties in the County, but most floodplain areas have had some NFIP claims within the past 20 years.
The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, insurance premiums under the NFIP are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance.
The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address existing buildings and infrastructure [201.6(c)(3)(ii)]. Inclusion into the Community Rating System program can help communities to enhance mitigation efforts and decrease the vulnerability to floods.
Flood is a high-medium risk level and hence a high-medium priority for this mitigation action.</td></tr>
<tr><th colspan="8">Ideas for Implementation:</th></tr>
<tr><td colspan="8">Review the CRS eligibility requirements
Work with city and county to determine the best means of outreach to floodplain residents (mailing? Public meeting? Other methods?)
Coordinate with the Department of Land Conservation and Development (DLCD) and FEMA to understand and potentially join the Community Rating System.
Educate businesses and homeowners currently under the NFIP program about the CRS program and any mitigation actions they can implement to reduce their insurance premiums.</td></tr>
<tr><th colspan="2">Coordinating Organization:</th><td colspan="6">Malheur County Planning Department</td></tr>
<tr><th colspan="3">Internal Partners:</th><th colspan="5">External Partners:</th></tr>
<tr><td colspan="3">Incorporated Cities, Chambers of Commerce</td><td colspan="5">DLCD, FEMA</td></tr>
<tr><th colspan="3">Potential Funding Sources:</th><th colspan="2">Estimated cost:</th><th colspan="3">Timeline:</th></tr>
<tr><td colspan="3"></td><td colspan="2"></td><td colspan="3">Long Term</td></tr>
<tr><th>Form Submitted by:</th><td colspan="7">2008 NHMP Steering Committee; revised and confirmed in 2013, revised and confirmed in 2019</td></tr>
<tr><th>Action Item Status:</th><td colspan="7">Long Term</td></tr>
</table>

Table A-13 Flood Hazard Mitigation Action #3

Proposed Action Item:	Alignment with Plan Goals:	High Priority Action Item?	
FL #3 – Implement stormwater improvement measures as identified in the 2003 City of Ontario Stormwater Master Plan	Goals 1 and 3	☐ Malheur ☐ Ontario	☐ Nyssa ☐ Vale

Affected Jurisdictions:

☐ Malheur County	☐ Nyssa	☒ Ontario	☐ Vale

Alignment with Existing Plans/Policies:

City of Ontario Stormwater Master Plan, Natural Hazards Mitigation Plans, and the NRCS Natural Resources Long Range Strategy in Malheur County, OR.

Rationale for Proposed Action Item:

- Ontario's Stormwater Master Plan (SMP), adopted in 2003, identifies infrastructure improvements that would mitigate flood risks for the City in addition to improving the overall stormwater system. Recommendations include:
    - Establish an annual pipeline replacement program and eventually replace all pipelines with at least 12-inch diameter pipelines (better outflow, reduced risk of surcharges).
    - Review and update interagency agreements between the City and irrigation districts to outline each entity's responsibilities in regards to water quality, stormwater runoff, and maintenance of jointly used facilities (improve efficiency).
    - Kmart Drainage Basin – pipe upsizings and a cleanout. (Reduce surcharges during storm events.)
    - Heinz Frozen Foods Basin – correct an adverse pipeline grade. (Reduce surcharge during storm events).
    - Park Boulevard Drainage Basin – combine this basin with the Double Trunk Line and Downtown Ontario Drainage Basin; upsize, connect, redirect, and limit inflow of several lines; add desiltation basins. (All of these measures would be to reduce surcharges during storm events).
    - SW 4th Ave Drainage Basin – construct a desiltation basin for agricultural runoff
    - Construct retention basins for several drainage areas (e.g. reduced flood risk, water filtration).
    - Preserve land identified for future water quality treatment needs.
- Flood is a high-medium risk level and hence a high-medium priority for this mitigation action.

Ideas for Implementation:

- Coordinate efforts with the Ontario Public Works Department to implement storm water improvement measures.
- Work with FEMA to identify funding sources.

Coordinating Organization:	City of Ontario Public Works

Internal Partners:	External Partners:
City of Ontario, Ontario Planning Department	FEMA, DLCD

Potential Funding Sources:	Estimated cost:	Timeline:
		Long Term

Form Submitted by:	2008 NHMP Steering Committee; revised and confirmed in 2013, revised and confirmed in 2019
Action Item Status:	Long Term

Table A-14 Flood Hazard Mitigation Action #4

<table>
<tr><th colspan="3">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="3">FL #4 – Update the FEMA Flood Insurance Rate Maps (FIRMs) for the County and Cities</td><td>Goals 2 and 3</td><td>☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><th colspan="6">Affected Jurisdictions:</th></tr>
<tr><td>☒ Malheur County</td><td>☒ Nyssa</td><td colspan="2">☒ Ontario</td><td colspan="2">☒ Vale</td></tr>
<tr><th colspan="6">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="6">Malheur County, Adrian, Jordan Valley, Ontario and Vale Flood Insurance Studies, County and Cities Development Codes, and Natural Hazards Mitigation Plans.</td></tr>
<tr><th colspan="6">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="6">
• Given the frequent occurrence of floods in the County and this hazard's high priority ranking, digital maps would greatly help the County plan flood mitigation actions. When and if County FIRM maps become available in digital form, local GIS and planning staff will be able to determine how much infrastructure is located in floodplain areas and determine how best to reduce those areas' flood risks on a localized level.
• The current floodplain maps for the County and Cities are only available in hard copy paper format and were last updated in 1986. The County and Cities have experienced enough development that these maps may not have accurate Base Flood Elevations and other measurements, thus exacerbating the flood risk.
• In 2008, FEMA was scheduled to begin upgrading flood hazard data in Eastern Oregon. However, funds are not expected to continue. Communities that are able to demonstrate significant need, and/or are able to provide accurate topological data, road maps, base elevation measurements, and a description of populations at-risk will be more competitive in acquiring a portion of the remaining funds.
• LiDAR has been shot in the watershed/ irrigation district north of Ontario (circa 2012).
• The Disaster Mitigation Act of 2000 requires that communities identify actions and projects that reduce the impact of a natural hazard on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Obtaining GPS floodplain maps will enable communities in Malheur County to improve assessments of flood risks and implement appropriate flood mitigation activities to reduce the vulnerability of floods in the county.
• Flood is a high-medium risk level and hence a high-medium priority for this mitigation action.
</td></tr>
<tr><th colspan="6">Ideas for Implementation:</th></tr>
<tr><td colspan="6">
• Coordinate with FEMA to acquire digital GIS floodplain maps for the County and Cities. Overlay digital FIRM maps against current property maps. Count and document the number of structures lying within the floodplain.
• Work with Malheur County GIS staff to determine what local topological and base elevation data may already be available to aid in the digitization process.
• Count the types and numbers of existing buildings, infrastructure, and critical facilities located in the floodplain.
</td></tr>
<tr><th colspan="2">Coordinating Organization:</th><td colspan="4">Malheur County Planning Department</td></tr>
<tr><th colspan="3">Internal Partners:</th><th colspan="3">External Partners:</th></tr>
<tr><td colspan="3">Incorporated cities, Malheur County GIS staff</td><td colspan="3">FEMA, DLCD, DOGAMI, Silver Jackets</td></tr>
</table>

Potential Funding Sources:		Estimated cost:	Timeline:
			Long Term
Form Submitted by:	2008 NHMP Steering Committee; revised and confirmed in 2013, revised and confirmed in 2019		
Action Item Status:	Long Term		

Table A-15 Flood Hazard Mitigation Action #5

<table>
<tr><th colspan="3">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="3">FL #5 – Develop a maintenance plan and restore the Bully Creek Levee System. Include vegetation and debris removal as part of the maintenance efforts. Prioritize actions that are identified in the inspection report when it is available from USACE (inspection done in June 2018).</td><td>Goal 1 and 4</td><td>☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☒ Vale</td></tr>
<tr><td colspan="6">Affected Jurisdictions:</td></tr>
<tr><td>☒ Malheur County</td><td>☐ Nyssa</td><td>☐ Ontario</td><td colspan="3">☒ Vale</td></tr>
<tr><td colspan="6">Alignment with Existing Plans/Policies:</td></tr>
<tr><td colspan="6">National Levee Safety Program Act of 2007, Periodic Inspection Report for the Vale Levee System, and Natural Hazards Mitigation Plans.</td></tr>
<tr><td colspan="6">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="6">• The Vale levee systems P, Q, R and sewage lagoons are operated and maintained by the City of Vale, They received an overall system ratings of “minimally acceptable” following the U.S. Army Corps of Engineers periodic inspection report finalized on April 28, 2010 and again in 2011. The rating in 2018 was also “minimally acceptable.”
• The U.S. Army Corps of Engineers will continue to rate the Vale levee systems Q and R as “minimally acceptable,” provided the City of Vale submits a maintenance plan to the Corps detailing how they will restore systems Q and R to an acceptable condition. The Corps will continue to rate systems Q and R as “minimally acceptable” provided satisfactory progress is made according to the City Council’s plan.
• The levee systems’ “minimally acceptable” rating means they remain eligible to apply for federal rehabilitation assistance if it is damaged in a flood or storm event. Corps of Engineers project ratings do not determine final eligibility under the National Flood Insurance Program, a FEMA-managed program. Certification documentation is the responsibility of the levee sponsor.
• System P is located in the City of Vale, Malheur County, Ore. The project was completed in 1961, and consists of approximately 8,244 feet of left bank levee embankment along Bully Creek and the Malheur River. The downtown area, numerous homes, the Vale Elementary and Middle School, the Vale Rodeo Grounds, and several farms are protected by the levee system.
• System Q is located near the City of Vale. The project was completed in 1961 and consists of approximately 2,088 feet of right bank levee embankment along the Malheur River. Several residential buildings and a small piece of farm ground are protected by the levee system.
• System R is located adjacent to the City of Vale. The project was completed in 1961, and consists of approximately 3,270 feet of right bank levee embankment along the Malheur River. Several residential and industrial buildings are protected by the levee system
• The City of Vale sewage lagoons are situated on the left bank of the Malheur River in Malheur County, Ore. The Vale Sewage Lagoon Flood Reduction System was excavated as part of a U.S. Army Corps of Engineers’ Vale Unit channel and levee construction project in 1960 and 1961. The Vale Sewage Lagoon Flood Reduction Project is considered a single system which protects the sewage lagoons from flooding on Willow Creek and the Malheur River.
• Flood is a high-medium risk level and hence a high-medium priority for this mitigation action.</td></tr>
<tr><td colspan="6">Ideas for Implementation:</td></tr>
</table>

<table>
<tr><td colspan="5">

- Work with Malheur County Emergency Services Manager, USACE, and Silver Jackets to develop and implement a maintenance plan to the ACOE and a repair plan detailing how the city will restore the levee to an acceptable condition.

</td></tr>
<tr><td colspan="2">Coordinating Organization:</td><td colspan="3">Malheur County Emergency Services Manager and Vale Department of Public Works</td></tr>
<tr><td colspan="3">Internal Partners:</td><td colspan="2">External Partners:</td></tr>
<tr><td colspan="3">City of Vale, Malheur County</td><td colspan="2">FEMA, ACOE, Silver Jackets</td></tr>
<tr><td colspan="3">Potential Funding Sources:</td><td>Estimated cost:</td><td>Timeline:</td></tr>
<tr><td colspan="3"></td><td></td><td>Long Term</td></tr>
<tr><td>Form Submitted by:</td><td colspan="4">2013 NHMP Steering Committee, revised and confirmed in 2019</td></tr>
<tr><td>Action Item Status:</td><td colspan="4">Long Term</td></tr>
</table>

Table A-16 Flood Hazard Mitigation Action #6

<table>
<tr><th colspan="3">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="3">FL #6 – Explore funding opportunities with Business Oregon for the maintenance, repairs, and other work related to the Bully Creek Levee System.</td><td>Goals 1, 3, 4</td><td>☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><td colspan="6">Affected Jurisdictions:</td></tr>
<tr><td>☒ Malheur County</td><td>☐ Nyssa</td><td colspan="2">☐ Ontario</td><td colspan="2">☒ Vale</td></tr>
<tr><td colspan="6">Alignment with Existing Plans/Policies:</td></tr>
<tr><td colspan="6">Emergency Operations Plans, Natural Hazards Mitigation Plans, Comprehensive Economic Development Strategy 2014-2019, and NRCS Natural Resources Long Range Strategy in Malheur County, OR.</td></tr>
<tr><td colspan="6">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="6">• Bully Creek Levee system has suffered many years with lack of maintenance and repairs. As noted in FL-#5, the USACE reviews the condition of the levee and generally finds it minimally acceptable.
• The 2019 NHMP Steering Committee raised concerns about the condition of the levee and expressed a desire to repair it, maintain it, and keep it in better condition.
• Flood is a high-medium risk level and hence a high-medium priority for this mitigation action.</td></tr>
<tr><td colspan="6">Ideas for Implementation:</td></tr>
<tr><td colspan="6">• Have Malheur County Emergency Services Manager and the Vale Department of Public Works staff meet with Business Oregon, Regional Solutions, USACE, Silver Jackets, OEM, and DLCD staff.
• Discuss potential projects and funding sources.</td></tr>
<tr><td colspan="2">Coordinating Organization:</td><td colspan="4">Malheur County Emergency Services Manager and Vale Department of Public Works</td></tr>
<tr><td colspan="3">Internal Partners:</td><td colspan="3">External Partners:</td></tr>
<tr><td colspan="3">City of Vale</td><td colspan="3">Business Oregon, Regional Solutions office, FEMA, USACE, Silver Jackets, OEM, DLCD</td></tr>
<tr><td colspan="3">Potential Funding Sources:</td><td colspan="2">Estimated cost:</td><td>Timeline:</td></tr>
<tr><td colspan="3"></td><td colspan="2"></td><td>Short Term</td></tr>
<tr><td>Form Submitted by:</td><td colspan="5">Established by the 2019 NHMP Steering Committee</td></tr>
<tr><td>Action Item Status:</td><td colspan="5">New</td></tr>
</table>

Table A-17 Flood Hazard Mitigation Action #7

<table>
<tr><th colspan="3">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="3">FL #7 – Evaluate status of the water treatment plan (1900 SE 5th Ave) and the wastewater treatment plan (2405 Malheur Drive) in Ontario in regards to preparing for and mitigating flood issues. Portions of these sites are in the floodplain.</td><td>Goal 1,3, 4</td><td>☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><th colspan="6">Affected Jurisdictions:</th></tr>
<tr><td>☒ Malheur County</td><td>☐ Nyssa</td><td colspan="2">☒ Ontario</td><td colspan="2">☒ Vale NO</td></tr>
<tr><th colspan="6">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="6">City of Ontario Stormwater Master Plan, Natural Hazards Mitigation Plans, Emergency Operations Plans, and Development Codes.</td></tr>
<tr><th colspan="6">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="6">• Both the water treatment plant and the wastewater treatment plan are partially located in the floodplain.
• These are critical facilities. The resilience of these structures needs to be addressed. See also the Critical Infrastructure List established by the NHMP Steering Committee. The list identifies the natural hazards that could impact the critical infrastructure of the County and the Cities.
• Flood is a high-medium risk level and hence a high-medium priority for this mitigation action.</td></tr>
<tr><th colspan="6">Ideas for Implementation:</th></tr>
<tr><td colspan="6">• Have staff from the Malheur County Emergency Services Manager and the City of Ontario Public Works and Planning Departments meet to discuss this. Use existing floodplain maps and potential floodplain maps (discuss with FEMA staff and DLCD RiskMAP Coordinator).</td></tr>
<tr><th>Coordinating Organization:</th><td colspan="5">Malheur County Emergency Services Manager and City of Ontario</td></tr>
<tr><th colspan="2">Internal Partners:</th><th colspan="4">External Partners:</th></tr>
<tr><td colspan="2">City of Ontario</td><td colspan="4">FEMA, USACE, Silver Jackets, OEM, DLCD</td></tr>
<tr><th colspan="2">Potential Funding Sources:</th><th colspan="2">Estimated cost:</th><th colspan="2">Timeline:</th></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td colspan="2">Long Term</td></tr>
<tr><th>Form Submitted by:</th><td colspan="5">Established by the 2019 NHMP Steering Committee</td></tr>
<tr><th>Action Item Status:</th><td colspan="5">New</td></tr>
</table>

Table A-18 Flood Hazard Mitigation Action #8

<table>
<tr><th colspan="2">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="2">FL #8– Ice jam and weather event flooding occur along the rivers due to flow levels. When water is released from storage facilities, it may cause or contribute to flood events. Malheur County cannot manage these releases of water. Notification, communication, and a memorandum of understanding between regulating agencies is needed.</td><td>Goals 1, 2, 3, 4, 5</td><td>☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><td colspan="5">Affected Jurisdictions:</td></tr>
<tr><td>☒ Malheur County</td><td>☒ Nyssa</td><td>☒ Ontario</td><td colspan="2">☒ Vale</td></tr>
<tr><td colspan="5">Alignment with Existing Plans/Policies:</td></tr>
<tr><td colspan="5">Natural Hazards Mitigation Plans, Emergency Operations Plans, mutual aid agreements, and Strategic Plans</td></tr>
<tr><td colspan="5">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="5">• Ice jams have been a problem in the past and potential steps have been discussed but never solidified into a formalized agreement between the applicable jurisdictions.
• Resources can be better shared, communication can be improved, and responsibilities clarified. More effective and better relationships, decision-making, and response times can be achieved.
• Flood is a high-medium risk level and hence a high-medium priority for this mitigation action.</td></tr>
<tr><td colspan="5">Ideas for Implementation:</td></tr>
<tr><td colspan="5">• Have Malheur County, Owyhee Irrigation District, City of Ontario, City of Nyssa, and City of Vale staff meet to discuss the concerns and identify the next steps.</td></tr>
<tr><td>Coordinating Organization:</td><td colspan="4">Malheur County Emergency Services Manager, Owyhee Irrigation District</td></tr>
<tr><td colspan="2">Internal Partners:</td><td colspan="3">External Partners:</td></tr>
<tr><td colspan="2">Cities of Ontario, Nyssa, and Vale</td><td colspan="3">USACE, Silver Jackets, Bureau of Reclamation, Oregon Department of State Lands</td></tr>
<tr><td colspan="2">Potential Funding Sources:</td><td>Estimated cost:</td><td colspan="2">Timeline:</td></tr>
<tr><td colspan="2"></td><td></td><td colspan="2">Long Term</td></tr>
<tr><td>Form Submitted by:</td><td colspan="4">Established by the 2019 NHMP Steering Committee</td></tr>
<tr><td>Action Item Status:</td><td colspan="4">New</td></tr>
</table>

Table A-19 Severe Weather/Winter Storms/Wind Storms Hazard Mitigation Action #1

Proposed Action Item:	Alignment with Plan Goals:	High Priority Action Item?	
SW #1 – Convert primary electrical overhead lines to mountaintop communication services with underground lines.	Goal 1	☐ Malheur ☐ Ontario	☐ Nyssa ☐ Vale

Affected Jurisdictions:			
☒ Malheur County	☐ Nyssa	☐ Ontario	☐ Vale

Alignment with Existing Plans/Policies:
Natural Hazards Mitigation Plans, Emergency Operations Plans, Development Codes, and Strategic Plans.

Rationale for Proposed Action Item:
• Overhead electrical lines are subject to high winds and winter storm damage. The risk is higher on the lines going to a mountaintop or peak. Most of the services at the top are communication sites. The communication sites are used by ODOT, State Police, county sheriff, emergency services, telephone utilities and cell phone companies. During a disaster the sites are especially vital for communication. During winter storm access to the line by the utility is difficult and this difficulty delays the time for restoration of power to the services. The utility company has experienced costs each year to repair and maintain the lines. Converting the lines to underground would remove the risk of damage from wind and winter storm. • The Disaster Mitigation Act of 2000 requires communities to develop comprehensive actions to reduce the impacts of natural hazards, with an emphasis on new and existing buildings and infrastructure.[201.6(c)(3)(ii)] Converting primary electrical overhead lines to mountaintop communication services with underground lines will reduce the impact of severe weather on power lines, and will continue power service to rural customers as well as ODOT, State Police, county sheriff, emergency services, telephone utilities, and cell phone companies. • Winter storms are a high risk level while wind storms and severe weather are is a high risk level.

Ideas for Implementation:
• The utility companies would be responsible to identify all the mountaintops and apply for grants to convert the lines to underground service. • Meet with Malheur County Emergency Services Manager to discuss concerns and next steps.

Coordinating Organization:	Oregon Rural Electric Cooperative Association and Harney Electric Cooperative

Internal Partners:	**External Partners:**
Malheur County	Companies which are served by the utility and the utility company such as Harney County Electric Cooperative

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
		Ongoing

Form Submitted by:	2008 NHMP Steering Committee; revised and confirmed in 2013, revised and confirmed in 2019
Action Item Status:	Ongoing

Table A-20 Severe Weather/Winter Storms/Wind Storms Hazard Mitigation Action #2

<table>
<tr><th colspan="4">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="4">SW #2 – Shorten spans and anchor poles on utility lines in high wind or heavy icing areas.</td><td>Goal 1</td><td>☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><td colspan="7">Affected Jurisdictions:</td></tr>
<tr><td>☒ Malheur County</td><td colspan="2">☐ Nyssa</td><td colspan="2">☐ Ontario</td><td colspan="2">☐ Vale</td></tr>
<tr><td colspan="7">Alignment with Existing Plans/Policies:</td></tr>
<tr><td colspan="7">Natural Hazards Mitigation Plans, Emergency Operations Plans, Development Codes, and Strategic Plans.</td></tr>
<tr><td colspan="7">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="7">• High windstorms or winter icing storms can cause damage to long spans between power poles and create power outages during storms. If poles are inserted between spans this reduces the risk of outages. Also by anchoring certain poles this can reduce the amount of line, which would go down in a storm. Both items reduce the cost of repair and replacement.
• Winter storms have a significant impact on the Electric Cooperatives, causing power outages when ice forms on the power lines. This is especially a problem with older power lines constructed in the 1950s that have a larger line span between poles. Placing intermediary poles between these spans cuts the span in half and reduces the likelihood of a power line breaking.
• The Disaster Mitigation Act of 2000 requires communities to develop comprehensive actions to reduce the impacts of natural hazards, with an emphasis on new and existing buildings and infrastructure.[201.6(c)(3)(ii)] Shortening the spans between long lines and anchoring poles will reduce the likelihood of lines breaking during wind and winter icing storms.
• Winter storms are a high risk level while wind storms and severe weather are is a high risk level.</td></tr>
<tr><td colspan="7">Ideas for Implementation:</td></tr>
<tr><td colspan="7">• The utility companies would be responsible to identify high wind and icing areas from previous outages and apply for grants to strengthen the areas by pole inserts and anchoring.</td></tr>
<tr><td colspan="2">Coordinating Organization:</td><td colspan="5">Oregon Rural Electric Cooperative Association, including the Harney Electric Cooperative</td></tr>
<tr><td colspan="3">Internal Partners:</td><td colspan="4">External Partners:</td></tr>
<tr><td colspan="3">Malheur County</td><td colspan="4">Century Link, Harney Electric Cooperative</td></tr>
<tr><td colspan="3">Potential Funding Sources:</td><td colspan="2">Estimated cost:</td><td colspan="2">Timeline:</td></tr>
<tr><td colspan="3"></td><td colspan="2"></td><td colspan="2">Ongoing</td></tr>
<tr><td>Form Submitted by:</td><td colspan="6">2008 NHMP Steering Committee; revised and confirmed in 2013, revised and confirmed in 2019</td></tr>
<tr><td>Action Item Status:</td><td colspan="6">Ongoing</td></tr>
</table>

Table A-21 Severe Weather/Winter Storms/Wind Storms Hazard Mitigation Action #3

<table>
<tr><th colspan="3">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="3">SW #3 – Obtain land along I-84 corridor to serve as emergency truck parking during winter storm events.</td><td>Goals 1, 3, 4</td><td>☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><td colspan="6">Affected Jurisdictions:</td></tr>
<tr><td>☒ Malheur County</td><td>☐ Nyssa</td><td colspan="2">☒ Ontario</td><td colspan="2">☐ Vale</td></tr>
<tr><td colspan="6">Alignment with Existing Plans/Policies:</td></tr>
<tr><td colspan="6">Transportation Systems Plans, Natural Hazards Mitigation Plans, Emergency Operations Plans, and ODOT requirements.</td></tr>
<tr><td colspan="6">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="6">• Winter storms often shut down Interstate-84 north of Ontario causing backups of commercial truck traffic. Trucks often park along the interstate or on county/ city roads.
• Providing a location for trucks to safely park off of the interstate will increase safety for other users of the road system and allow for snow removal equipment to safely clear roads.
• Identifying a location in or near the City of Ontario is preferred in order to take advantage of existing economic development opportunities.
• Winter storms are a high risk level while wind storms and severe weather are is a high risk level.</td></tr>
<tr><td colspan="6">Ideas for Implementation:</td></tr>
<tr><td colspan="6">• Work with the city, county and ODOT to locate a suitable area to develop a parking area.
• Once a location is identified work with land owner/s to acquire the property.</td></tr>
<tr><td>Coordinating Organization:</td><td colspan="5">City of Ontario Economic Development</td></tr>
<tr><td colspan="2">Internal Partners:</td><td colspan="4">External Partners:</td></tr>
<tr><td colspan="2">Chamber of commerce, local businesses, police, public works, Malheur County</td><td colspan="4">ODOT</td></tr>
<tr><td colspan="2">Potential Funding Sources:</td><td colspan="2">Estimated cost:</td><td colspan="2">Timeline:</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td colspan="2">Long Term</td></tr>
<tr><td>Form Submitted by:</td><td colspan="5">2013 NHMP Steering Committee, revised and confirmed in 2019</td></tr>
<tr><td>Action Item Status:</td><td colspan="5">Long Term</td></tr>
</table>

Table A-22 Severe Weather/Winter Storms/Wind Storms Hazard Mitigation Action #4

Proposed Action Item:	Alignment with Plan Goals:	High Priority Action Item?	
SW #4 – Severe weather events occur with debris or snow removal beyond the resources available to the County, the Cities, and the Special Districts affected. A list of available local resources, contacts, and a memorandum of understanding between contributing agencies and organizations is needed.	Goals 1, 2, 3, 4, 5	☐ Malheur ☐ Ontario	☐ Nyssa ☐ Vale

Affected Jurisdictions:			
☒ Malheur County	☐ Nyssa	☒ Ontario	☐ Vale

Alignment with Existing Plans/Policies:
Emergency Operations Plans, Natural Hazards Mitigation Plans, Strategic Plans, and budgets.
Rationale for Proposed Action Item:
• Winter storms often shut down Interstate-84 north of Ontario and other locations. • Providing resources for the prompt and thorough response to winter, wind, and severe weather events is important for the communities. Economic impacts can be dramatic. • The Owyhee Irrigation District has resources they can contribute. • Winter storms are a high risk level while wind storms and severe weather are is a high risk level.
Ideas for Implementation:
• Work with the city, county and others who are responsible for responding to natural hazards. • Prepare a list of resources and contacts. Identify responsibilities and collaborative areas. • Write a memorandum of agreement and have it signed by the involved parties.

Coordinating Organization:	Malheur County Emergency Manager and Owyhee Irrigation District

Internal Partners:	**External Partners:**
Malheur County, Cities of Ontario, Nyssa, and Vale, Ontario Rural Road Assessment District #3,	ODOT

Potential Funding Sources:	**Estimated cost:**	**Timeline:**
		Long Term

Form Submitted by:	Established by the 2019 NHMP Steering Committee
Action Item Status:	New

Table A-23 Wildfire Hazard Mitigation Action #1

<table>
<tr><th colspan="2">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="2">WF #1 – Coordinate wildfire mitigation action items through the Malheur County Community Wildfire Protection Plan.</td><td>Goal s 2 and 3</td><td>☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><th colspan="5">Affected Jurisdictions:</th></tr>
<tr><td>☒ Malheur County</td><td>☒ Nyssa</td><td>☒ Ontario</td><td colspan="2">☒ Vale</td></tr>
<tr><th colspan="5">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="5">Malheur County Community Wildfire Protection Plan, Natural Hazards Mitigation Plans, Development Codes, and Emergency Operations Plans.</td></tr>
<tr><th colspan="5">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="5">• Malheur County has an adopted CWPP which contains a number of action items that, when implemented, will mitigation against wildfires. The CWPP is meant to serve as the wildfire chapter for the Malheur County NHMP. Implementing actions identified in the CWPP can assist in reducing the impact of wildfire on Malheur County.
• Incorporating mitigation actions from the Malheur Community Wildfire Protection Plan will ensure that both the NHMP and the CWPP contain compatible actions, and that the NHMP provides a comprehensive range of actions as required by the Disaster Mitigation Act of 2000 [201.6(c)(3)(ii)].
• Goal 7 of Oregon's Land Use Planning Goals requires that local governments "adopt or amend, as necessary, based on the evaluation of risk, plan policies and implementing measures...[that avoid] development in hazard areas where the risk to people and property cannot be mitigated." Including mitigation measure in subdivision and partition ordinances can reduce the impact of wildfires on new development and help to prevent future wildfire losses.
• Wildfire is a high-medium risk level and hence is a high-medium priority for this mitigation action.</td></tr>
<tr><th colspan="5">Ideas for Implementation:</th></tr>
<tr><td colspan="5">• Coordinate with responsible agencies listed in the Malheur County CWPP to implement action items.
• Seek funding to help pay for wildfire mitigation projects within the County.</td></tr>
<tr><th>Coordinating Organization:</th><td colspan="4">Emergency Management Team</td></tr>
<tr><th colspan="2">Internal Partners:</th><th colspan="3">External Partners:</th></tr>
<tr><td colspan="2">Malheur County Emergency Services, County Court</td><td colspan="3">Oregon Department of Forestry, FEMA, BLM</td></tr>
<tr><th colspan="2">Potential Funding Sources:</th><th colspan="2">Estimated cost:</th><th>Timeline:</th></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td>Ongoing</td></tr>
<tr><th>Form Submitted by:</th><td colspan="4">2008 NHMP Steering Committee; revised and confirmed in 2013, revised and confirmed in 2019</td></tr>
<tr><th>Action Item Status:</th><td colspan="4">Ongoing</td></tr>
</table>

Table A-24 Wildfire Hazard Mitigation Action #2

<table>
<tr><th colspan="4">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="4">WF #2 – Construct barriers on pole power transformers to prevent birds from building nests on them, thereby reducing the chance of wildfires from transformer shorts.</td><td>Goals 2 and 3</td><td>☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><th colspan="7">Affected Jurisdictions:</th></tr>
<tr><td colspan="2">☒ Malheur County</td><td>☐ Nyssa</td><td colspan="2">☐ Ontario</td><td colspan="2">☐ Vale</td></tr>
<tr><th colspan="7">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="7">Malheur County Community Wildfire Protection Plan, Strategic Plans, Natural Hazards Mitigation Plans, and Emergency Operations Plans.</td></tr>
<tr><th colspan="7">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="7">• Birds making nests on transformers attached to power poles can cause power shorts which often lead to wildfires. Installing barriers on power transformers to prevent birds from nesting on them will reduce the electrocution risk to birds, decrease the amount of power outages, and reduce the chance of sparking a wildfire.
• The Disaster Mitigation Act of 2000 requires communities to identify comprehensive actions and projects that will reduce the effects of hazards on the community, particularly to critical infrastructure [201.6(c)(3)(ii)]. Constructing barriers on power transformers will assist in reducing the potential for power outages, while also protecting wildlife and reducing the likelihood of wildfires.
• Wildfire is a high-medium risk level and hence is a high-medium priority for this mitigation action.</td></tr>
<tr><th colspan="7">Ideas for Implementation:</th></tr>
<tr><td colspan="7">• Coordinate with the nature organizations such as the Audubon Society or the Nature Conservancy to develop appropriate barriers that will prevent wildlife from nesting on power transformers. .</td></tr>
<tr><th colspan="2">Coordinating Organization:</th><td colspan="5">Oregon Rural Electric Cooperative Association, including the Harney Electric Cooperative</td></tr>
<tr><th colspan="3">Internal Partners:</th><th colspan="4">External Partners:</th></tr>
<tr><td colspan="3">Malheur County</td><td colspan="4">Harney County, Audubon Society, Century Link, Idaho Power,</td></tr>
<tr><th colspan="3">Potential Funding Sources:</th><th colspan="2">Estimated cost:</th><th colspan="2">Timeline:</th></tr>
<tr><td colspan="3"></td><td colspan="2"></td><td colspan="2">Ongoing</td></tr>
<tr><th>Form Submitted by:</th><td colspan="6">2013 NHMP Steering Committee, confirmed in 2019</td></tr>
<tr><th>Action Item Status:</th><td colspan="6">Ongoing</td></tr>
</table>

Table A-25 Wildfire Hazard Mitigation Action #3

<table>
<tr><th colspan="3">Proposed Action Item:</th><th>Alignment with Plan Goals:</th><th colspan="2">High Priority Action Item?</th></tr>
<tr><td colspan="3">WF #3 – Manage weeds and vegetation growth at base of poles in fire prone regions.</td><td>Goals2 and 3</td><td>☐ Malheur
☐ Ontario</td><td>☐ Nyssa
☐ Vale</td></tr>
<tr><th colspan="6">Affected Jurisdictions:</th></tr>
<tr><td>☒ Malheur County</td><td>☐ Nyssa</td><td colspan="2">☐ Ontario</td><td colspan="2">☐ Vale</td></tr>
<tr><th colspan="6">Alignment with Existing Plans/Policies:</th></tr>
<tr><td colspan="6">Malheur County Community Wildfire Protection Plan, Strategic Plans, Natural Hazards Mitigation Plans, and Emergency Operations Plans.</td></tr>
<tr><th colspan="6">Rationale for Proposed Action Item:</th></tr>
<tr><td colspan="6">For example soil sterilant herbicides are total kill products that last in the soil for long periods, particularly in arid environments. They are sometimes called bare-ground herbicides, as they are used to remove all vegetation from the area of application, and they persist in their active form for long periods. They are designed to be used in areas where wildfire is a risk.
The application of sterilant around the base of poles may prevent wildfires from damaging poles in high-risk areas.
Another example is to use a spray-on product that could be applied on the pole to retard wildfire.
The Disaster Mitigation Act of 2000 requires communities to identify comprehensive actions and projects that will reduce the effects of hazards on the community, particularly to critical infrastructure [201.6(c)(3)(ii)]. Constructing barriers on power transformers will assist in reducing the potential for power outages, while also protecting wildlife and reducing the likelihood of wildfires.
Wildfire is a high-medium risk level and hence is a high-medium priority for this mitigation action.</td></tr>
<tr><th colspan="6">Ideas for Implementation:</th></tr>
<tr><td colspan="6">Apply sterilant around power poles in high fire risk areas.
Apply fire retardant spray around outside of power poles in high fire risk areas.</td></tr>
<tr><th colspan="2">Coordinating Organization:</th><td colspan="4">Oregon Rural Electric Cooperative Association, including the Harney Electric Cooperative</td></tr>
<tr><th colspan="2">Internal Partners:</th><th colspan="4">External Partners:</th></tr>
<tr><td colspan="2">Malheur County</td><td colspan="4">Harney County, BLM, USFW, Idaho Power</td></tr>
<tr><th colspan="2">Potential Funding Sources:</th><th colspan="2">Estimated cost:</th><th colspan="2">Timeline:</th></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td colspan="2">Ongoing</td></tr>
<tr><th>Form Submitted by:</th><td colspan="5">2013 NHMP Steering Committee, confirmed in 2019</td></tr>
<tr><th>Action Item Status:</th><td colspan="5">Ongoing</td></tr>
</table>

Appendix B:
Planning and Public Process

Table of Contents

Tables

Purpose

This Appendix describes the changes made to the *2014 Malheur County Natural Hazards Mitigation Plan (NHMP)* during the 2019 plan update process.

Project Background

Malheur County partnered with the Oregon Department of Land Conservation and Development (DLCD) to update the *2014 Malheur County Natural Hazards Mitigation Plan (NHMP).*

As has been described, briefly in the Executive Summary and in more detail in the Introduction, the Disaster Mitigation Act of 2000 requires communities to update their mitigation plans every five years to remain eligible for Pre-Disaster Mitigation (PDM) program funding, Flood Mitigation Assistance (FMA) program funding, and Hazard Grant Mitigation Program (HMGP) funding.

DLCD staff met with members of the Malheur County NHMP Steering Committee, led by Lt. Rich Harriman, for this update to the *2014 Malheur County NHMP*. The Malheur County NHMP Steering Committee includes the Cities of Nyssa, Ontario and Vale. A roster of the Steering Committee is included in the Acknowledgements section of this NHMP and in this Appendix. The Malheur County NHMP Steering Committee also serves as the Emergency Management Team (EMT) and the Local Emergency Planning Committee (LEPC); there are meetings each month for this triple duty high energy group.

The cities of Adrian and Jordan Valley opted to not participate in the update.

2019 Plan Update Changes

The entire *2014 Malheur County NHMP* has been revised and updated. While the basic format of the existing NHMP was retained, substantial changes have been. In Table B-1, the sections of the *2014 Malheur County NHMP* are compared and contrasted to the *2019 Malheur County NHMP*. A more complete description of each of the sections is provided in the text after Table B-1.

Table B-1 Changes to Plan Organization

2014 Malheur County NHMP	2019 Malheur County NHMP
Cover, FEMA Approval Letters, Jurisdictional Resolutions,	Cover, FEMA Approval Letters, Jurisdictional Resolutions,
Acknowledgements, Table of Contents	Acknowledgements, Table of Contents
Executive Summary	Executive Summary
Volume I: Basic Plan	Volume I: Basic Plan
Section 1: Introduction	Section 1: Introduction
Section 2: Risk Assessment	Section 2: Risk Assessment
Section 3: Mitigation Strategy	Section 3: Mitigation Strategy

Section 4: Plan Implementation and Maintenance	Section 4: Plan Implementation and Maintenance
Volume II: Hazard Annexes	Volume II: Hazard Annexes with Introduction
Drought	Drought
Earthquake	Earthquake
Flood	Flood
Landslide	Landslide
Severe Weather	Severe Weather
Volcanic Event	Volcanic Event
Wildfire	Wildfire
Volume III: Jurisdictional Addenda	Information from this section of the NHMP has been integrated into the main body of the NHMP. For example, each hazard section in Volume II includes Malheur County and the Cities of Nyssa, Ontario, and Vale.
City of Nyssa	
City of Ontario	
City of Vale	
Volume IV: Mitigation Resources	Volume III: Mitigation Resources
Appendix A: Action Item Forms	Appendix A: Action Item Forms
Appendix B: Planning and Public Process	Appendix B: Planning and Public Process
Appendix C: Community Profile	Appendix C: Community Profile
Appendix D: Economic Analysis of Natural Hazards Mitigation Projects	Appendix D: Economic Analysis of Natural Hazards Mitigation Projects
Appendix E: Grant Programs and Resources	Appendix E: Grant Programs and Resources
Appendix F: Regional Household Preparedness Survey	Appendix F: Future Climate Projections Reports
	Appendix G: Malheur County NHMP Success Stories
	Appendix H: Malheur County HAZUS Global Reports for Crustal and Probabilistic Scenarios

Source: Tricia Sears, DLCD

The entire *2014 Malheur County NHMP* was reviewed, revised, and updated. The following descriptions of each section provide details on the changes. Besides updating the NHMP with an extensive amount of new and more current information, goals for DLCD staff and the Malheur

County NHMP Steering Committee was to make the NHMP shorter, more user friendly, and less repetitive.

Cover and Front Pages

The cover and the front pages orient the reader of the NHMP to what the NHMP contains.

- A new NHMP cover was created. The photos for the cover were taken by Malheur County and DLCD staff. Photos were also added to the Volume I,II, and III covers.
- The FEMA Approval Pending Adoption (APA) and final approval letter as well as the County and Cities resolutions of adoption are included (when available).
- The Acknowledgements have been updated to include the 2018-19 Steering Committee members.
- The Table of Contents has been updated.

Volume I: Basic Plan

Volume I includes the cover, approval letters, jurisdictional resolutions, the Table of Contents, and the Executive Summary. It provides the overall plan framework for the *2019 Malheur County NHMP*. It also contains Section 1: Introduction; Section 2: Risk Assessment; Section 3: Mitigation Strategy; and Section 4: Plan Implementation and Maintenance.

Executive Summary

The *2019 Malheur County NHMP* includes an Executive Summary that provides information about the purpose of natural hazards mitigation planning and describes how the plan will be implemented.

Section 1: Introduction

Section 1 introduces the concept of natural hazards mitigation planning and answers the question, "Why develop a mitigation plan?" Additionally, Section 1 summarizes the 2019 plan update process, and provides an overview of how the plan is organized.

The main change to this section and the entire NHMP, is that information from the Cities of Ontario, Nyssa, and Vale has been integrated into the Malheur County information; in other words, rather than having separate addenda for the Cities, the Cities are included in the main body of the NHMP. Where applicable, the Cities are specifically called out for their unique situations.

Section 2: Risk Assessment

Section 2, Risk Assessment, consists of three phases: natural hazard identification, vulnerability assessment, and risk analysis. Hazard identification involves the identification of hazard geographic extent, its intensity, and probability of occurrence. The second phase combines the information from the hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard, then attempts to predict how different types of property and population groups will be affected by the hazard. The third phase involves estimating the damage, injuries, and costs likely to be incurred in a geographic area over a period of time.

Changes to Section 2 include:

- Format changes to the document.

- The inclusion of the information from the Cities of Ontario, Nyssa, and Vale in addition to the Malheur County information in one Risk Assessment section instead of separate sections for the Cities.
- Hazard identification, characteristics, history, probability, vulnerability, and hazard specific mitigation activities were updated. More detailed information is within the specific hazard annexes of Volume II, the Appendix C Community Profile, and other Appendices.
- NFIP information was updated.
- The Malheur County NHMP Steering Committee performed a new Hazard Vulnerability Analysis/Assessment (HVA), resulting in new scores for the identified hazards of drought, earthquake, flood, landslide, severe weather, volcanic event, and wildfire. The HVA uses scores for the categories of history, maximum threat, probability, and vulnerability scores to obtain a risk score for each hazard. From these, the Steering Committee determined the risk level of each hazard. The risk level information was used to prioritize the mitigation actions.

Section 3: Mitigation Strategy

This section provides the basis and justification for the mission, goals, and mitigation actions identified in the NHMP. Changes to Section 3 include the following:

- The NHMP Steering Committee opted to prioritize mitigation actions as described in the section above, using the HVA risk levels. All the multi-hazard mitigation actions were identified as high priority while hazard specific mitigation actions are high, high-medium, medium, and low.
- The mission statement and the goals were reviewed and re-confirmed by the 2019 Steering Committee without any changes.
- The mitigation actions from the *2014 Malheur County NHMP* were reviewed. Actions were deleted, retained as is, or retained in a modified fashion. New mitigation actions were established. The process resulted in the creation of two mitigation actions tables.
  - The Mitigation Actions Table – Status of 2014 NHMP is included in Table 3-2 and provides an update on the status of each mitigation action from the *2014 Malheur County NHMP*.
  - Table 3-3 Mitigation Actions 2019 NHMP includes the mitigation actions that the Steering Committee supports for the current *2019 Malheur County NHMP*.

Section 4: Plan Implementation and Maintenance

The Malheur County NHMP convener is the Emergency Manager; this person will facilitate a Steering Committee for maintaining, updating, and implementing the NHMP. The coordinating body is composed of members of the NHMP Steering Committee, the Emergency Management Preparedness Team (EMT), and the Local Emergency Preparedness Committee (LEPC). The coordinating body will meet twice per year to complete the tasks identified in Section 4 Plan Implementation and Maintenance.

Volume II: Hazard Annexes

An Introduction was added to the Hazard Annexes section. All hazard specific annexes were reformatted and updated to include new history, data, maps, vulnerability information, and resources as available. Cross references to other information in the NHMP has been updated.

Information about climate change has been integrated into the hazard specific annexes and added as Appendix F: Future Climate Projections Reports. Information from the Cities of Ontario, Nyssa, and Vale has been integrated into the Malheur County information. Where this is applicable, the Cities are specifically called out for their unique situations.

Volume III: Mitigation Resources

Rather than having separate addenda for the Cities, the Cities are included with Malheur County information in the main body of the NHMP. Where applicable, the Cities are specifically called out for their unique situations. All of the appendices have been revised and updated.

Appendix A: Action Item Forms

The mitigation action item forms were updated to correspond to the *2019 Malheur County NHMP* actions that are identified in Table 3-3 Mitigation Actions 2019 NHMP.

Appendix B: Planning and Public Process

This appendix describes and documents the planning and public process for this NHMP update.

Appendix C: Community Profile

The community profile has been updated for Malheur County, Nyssa, Ontario and Vale.

Appendix D: Economic Analysis of Natural Hazards Mitigation Projects

Updates have been made to this appendix about the economic analysis of natural hazards mitigation projects.

Appendix E: Grant Programs and Resources

Information in this appendix has been updated. Website links were also revised and updated as applicable.

Appendix F: Future Climate Projections Reports

The previous Appendix F was called Regional Household Preparedness Survey. It was deleted and replaced with the climate change information obtained from the Oregon Climate Change Research Institute (OCCRI). The two documents in this appendix are the *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports* and the *Future Climate Projections: Malheur County.*

Appendix G: Malheur County NHMP Success Stories

This appendix describes examples of the communities identifying a problem and finding a solution.

Appendix H: Malheur County HAZUS Global Reports for Crustal and Probabilistic Scenarios

DOGAMI produced the *Malheur County HAZUS Global Reports for Crustal and Probabilistic Scenarios*; it has details about two simulated scenarios and the results: Malheur Arbitrary Crustal M6.9 and 2500 Year Probably Scenario M6.5 Driving.

2019 NHMP
PUBLIC PARTICIPATION PROCESS

2019 NHMP Update

Malheur County is dedicated to directly involving the public in the review and update of the natural hazard mitigation plan. Although members of the NHMP Steering Committee represent the public to some extent, the residents of Malheur County, Nyssa, Ontario and Vale are also given the opportunity to provide feedback about the NHMP. As described in in Section 4 Plan Implementation and Maintenance, the NHMP will undergo review twice per year.

Malheur County made the *2019 Malheur County NHMP* available via their websites for Emergency Management and the Sheriff's Office for public comment on March 19, 2019; it was also posted on the Emergency Management and Sheriff's Office Facebook pages. They also did a press release on March 19, 2019. The Cities of Nyssa, Ontario, and Vale were included within the press release that was provided by Malheur County Emergency Management. The press release stated the comments would be accepted until April 9, 2019. A newspaper notice regarding the *2019 Malheur County NHMP* was published in the Ontario Argus Observer on March 22, 2019; it included a description Malheur County, Ontario, Nyssa, and Vale's participation on the NHMP.

Public Involvement Summary

Members of the Steering Committee provided edits and updates to the NHMP during this period as reflected in the final document. Opportunities for the public to comment were provided.

Project Steering Committee:

Department of Land Conservation & Development Staff:

Tricia Sears, Natural Hazards Planner

Malheur County

Representatives from the following organizations served as Steering Committee members for the Malheur County Natural Hazards Mitigation Plan update process.

Convener, Rich Harriman	Lieutenant, Malheur County Emergency Management
Jamie Willet	Malheur County, Planning
Dave Fenstemacher	Malheur County Health Department, Emergency Coordinator
Gina Lewis	Malheur County, GIS Specialist (maps)
Craig Geddes	Malheur County, Environmental Health
Adele Dockter	Adrian City Mayor
Bob Webb	City of Adrian, Fire Chief
Marie Kershner	City of Jordan Valley, Mayor

Al Crouch	Bureau of Land Management, Fire Mitigation/Education Specialist
Jason Simmons	Bureau of Land Management (BLM), Assistant Fire Management Officer (Fuels)
Todd Gregory	BLM, Assistant Fire Management Officer (Ops) (former)
Don Rotell	BLM, Supervisory Natural Resource Specialist

City of Nyssa

Jim Maret	City of Nyssa, City Manager
Ray Rau	City of Nyssa, Chief of Police
Eric Menchaca	City of Nyssa, Fire Chief
Duane Petty	City of Nyssa, Public Works Lead

City of Ontario

Adam Brown,	City of Ontario, City Manager
Cal Kunz	City of Ontario, Police Chief
Kari Ott	City of Ontario, Finance
Terry Leighton	City of Ontario, Fire Chief

City of Vale

Katy Lamb	City of Vale, City Manager
Mike McLaughlin	City of Vale, Mayor
Chad Cooper	City of Vale, Public Works
Jess Tolman	City of Vale, Fire Chief

Other Participants

Brule Lehman	Owyhee Irrigation District, Vegetation & Environmental Coordinator/ SPCC
Jay Chamberlain	Owyhee Irrigation District, Manager
Pam Uyeki	St. Alphonsus Hospital, Trauma/Emergency Preparedness Coordinator
Katherine Sherman	St. Alphonsus Hospital, RN
Heidi Ragsdale	Eastern Oregon Center for Independent Living, Independent Living Specialist
David Armstrong	Tri-County Love, Inc., Executive Director (former)
Kyle McCauly	Cascade Natural Gas, Engineer Associate
Brittany White	Malheur Council on Aging & Community Services (MCOACS), Transportation Project Manager
Tom Davis	ODOT, D-14 Operations Coordinator

Dylan Martin	Idaho Power
Kaitlyn Kyro (formerly Stratton)	Idaho Emergency Management Office, Payette County
Robert Batcheller	Amateur Radio Emergency Services, Engineer
Bob Dickinson	Malheur County Ambulance Service District (ASD), Director
Jane Padgett	Oregon Department of Human Services, Business Integrity/ Community Development
Mark Redmond	Malheur County Education Service District, Superintendent
Loni Thomas (formerly Debban)	Malheur Council on Aging & Community (MCOACS)
Lindsay Atagai	Malheur County Health Department, Director (former)
Emily Mateer	Valley Family Health Care, Staff & Compliance Officer
Mindy Volmer	Valley Family Health Care, Facilities Manager
Martin Heisig	American Red Cross
Belinda Heisig	American Red Cross
Brandon Tarvin	Lifeways, HM14, OFD
Molly Smith	Southwest District Health, Idaho, Health Educator
Maria Ramos	Southwest District Health, Volunteer and student in Emergency Management, Idaho St. University
Linda Pratzner	Southwest District Health, Idaho, Administrative Assistant
TJ Wilson	Southwest District Health, Idaho, PHD3 Planner

Project Managers:

Tricia Sears, Natural Hazards Planner, DLCD

Rich Harriman, Lieutenant, Malheur County Emergency Management

The following pages include copies of meeting agendas and sign-in sheets from NHMP Steering Committee meetings, website screenshots, flyers, and other information that demonstrates the outreach that has been done during this NHMP update process.

Summary of Outreach

Table B-2 Malheur County NHMP Outreach Efforts

Date	Description of Event/Activity
April 17, 2017	Rob Hunsucker (former Malheur County Emergency Services Manager) convened the NHMP Committee to discuss the NHMP update.
June 21, 2017	Approval by Malheur County Court to collaborate on the NHMP plan update with DLCD.
August 17, 2017	Rob Hunsucker reviews the DLCD/Malheur County IGA/SOW, and forwards it to the County Attorney for review.
August 19, 2017	Rob Hunsucker convenes NHMP committee to discuss IGA/SOW & project going forward.
September 19, 2017	Malheur County Court authorizes Rob's signature on the DLCD/Malheur County IGA/SOW, and provides it to DLCD.
October 26, 2017	Rob submits Malheur County portion of Critical Infrastructure information to DLCD Natural Hazards Planner, Tricia Sears.
November 2017	Working with new Emergency Services Manager, Rich Harriman to update him on the update to the NHMP. Malheur County and the Cities of Nyssa, Vale, and Ontario provide critical infrastructure to DLCD by November 7, 2017. Malheur County and the Cities of Nyssa, Vale, and Ontario all had the websites updated by November 28, 2017 to include information about the NHMP update process.
January - February 2018	Rich reached out to the Steering Committee members to set up the first Steering Committee meeting about the NHMP.
February 20, 2018	Rich posted on the Malheur County Emergency Management Facebook page about the April 12, 2018 Steering Committee meeting for the NHMP.
March 18, 2018	Emergency Management Team (EMT) (also known as the Local Emergency Planning Committee or LEPC) meeting, talked about the NHMP.
April 12, 2018	EMT meeting and Malheur County NHMP Steering Committee meeting (9 am to 12:30 pm). This was the first meeting of the Steering Committee meeting with Tricia in person. The focus of the meeting was the Hazard Vulnerability Analysis. The group also talked about the critical infrastructure list and other matters. Tricia facilitated the meeting.
April 19, 2018	David Armstrong with Tri-County Love Inc. shared information about the NHMP with the local pastors' group meeting he attended.

May 3, 2018	Finalized the Malheur County NHMP Flyer (created by DLCD). Rich printed 250 of them to distribute.
May 10, 2018	Emergency Management Team (EMT) meeting, talked about the NHMP and upcoming outreach events.
May 25, 2018	Rich did a presentation to Oregon Child Development Center (OCDC). He talked about what he does as an Emergency Manager, plans they have, and about the in process NHMP update.
June 14, 2018	EMT meeting and Malheur County Steering Committee NHMP meeting (9 am to 12:30 pm). The focus of the meeting was Mitigation Actions – determine the status of existing ones, and discussion to add, modify or delete mitigation actions. Tricia facilitated the meeting.
July 4, 2018	Red, White, & Breakfast event at the Ontario Fire Department. Information about the NHMP was available.
July 12, 2018	Emergency Management Team (EMT) meeting. Mission statement and NHMP update discussed.
July 31 to August 4, 2018	Malheur County Fair in Ontario, OR. Rich and other SC members will be there each day of the fair with a table of information and materials.
August 9, 2018	Emergency Management (EMT) meeting and Malheur County NHMP Steering Committee NHMP meeting (9 am to 12:30 pm). This was the second NHMP with Tricia in person. Discuss mitigation actions, outreach efforts, critical infrastructure list, and floodplain mapping. Tricia facilitated the meeting and Dave Lentzner, RiskMAP Coordinator, presented about floodplain maps in Malheur County and the RiskMAP program. Afternoon site visits to review the Vale levee, the back-up water site in the park in Nyssa, and the Nyssa water treatment plant.
Throughout the NHMP update until the organization closed in November 2018	David Armstrong posted the Malheur County NHMP flyer in the Tri-County Love Inc. thrift store. He noted they reach about 2000 people monthly with the majority in the low demographic. David Armstrong stated that his organization works with 30 partner churches in Malheur and Payette County. They often act as a bridge between the faith community and other services in the community.
August 14, 2018	Rich Harriman has a table at the Snake River Correctional Institute's Destination 2016 Festival.
September 13, 2018	Emergency Management Team (EMT) (also known as the Local Emergency Planning Committee or LEPC) meeting, talked about the NHMP and worked on LEPC bylaws.

October 11, 2018	Emergency Management Team (EMT) meeting. Worked on bylaws.
November 8, 2018	Emergency Management Team (EMT) and NHMP Steering Committee meeting. Worked on bylaws. Tricia called in to discuss project schedule (including draft NHMPs available for review), mitigation actions, and outreach for the NHMP.
December 2018	Target to have the Cities of Ontario, Nyssa, and Vale have their water bill include a description of the NHMP update process. Tricia provided the water bill information on 11/9/18.
December 13, 2018	Emergency Management Team (EMT) meeting.
Every month/week	Each week Rich sends out an email to the EMT with a disaster of the week and an emergency preparedness tip.
January 10, 2019	Emergency Management Team (EMT) and NHMP Steering Committee meeting. Tricia called in and discussed the NHMP timeline, draft NHMP sections, cost share, and outreach.
January 15, 2019	The City of Nyssa sent information about the NHMP in their water/sewer bills.
February 1, 2019	The City of Ontario sent information about the NHMP in their water bills.
February 14, 2019	Emergency Management Team (EMT) and NHMP Steering Committee meeting. Tricia called in to discuss the draft NHMP, timeline, comments from the Steering Committee members.
March 14, 2019	Emergency Management Team (EMT) meeting. Rich and Jane noted that Tricia would be sending out the draft NHMP for review and that a press release would be sent out related to it.
March 19, 2019	Malheur County's press release about the draft NHMP.
March 22, 2019	Public notice about the draft NHMP published in the Ontario Argus Observer newspaper.
April 9, 2019	Date identified in the press release and newspaper for comments to be submitted on the NHMP.
April 11, 2019	Emergency Management Team (EMT) and NHMP Steering Committee meeting. Tricia called in to discuss the NHMP timeline, draft NHMP sections, comments on the NHMP, and outreach about the NHMP.

Steering Committee Meeting Agendas and Sign-in Sheets

Malheur County NHMP Update
Steering Committee Meeting

Thursday, April 12, 2018
9:00 AM – 12:30 PM

St. Alphonsus Medical Center
1050 SW 4th Avenue, Payette River Room
Ontario, OR 97914

AGENDA

I. Welcome & Introductions (5 min) — Rich Harriman

II. NHMP Update Project (25 min) — Tricia Sears
- What is the Natural Hazards Mitigation Plan (NHMP)? (NHMP Info Sheet)
- NHMP Grant, including Cost Share (Cost Share Form)
- NHMP Process and Schedule (Project Schedule) (FEMA Approval 5/2/14)
- Public Outreach for the NHMP

III. Oregon Climate Change Research Institute (OCCRI) (15 min) (Handout) — Meghan Dalton
- She will call at 10 am (541-881-7323)

IV. Steering Committee (25 min) — Rich and Tricia
- Composition of the Committee (SC Roster)
- Roles and Participation
- Elect/Decide a Chairperson
- Ground Rules (e.g. Vote or Consensus)
- Mission and Goals (On back of Agenda)

V. Hazard Vulnerability Analysis (HVA) (80 min) — Tricia
- Work Session (Significant Historic Hazard Events Tables, HVA Worksheet)
- County vs City HVAs

VI. Critical Infrastructure, Critical Facilities, and Lifelines (20 min) — Rich and Tricia
- Review Draft List

VII. Next Steps (10 min) — Tricia
- Next Meeting
- Meeting Notes and Follow up

Materials
From Malheur County: Printed copies of 2014 NHMP
From DLCD: Meeting Agenda; NHMP Info Sheet; Cost Share Form; Project Schedule; SC Roster; Significant Historic Hazard Events Tables; HVA Worksheet; and Critical Infrastructure List

From the Malheur County NHMP May 2014

Approval Process

Malheur County adopted the plan on **April 16, 2014**.

The City of Nyssa adopted the plan on **May 13, 2014.**

The City of Ontario adopted the plan on **April 21, 2014.**

The City of Vale adopted the plan on **April 9, 2014**.

FEMA Region X approved the Malheur County Multi-jurisdictional NHMP on **May 2, 2014**. With approval of this plan, the entities listed above are now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **May 1, 2019**.

Mission

To create a disaster-resilient Malheur County by building partnerships, reducing risk, preventing loss, and protecting life, property, and the environment from future natural hazard events.

Goals

The plan goals describe the overall direction that the participating jurisdiction's agencies, organizations, and citizens can take toward mitigating risk from natural hazards.

Goal 1: *Protect Infrastructure, Safeguard Economy*

Implement projects and activities to lessen the impacts of natural hazards on infrastructure and property, protect the local economy, and reduce economic hardship in post-*disaster situations.*

Goal 2*: Increase Education, Outreach and Awareness*

Implement education programs to increase awareness of hazards and risk reduction practices for citizens, government, and business.

Goal 3: *Strengthen Organizational and Community Capacity*

Develop, strengthen, and sustain community partnerships among public and private sector stakeholders to build upon local resources for mitigation efforts.

Goal 4: *Reduce the Threat to Life Safety*

Minimize the threat to life in disaster events through mitigation activities that improve community notification and preparation.

Goal 5: *Protect Natural and Cultural Resources*

Strengthen land use planning and natural resource management to protect natural systems and allow them to serve mitigation functions. Develop measures to protect cultural resources from natural hazard risks.

Malheur County Natural Hazards Mitigation Plan
Steering Committee Meeting

St. Alphonsus Medical Center, Payette River Room, 1050 SW 4th Avenue
Ontario, OR 97914

Thursday, April 12, 2018 from 10:30 am to 12:30 pm

PLEASE SIGN IN (Sign your name or add to the list)

Full Signature	Name	Title	Representing	Phone	Email
[signature]	Rich Harriman, Lt.	Emergency Manager	Malheur County	541-473-5120	rharriman@malheurco.org
	Alvin Scott	County Planner	Malheur County	541-473-5179	ascott@malheurco.org
	Adele Dockter	Adrian City Mayor	Malheur County	541-372-2455	cityofadrian@hotmail.com
	Bob Webb	Adrian Fire Chief	Malheur County	541 372-3246	georgemshop@yahoo.com
	Marie Kershner	Jordan Valley City Mayor	Malheur County	541-586-2240	no email available
	Al Crouch	Fire Mitigation/Education Spec.	Bureau of Land Management	541-473-6361	acrouch@blm.gov
	Jason Simmons	Asst. Fire Mgmt. Ofcr. (Fuels)	Bureau of Land Management	541-473-6336	jsimmons@blm.gov
	Todd Gregory	Asst. Fire Mgmt. Ofcr. (Ops)	Bureau of Land Management	541-473-6264	tgregory@blm.gov
	Don Rotell	Supervisory Natural Resource Spec.	Bureau of Land Management	541-473-6229	drotell@blm.gov
	Jim Maret	City Manager	City of Nyssa		jmaret@nyssacity.org
	Ray Rau	Chief of Police	City of Nyssa	541-372-3825	rrau@nyssacity.org
	Eric Menchaca	Nyssa Fire Chief	City of Nyssa		emenchaca@nyssacity.org
	Duane Petty	Public Works Lead	City of Nyssa		dpetty@nyssacity.org
[signature]	Adam Brown	City Manager	City of Ontario	541 709 4001	adam.brown@ontariooregon.org
Terry Leighton	Terry Leighton	Ontario Fire Chief	City of Ontario	(208) 941-9158	Terry.Leighton@ontariooregon.org
	Kari Ott	Finance Director	City of Ontario	(541) 881-3217	kott@opgcpa.com
	Katy Lamb	City Manager	City of Vale	541-473-3133	klamb@cityofvale.com
	Jess Tolman	Vale Fire Chief	City of Vale	541 212-6868	jesstolman203@hotmail.com
Tricia R. Sears	Tricia Sears	Natural Hazards Planner	Oregon Department of Land Conservation & Development	503-934-0031 (office)	tricia.sears@state.or.us
	Katy Lamb	Vale City Mananger	City of Vale	(541) 473-3133	klamb@cityofvale.com
Cal K	Cal Kunz	Ontario Police Chief	City of Ontario		Cal.kunz@ontariooregon.org
[signature]	Dave Fenstemacher	Emergency Coordinator	Malheur County		Dave.Fenstemacher@malheurco.org

Thursday, April 12, 2018 from 10:30 am to 12:30 pm

PLEASE SIGN IN (Sign your name or add to the list)

Full Signature	Name	Title	Representing	Phone	Email
[illegible]	Brole Lehman		OID-OFD-HM14	541-889-4481	brole@owyheeirrigation.org
Pam Uyeki	Pam Uyeki	Trauma/Emerg Prep Coordinator	Saint Alphonsus Medical Center	541-881-7115	pamela.uyeki@saintalphonsus.org
[illegible]	DAVE FENSTEMACHER	EMER. COORDINATOR			
[illegible]	Heidi Ragsdale	ILS	EOC12	541-889-3119	heidiragsdale@
KSherman	Katherine Sherman	RN	St Alphonsus	541-881-7102	Katherine.Sherman@SaintAlphonsus.org
James L. [illegible]	James L. [illegible]	City mgr	City of Nyssa	541-212-2863	jmarett@nyssacity.org
[illegible]	David Armstrong		LCVE INC	541-889-7840	director@tr.countylcveinc.org
[illegible]	Kyle McCauley	Engineer Associate	Cascade Natural Gas	541-709-6316	kyle.mccauley@cngc.com
Craig Geddes	Craig Geddes	EH Director	Malheur Co	541-473-5186	craig.geddes@malheurco.org
BWhite	Brittany White	Trans Project Manager	MCOA/CS	541 881 0000	brittany.white@mcoacs.org
[illegible]	Adam Brown	City Manager	City of Ontario	541 709 4001	adam.brown@ontariooregon.org
Cal K	CAL KUNZ	Police Chief Ontario	" "	541-709-8073	cal.kunz@ontariooregon.org

Malheur County NHMP Update
Steering Committee Meeting

Thursday, June 14, 2018
9:00 AM – 12:30 PM

DHS Building
186 East Lane, Snake River Conference Room
Ontario, OR 97914

AGENDA

I. Welcome & Introductions (5 min) — Rich Harriman

II. NHMP Update Discussion (45 min) — Tricia Sears
- Cost Share Form (Cost Share Form and Cost Share Instructions)
- Updated Steering Committee Roster (Handout)
- Updated Project Schedule (Handout)
- Public Outreach for the NHMP; determine outreach events
- Malheur County NHMP flyer (Handout)
- Mission and Goals (On back of Agenda); confirm or modify
- Oregon Climate Change Research Institute (OCCRI) Report Status (June 2018)

III. Hazard Vulnerability Analysis Summary (HVA) (20 min) — Tricia
- Review and Discuss (HVA Summary)

VI. Critical Infrastructure, Critical Facilities, and Lifelines (20 min) — Rich and Tricia
- Review Draft List

V. Mitigation Actions (90 min) — Tricia
- Review 2014 list of actions, update with status, and identify (modify, delete, add) actions for the 2018-2019 NHMP (Mitigation Actions Tables)
- Definitions of Mitigation Actions Timelines (on back of agenda)
- Mitigation Actions Tables: Malheur County, City of Ontario, City of Nyssa, City of Vale, NEW

VI. Next Steps (10 min) — Tricia
- Next Meeting
- Meeting Notes and Follow up

Materials

From Malheur County: The Malheur County 2014 NHMP is available here: https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf

From DLCD: Meeting Agenda; Cost Share Form; Cost Share Instructions; SC Roster; Project Schedule; Malheur County NHMP Flyer: HVA Summary; and Critical Infrastructure List; Mitigation Actions Tables (Status and New)

From the Malheur County NHMP May 2014

<u>Approval Process</u>

Malheur County adopted the plan on **April 16, 2014**.

The City of Nyssa adopted the plan on **May 13, 2014**.

The City of Ontario adopted the plan on **April 21, 2014**.

The City of Vale adopted the plan on **April 9, 2014**.

FEMA Region X approved the Malheur County Multi-jurisdictional NHMP on **May 2, 2014**. With approval of this plan, the entities listed above are now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **May 1, 2019**.

<u>Mission</u>

To create a disaster-resilient Malheur County by building partnerships, reducing risk, preventing loss, and protecting life, property, and the environment from future natural hazard events.

<u>Goals</u>

The plan goals describe the overall direction that the participating jurisdiction's agencies, organizations, and citizens can take toward mitigating risk from natural hazards.

Goal 1: *Protect Infrastructure, Safeguard Economy*
Implement projects and activities to lessen the impacts of natural hazards on infrastructure and property, protect the local economy, and reduce economic hardship in post-*disaster situations.*

Goal 2*: Increase Education, Outreach and Awareness*
Implement education programs to increase awareness of hazards and risk reduction practices for citizens, government, and business.

Goal 3: *Strengthen Organizational and Community Capacity*
Develop, strengthen, and sustain community partnerships among public and private sector stakeholders to build upon local resources for mitigation efforts.

Goal 4: *Reduce the Threat to Life Safety*
Minimize the threat to life in disaster events through mitigation activities that improve community notification and preparation.

Goal 5: *Protect Natural and Cultural Resources*
Strengthen land use planning and natural resource management to protect natural systems and allow them to serve mitigation functions. Develop measures to protect cultural resources from natural hazard risks.

<u>Mitigation Actions Timelines</u>

"Action items include short, long-term and ongoing activities. Each action item includes an estimate of the timeline for implementation. *Ongoing actions items* are activities that are currently in process and will continue to be implemented during the next planning period. *Short-term action items* are activities that may be implemented with existing resources and authorities in one to two years. *Long-term action items* may require new or additional resources and/or authorities, and may take from one to five years to implement."

MALHEUR COUNTY NHMP UPDATE 6/14/18
STEERING COMMITTEE MTG
DHS BLDG
186 EAST LANE, SNAKERIVER CONF RM, ONTARIO, OR 97914

SIGNATURE	NAME	ORGANIZATION
1. [illegible]	Kaitlyn Stratton	Payette County, ID EM office
2. [illegible]	Heidi Ringold	EOCIL
3. [illegible]	Dylan Martin	Idaho Power
4. Dan Fenstermacher	DAVE FENSTEMACHER	MCHD
5. Tom [illegible]	TOM DAVIS	ODOT
6. [illegible]	Jay Chamberlin	OID oidh2o@fmtc.com
7. [illegible]	RICH HARRIMAN	MCES
8. Robert H. Batchelor	Robert H. Batchelor	Amateur Radio Emergency Service
9. [illegible]	Tricia Sears	DLCD
10. Jane Padgett ~~Jane Padgett~~	Jane Padgett ~~DHS~~	DHS
11. [illegible]	Bob Dickerson	bdickinson@malheurco.org Malheur County ASD
12. Pam Myers	Pamela Myers	Saint Alphonsus Medical Center - Ontario

SIGNATURE	NAME	ORGANIZATION
13 ~~12~~. Tonny Leighton	TERRY LEIGHTON	ONTARIO FIRE
14. ~~13~~. [signature]	Mark Redman	Malheur ESD
15. ~~14~~. Adam Brown [signature]		City of Ontario
16 ~~15~~. [signature]	David Armstrong	Love INC
17 ~~16~~. Lori Debban	Lori Debban	MCOA&CS
18 ~~17~~. Cal K	CAL KUNZ	ONTARIO P.D.
19. Jason Gately	JASON GATELY	DLCD

Malheur County NHMP Update
Steering Committee Meeting

Thursday, August 9, 2018
9:00 AM – 12:30 PM

DHS Building
186 East Lane, Snake River Conference Room
Ontario, OR 97914

AGENDA

I. Welcome & Introductions (5 min) — Rich Harriman
- Be sure to sign the sign in sheet.

II. NHMP Update Discussion (45 min) — Tricia Sears
- Cost Share Form (Cost Share Form and Cost Share Instructions)
- Updated SC Roster, Project Schedule, Hazard Vulnerability Analysis (HVA) (Handouts)
- Public Outreach for the NHMP: updates on past and upcoming events
- Updated Critical Infrastructure List (Handout)
- Oregon Climate Change Research Institute (OCCRI) Future Climate Projections (Handout)

III. Report on the Bully Dam and Levees (Handout, if available) — Chad Cooper

IV. Malheur County Floodplain Mapping (60 min) — Dave Lentzner
- Flood Risk in Malheur County and current Flood Insurance Rate Maps
- In the Malheur County HVA, floods are ranked 4th
- Base Level Engineering data
- 2015 FEMA Discovery Meeting and on-going Risk MAP Process
- State and Federal levee issues and policies, and potential funding sources

V. Mitigation Actions (45 min) — Tricia
- Review Status of 2014 NHMP Mitigation Actions Table (Handout)
- Review 2018 NHMP Mitigation Actions Table & Discuss Prioritization (Handout)
- Tables include: Malheur County, City of Ontario, City of Nyssa, and the City of Vale

VI. Risk MAP (15 min) — Dave
- What is it and how does it relate to Malheur County?

VII. Next Steps (10 min) — Tricia
- Next Meeting
- Meeting Notes and Follow up

Materials

From Malheur County: The Malheur County 2014 NHMP is available here: https://www.malheurco.org/wp-content/uploads/Departments/EmergencyManagement/Malheur%20County%20NHMP%20-%202014.pdf

From DLCD: Meeting Agenda; Cost Share Form; Cost Share Instructions; SC Roster; Project Schedule; HVA Summary; OCCRI Report; Critical Infrastructure List; Mitigation Actions Tables (2014 Status and 2018)

From the Malheur County NHMP May 2014

Approval Process

Malheur County adopted the plan on **April 16, 2014.**

The City of Nyssa adopted the plan on **May 13, 2014.**

The City of Ontario adopted the plan on **April 21, 2014.**

The City of Vale adopted the plan on **April 9, 2014.**

FEMA Region X approved the Malheur County Multi-jurisdictional NHMP on **May 2, 2014**. With approval of this plan, the entities listed above are now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through **May 1, 2019**.

Mission

To create a disaster-resilient Malheur County by building partnerships, reducing risk, preventing loss, and protecting life, property, and the environment from future natural hazard events.

Goals

The plan goals describe the overall direction that the participating jurisdiction's agencies, organizations, and citizens can take toward mitigating risk from natural hazards.

Goal 1: *Protect Infrastructure, Safeguard Economy*
Implement projects and activities to lessen the impacts of natural hazards on infrastructure and property, protect the local economy, and reduce economic hardship in post-disaster situations.

Goal 2*: Increase Education, Outreach and Awareness*
Implement education programs to increase awareness of hazards and risk reduction practices for citizens, government, and business.

Goal 3: *Strengthen Organizational and Community Capacity*
Develop, strengthen, and sustain community partnerships among public and private sector stakeholders to build upon local resources for mitigation efforts.

Goal 4: *Reduce the Threat to Life Safety*
Minimize the threat to life in disaster events through mitigation activities that improve community notification and preparation.

Goal 5: *Protect Natural and Cultural Resources*
Strengthen land use planning and natural resource management to protect natural systems and allow them to serve mitigation functions. Develop measures to protect cultural resources from natural hazard risks.

Mitigation Actions Timelines

"Action items include short, long-term and ongoing activities. Each action item includes an estimate of the timeline for implementation. *Ongoing actions items* are activities that are currently in process and will continue to be implemented during the next planning period. *Short-term action items* are activities that may be implemented with existing resources and authorities in one to two years. *Long-term action items* may require new or additional resources and/or authorities, and may take from one to five years to implement."

Thursday, August 9, 2018 from 9:00 am to 12:30 pm

PLEASE SIGN IN (Sign your name or add to the list)

Full Signature	Name	Title	Representing	Phone	Email
[illegible]	Rich Harriman, Lt.	Emergency Manager	Malheur County	541-473-5120	rharriman@malheurco.org
	Adele Dockter	Adrian City Mayor	Malheur County	541-372-2455	cityofadrian@hotmail.com
	Bob Webb	Adrian Fire Chief	Malheur County	541 372-3246	georgemshop@yahoo.com
	Marie Kershner	Jordan Valley City Mayor	Malheur County	541-586-2240	no email available
	Dave Fenstenmacher	Emergency Coordinator	Malheur County	541-889-7279 ext 117	Dave.fenstemacher@malheurco.org
	Craig Geddes	Environmental Health	Malheur County	541-473-5186	craiggeddes@malheurco.org
	Jamie Willet	Assistant Planner	Malheur County	541-473-5185	jwillet@malheurco.org
	Al Crouch	Fire Mitigation/Education Spec.	Bureau of Land Management	541-473-6361	acrouch@blm.gov
	Jason Simmons	Asst. Fire Mgmt. Ofcr. (Fuels)	Bureau of Land Management	541-473-6336	jsimmons@blm.gov
	Todd Gregory	Asst. Fire Mgmt. Ofcr. (Ops)	Bureau of Land Management	541-473-6264	tgregory@blm.gov
	Don Rotell	Supervisory Natural Resource Spec.	Bureau of Land Management	541-473-6229	drotell@blm.gov
[illegible]	Jim Maret	City Manager	City of Nyssa	541-212-2863	jmaret@nyssacity.org
	Ray Rau	Chief of Police	City of Nyssa	541-372-3825	rrau@nyssacity.org
	Eric Menchaca	Nyssa Fire Chief	City of Nyssa	208-739-3639	emenchaca@nyssacity.org
	Duane Petty	Public Works Lead	City of Nyssa		dpetty@nyssacity.org
	Adam Brown	City Manager	City of Ontario	541-709-4001	adam.brown@ontariooregon.org
Terry Leighton	Terry Leighton	Ontario Fire Chief	City of Ontario	208-941-9158	Terry.Leighton@ontariooregon.org
	Kari Ott	Finance Director	City of Ontario	541-881-3217	kott@opgcpa.com
	Cal Kunz	Ontario Police Chief	City of Ontario		Cal.kunz@ontariooregon.corg
	Katy Lamb	City Manager	City of Vale	541-473-3133	klamb@cityofvale.com
	Jess Tolman	Vale Fire Chief	City of Vale	541 212-6868	jesstolman203@hotmail.com
	Chad Cooper	Public Works	City of Vale	541-212-6126	ccooper@cityofvale.com
[illegible]	Brule Lehman	Vegetation & Environmental Coordinator/ SPCC	Owyhee Irrigation District	541-889-4481	brule@owyheeirrigation.org
	Lindsay Atagi	MCHD Director	Malheur County Health	5418897279	Lindsay.Atagi@malheurco.org

Thursday, August 9, 2018 from 9:00 am to 12:30 pm

PLEASE SIGN IN (Sign your name or add to the list)

Full Signature	Name	Title	Representing	Phone	Email
	Pam Uyeki	Trauma/Emergency Preparedness Coordinator	St. Alphonsus Medical Center	541-881-7115	Pamela.uyeki@saintalphonsus.org
	Jay Chamberlain	Manager	Owyhee Irrigation District	541-889-4433 ext. 102 (office)	jay@owyheeirrigation.org
	Katherine Sherman	RN	St. Alphonsus Medical Center	541-881-7102	Katherine.sherman@saintalphonsus.org
[illegible]	Heidi Ragsdale	Independent Living Specialist	Eastern Oregon Center for Independent Living	541-889-3119	heidiragsdale@eoc.org
[illegible]	David Armstrong	Executive Director	Tri-County Love Inc.	541-889-7860	director@tri.countyloveinc.org
	Kyle McCauly	Engineer Associate	Cascade Natural Gas	541-473-5186	Kyle.mccauly@cngc.com
	Brittany White	Transportation Project Manager	MCOACS	541-881-0000	Brittany.white@mcoacs.org
Tom D	Tom Davis	D-14 operations Coordinator	ODOT	541-~~889-9115~~ 823-4017	Thomas.j.davis@odot.state.or.us
	Dylan Martin		Idaho Power	208-642-6552	dmartin@idahopower.com
	Kaitlyn Stratton		Payette County, ID emergency Management Office		kstratton@payettecounty.org
Robert H. Batcheller	Robert Batcheller	Amateur Radio Emergency Service	Amateur Radio Emergency Services	541-212-6850	rhbatcheller@hotmail.com
	Bob Dickinson		Malheur County ASD	541-881-8367	bdickinson@malheurco.org
Jane Padgett	Jane Padgett	Business Integrity/ Community Development	Oregon Department of Human Services	541-889-8657 ext. 563 (office) 805-9693	Jane.padgett@state.or.us
	Mark Redmond		Malheur County Education Service District	541-473-4824	Mark.redmond@malesd.k12.or.us
	Lori Debban		MCOACS		
Tricia Fadeaux	Tricia Sears	Natural Hazards Planner	Oregon Department of Land Conservation & Development	503-934-0031 (office)	tricia.sears@state.or.us
Dave Lentzner	Dave Lentzner	Risk MAP Coordinator	Oregon Department of Land Conservation & Development	503-934-0010 (office)	David.lentzner@state.or.us
Emily Mateer	Emily Mateer	Safety & Compliance Officer	Valley Family Health Care	208-642-9376	emateer@vfhc.org
Mindy Volmer	Mindy Volmer	Facilities Manager	Valley Family Health Care	208 642-9376	mvolmer@VFHC.org
Martin Heisig	Martin HEISIG	Red Cross		208-739-1696	—
Belinda Heisig	BELINDA HEISIG	Red Cross		208-230-0542	
[illegible]	Brole Lehman	OID - HM14-OFD	Env. Coord.	541-889-6433	brole@owyheeirrigation.org
Brandon Tarvin	BRANDON TARVIN	LIFEWAYS - HM14-OFD	LIFEWAYS	208-350-9133	btarvin@lifeways.org
Molly Smith	Molly Smith	Health Educator	Southwest District Health - Idaho	208 455 5372	molly.smith@phd3.idaho.gov
Maria Ramos	Maria Ramos	ISU Em. Student	Southwest District Health - ID - Volunteer	208 8009924	ramomar2@isu.edu
Linda Pretzner	Linda Pretzner	Admin. Asst	Southwest District Health	~~208~~ 455-5377	linda.pretzner@phd3.idaho.gov
TJ	TJ WILSON	PHD3 PLANNER	" " "	208-455-5326	terry.wilson@phd3.idaho.gov

Malheur County Emergency Management Team Meeting

aka Local Emergency Planning Committee (LEPC)

Thursday, November 8, 2018 9:00 am

DHS Building, 186 East Lane, Ontario OR – Snake River Conference Room

Agenda

9:00 am Welcome & Introductions
Lt. Rich Harriman, MCSO Emergency Services Manager

9:05 am LEPC Bylaws – Review & Distribute Membership Applications
Lt. Rich Harriman, MCSO Emergency Services Manager
Michael Heffner, Asst Chief Deputy - Emergency Response Services, Office of State Fire Marshal

9:30 am NHMP Mitigation Actions Table & Project Schedule Revisions
Tricia Sears, Natural Hazards Planner
OR Dept Land Conservation & Development

10:00 am Round Table

10:30 am Adjourn

Next Meeting: Thursday, December 13, 2018, 9:00am @ DHS Bldg

Upcoming Events:
November 5-9, 2018 CIT Training @ National Guard Armory in Ontario
May 13-15, 2019 Oregon LEPC Conference in Pendleton

Malheur County Emergency Management Plans:
Malheur County Emergency Operation Plan (EOP)
Malheur County Community Wildfire Protection Plan
Malheur County Multi-Jurisdictional Natural Hazard Mitigation Plan

Malheur County Emergency Management Team Meeting

DHS Building, Snake River Conference Room, 186 East Lane, Ontario OR 97914

Thursday, November 8, 2018 @ 9:00 am

PLEASE SIGN IN (Sign your name or add to the list, edit your contact information if needed)

Full Signature	Name	Title	Representing	Phone	Email
	Adam Brown	City Manager	City of Ontario	541-709-4001	adam.brown@ontariooregon.org
	Adele Dockter	Adrian City Mayor	Malheur County	541-372-2455	cityofadrian@hotmail.com
	Al Crouch	Fire Mitigation/Education Spec.	Bureau of Land Management	541-473-6361	acrouch@blm.gov
[illegible]	Bob Dickinson	Director	Malheur County ASD	541-881-8367	bdickinson@malheurco.org
	Bob Webb	Adrian Fire Chief	Malheur County	541 372-3246	georgemshop@yahoo.com
[illegible]	Brandon Tarvin	Facilities Tech	Lifeways	208-350-9833	btarvin@lifeways.org
Brittany White	Brittany White	Transportation Project Manager	MCOACS	541-881-0000	Brittany.white@mcoacs.org
[illegible]	Brule Lehman	Vegetation & Environmental Coordinator/ SPCC	Owyhee Irrigation District	541-889-4481	brule@owyheeirrigation.org
	Cal Kunz	Ontario Police Chief	City of Ontario	541-889-5312	Cal.kunz@ontariooregon.corg
	Chad Cooper	Public Works	City of Vale	541-212-6126	ccooper@cityofvale.com
	Christine Crysler	Compliance Officer	Lifeways	541-823-9091	cmosier@lifeways.org
	Craig Geddes	Environmental Health	Malheur County	541-473-5186	craiggeddes@malheurco.org
	Dave Fenstenmacher	Emergency Coordinator	Malheur County	541-889-7279 ext 117	Dave.fenstemacher@malheurco.org
	Dave Lentzner	Risk MAP Coordinator	Oregon Department of Land Conservation & Development	503-934-0010 (office)	David.lentzner@state.or.us
Remove	~~David Armstrong~~	Executive Director	Tri-County Love Inc.	541-889-7860	director@tri.countyloveinc.org
	David Tovar	Crisis Supervisor	Lifeways	541-889-9167	dtovar@nnu.edu
	Don Rotell	Supervisory Natural Resource Spec.	Bureau of Land Management	541-473-6229	drotell@blm.gov
	Duane Petty	Public Works Lead	City of Nyssa		dpetty@nyssacity.org
	Dylan Martin		Idaho Power	208-642-6552	dmartin@idahopower.com
Emily Mateer	Emily Mateer	Safety Compliance Officer	Valley Family Health Care	208-642-9376	emateer@vfhc.org
	Eric Menchaca	Nyssa Fire Chief	City of Nyssa	208-739-3639	emenchaca@nyssacity.org
	Heidi Ragsdale	Independent Living Specialist	Eastern Oregon Center for Independent Living	541-889-3119	heidiragsdale@eoc.org
	Jamie Willet	Assistant Planner	Malheur County	541-473-5185	jwillet@malheurco.org
Jane Padgett	Jane Padgett	Business Integrity/ Community Development	Oregon Department of Human Services	541-889-8657 ext. 563 (office)	Jane.padgett@state.or.us

Malheur County Emergency Management Team Meeting
DHS Building, Snake River Conference Room, 186 East Lane, Ontario OR 97914

Thursday, November 8, 2018 @ 9:00 am

PLEASE SIGN IN **(Sign your name or add to the list, edit your contact information if needed)**

Full Signature	Name	Title	Representing	Phone	Email
	Jason Simmons	Asst. Fire Mgmt. Ofcr. (Fuels)	Bureau of Land Management	541-473-6336	jsimmons@blm.gov
	Jay Chamberlain	Manager	Owyhee Irrigation District	541-889-4433 ext. 102 (office)	jay@owyheeirrigation.org
	Jess Tolman	Vale Fire Chief	City of Vale	541 212-6868	jesstolman203@hotmail.com
Jim Maret	Jim Maret	City Manager	City of Nyssa	541-212-2863	jmaret@nyssacity.org
	Kaitlyn Stratton	Emergency Manager	Payette County, ID Emergency Management Office	208-642-6006 x 1182	kstratton@payettecounty.org
	Kari Ott	Finance Director	City of Ontario	541-881-3217	kott@opgcpa.com
Katherine Sherman	Katherine Sherman	RN	St. Alphonsus Medical Center	541-881-7102	Katherine.sherman@saintalphonsus.org
	Katy Lamb	City Manager	City of Vale	541-473-3133	klamb@cityofvale.com
Kyle McCauly	Kyle McCauly	Engineer Associate	Cascade Natural Gas	541-473-5186	Kyle.mccauly@cngc.com
	Lacee Salinas	Quality / Regulatory Manager	Lifeways	541-823-9053	lsalinas@lifeways.org
	Loni Thomas	Executive Director	Malheur Council on Aging & Community Services	541-889-7651	loni.thomas@mcoacs.org
	Marie Kershner	Jordan Valley City Mayor	Malheur County	541-586-2240	no email available
Mark Peterson	Mark Peterson	Emergency Preparedness Coordinator	Snake River Correctional Institution	541-881-4527	Mark.e.peterson@doc.state.or.us
	Mark Redmond	Superintendent	Malheur County Education Service District	541-473-4824	Mark.redmond@malesd.k12.or.us
	Michael Heffner	Office of State Fire Marshal	Oregon State Police	503-930-2934	Michael.heffner@state.or.us
Mindy Volmer	Mindy Volmer	Facilities Manager	Valley Family Health Care	208-642-9376	mvolmer@vfhc.org
	Mysty Boyd	Quality Service Implementation Specialist	Lifeways	541-823-9053	mboyd@lifeways.org
[illegible]	Pam Uyeki	Trauma/Emergency Preparedness Coordinator	St. Alphonsus Medical Center	541-881-7115	Pamela.uyeki@saintalphonsus.org
	Ray Rau	Chief of Police	City of Nyssa	541-372-3825	rrau@nyssacity.org
	Rene Kesler	Investigator / compliance	Lifeways	541-823-9090	rkesler@lifeways.org
[illegible]	Rich Harriman, Lt.	Emergency Manager	Malheur County	541-473-5120	rharriman@malheurco.org
	Ridg Medford	CIT Coordinator	Ontario Police Dept	541-212-3440	Ridg.medford@ontariooregon.org
	Robert Batcheller		Amateur Radio Emergency Services	541-212-6850	rhbatcheller@hotmail.com
Terry Leighton	Terry Leighton	Ontario Fire Chief	City of Ontario	208-941-9158	Terry.Leighton@ontariooregon.org
	Todd Gregory	Asst. Fire Mgmt. Ofcr. (Ops)	Bureau of Land Management	541-473-6264	tgregory@blm.gov

Malheur County Emergency Management Team Meeting

DHS Building, Snake River Conference Room, 186 East Lane, Ontario OR 97914

Thursday, November 8, 2018 @ 9:00 am

PLEASE SIGN IN (Sign your name or add to the list, edit your contact information if needed)

Full Signature	Name	Title	Representing	Phone	Email
[illegible]	Tom Davis	Region Operations Coordinator	ODOT	541-889-9115	Thomas.j.davis@odot.state.or.us
Called in	Tricia Sears	Natural Hazards Planner	Oregon Department of Land Conservation & Development	503-934-0031 (office)	tricia.sears@state.or.us
[illegible]	Peter Hall	Asst to the City Manager	City of Ontario	541-881-3248	peter.hall@ontariooregon.org
[illegible]	Terry J. Wilson	PHD 3 Planner	SWDH	208-455-5326	terry.wilson@phd3.idaho.gov
[illegible]	Molly Smith	Training + Exercise Coordinator	Southwest District Health-SWDH	208 455 5372	molly.smith@phd3.idaho.gov * please add me to LEPC meetings + correspondence
[illegible]	Ricky Bowman	Program Manager - Public Health Prep.	Southwest District Health	208-455-5311	ricky.bowman@phd3idaho.gov

Malheur County Emergency Management Team Meeting

aka Local Emergency Planning Committee (LEPC)

Thursday, January 10, 2019 9:00 am

DHS Building, 186 East Lane, Ontario OR – Snake River Conference Room

Agenda

9:00 am Welcome & Introductions
Lt. Rich Harriman, MCSO Emergency Services Manager

9:05 am Natural Hazards Mitigation Plan Updates
Tricia Sears, Natural Hazards Planner
OR Dept of Land Conservation & Development

9:20 am Roundtable

10:00 am Adjourn

Next Meeting: Thursday, February 14, 2019, 9:00am @ DHS Bldg
Agenda: Stop the Bleed Training w/Katherine Sherman, RN / Pam Uyeki, RN

Upcoming Events:
March 18-22, OR Emergency Preparedness Conference @ River House in Bend
May 13-15, OR LEPC Conference in Pendleton
June 16-20, ID READYKAMP for 7-9 grade

Malheur County Emergency Management Plans:
Malheur County Emergency Operation Plan (EOP)
Malheur County Community Wildfire Protection Plan
Malheur County Multi-Jurisdictional Natural Hazard Mitigation Plan

Malheur County Emergency Management Team Meeting
DHS Building, Snake River Conference Room, 186 East Lane, Ontario OR 97914

Thursday, January 10, 2019 @ 9:00 am

PLEASE SIGN IN **(Sign your name or add to the list, edit your contact information if needed)**

Full Signature	Name	Title	Representing	Phone	Email	Membership Form
	Adam Brown	City Manager	City of Ontario	541-709-4001	adam.brown@ontariooregon.org	X
	Adele Dockter	Adrian City Mayor	Malheur County	541-372-2455	cityofadrian@hotmail.com	
	Al Crouch	Fire Mitigation/Education Spec.	Bureau of Land Management	541-473-6361	acrouch@blm.gov	X
[illegible]	Bob Dickinson	Director	Malheur County ASD	541-881-8367	bdickinson@malheurco.org	
	Bob Webb	Adrian Fire Chief	Malheur County	541 372-3246	georgemshop@yahoo.com	
	Brandon Tarvin	Facilities Tech	Lifeways	208-350-9833	btarvin@lifeways.org	
	Brittany White	Transportation Project Manager	MCOACS	541-881-0000	Brittany.white@mcoacs.org	X
[illegible]	Brule Lehman	Vegetation & Environmental Coordinator/ SPCC	Owyhee Irrigation District	208-230-0549	brule@owyheeirrigation.org	X
he's gone	~~Cal Kunz~~	~~Ontario Police Chief~~	~~City of Ontario~~	~~541-889-5312~~	~~Cal.kunz@ontariooregon.corg~~	
	Chad Cooper	Public Works	City of Vale	541-212-6126	ccooper@cityofvale.com	
	Christine Crysler	Compliance Officer	Lifeways	541-823-9091	cmosier@lifeways.org	
	Craig Geddes	Environmental Health	Malheur County	541-473-5186	craiggeddes@malheurco.org	
[illegible]	Dave Fenstemacher	Emergency Coordinator	Malheur County	541-889-7279 ext 117	Dave.fenstemacher@malheurco.org	X
	Dave Lentzner	Risk MAP Coordinator	Oregon Department of Land Conservation & Development	503-934-0010 (office)	David.lentzner@state.or.us	
	David Tovar	Crisis Supervisor	Lifeways	541-889-9167	dtovar@nnu.edu	
	Don Rotell	Supervisory Natural Resource Spec.	Bureau of Land Management	541-473-6229	drotell@blm.gov	
	Duane Petty	Public Works Lead	City of Nyssa		dpetty@nyssacity.org	
	Dylan Martin		Idaho Power	208-642-6552	dmartin@idahopower.com	
Emily Mateer	Emily Mateer	Safety Compliance Officer	Valley Family Health Care	208-642-9376	emateer@vfhc.org	X
	Eric Menchaca	Nyssa Fire Chief	City of Nyssa	208-739-3639	emenchaca@nyssacity.org	
	Heidi Ragsdale	Independent Living Specialist	Eastern Oregon Center for Independent Living	541-889-3119	heidiragsdale@eoc.org	X
	Jamie Willet	Assistant Planner	Malheur County	541-473-5185	jwillet@malheurco.org	
Jane Padgett	Jane Padgett	Business Integrity/ Community Development	Oregon Department of Human Services	541-889-8657 ext. 563 (office)	Jane.padgett@state.or.us	X
	Jason Simmons	Asst. Fire Mgmt. Ofcr. (Fuels)	Bureau of Land Management	541-473-6336	jsimmons@blm.gov	

Malheur County Emergency Management Team Meeting
DHS Building, Snake River Conference Room, 186 East Lane, Ontario OR 97914
Thursday, January 10, 2019 @ 9:00 am

PLEASE SIGN IN **(Sign your name or add to the list, edit your contact information if needed)**

Full Signature	Name	Title	Representing	Phone	Email	Membership Form
	Jay Breidenbach	Warning Coordinator Meteorologist	NOAA / National Weather Service	208-339-9861	Jay.breidenbach@noaa.gov	X
	Jay Chamberlain	Manager	Owyhee Irrigation District	541-889-4433 ext. 102 (office)	jay@owyheeirrigation.org	
	Jess Tolman	Vale Fire Chief	City of Vale	541 212-6868	jesstolman203@hotmail.com	
Jim Maret	Jim Maret	City Manager	City of Nyssa	541-212-2863	jmaret@nyssacity.org	X
	Kaitlyn Kyro	Emergency Manager	Payette County, ID Emergency Management Office	208-642-6006 x 1182	kkyro@payettecounty.org	X
	Kari Ott	Finance Director	City of Ontario	541-881-3217	kott@opgcpa.com	
	Katherine Sherman	RN	St. Alphonsus Medical Center	541-881-7102	Katherine.sherman@saintalphonsus.org	X
	Katy Lamb	City Manager	City of Vale	541-473-3133	klamb@cityofvale.com	
Kyle McCauley	Kyle McCauley	Engineer Associate	Cascade Natural Gas	541-473-5186	Kyle.mccauley@cngc.com	X
[illegible]	Lacee Salinas	Quality / Regulatory Manager	Lifeways	541-823-9053	lsalinas@lifeways.org	X
	Loni Thomas	Executive Director	Malheur Council on Aging & Community Services	541-889-7651	loni.thomas@mcoacs.org	
	Marie Kershner	Jordan Valley City Mayor	Malheur County	541-586-2240	no email available	
	Mark Peterson	Emergency Preparedness Coordinator	Snake River Correctional Institution	541-881-4527	Mark.e.peterson@doc.state.or.us	
	Mark Redmond	Superintendent	Malheur County Education Service District	541-473-4824	Mark.redmond@malesd.k12.or.us	
	Michael Heffner	Office of State Fire Marshal	Oregon State Police	503-930-2934	Michael.heffner@state.or.us	
	Mike Cantin	Meteorologist	NOAA / National Weather Service		~~Mike.cantin@noaa.gov~~ bad email	
Mindy Volmer	Mindy Volmer	Facilities Manager	Valley Family Health Care	208-642-9376	mvolmer@mfhc.org	
Molly Smith	Molly Smith	Training and Exercise Coordinator	SW Idaho Health District	208-455-5372	Molly.Smith@phd3.idaho.gov	
Mysty Boyd	Mysty Boyd	Quality Service Implementation Specialist	Lifeways	541-823-9053	mboyd@lifeways.org	
Pam Uyeki	Pam Uyeki	Trauma/Emergency Preparedness Coordinator	St. Alphonsus Medical Center	541-881-7115	Pamela.uyeki@saintalphonsus.org	X
	Peter Hall	Assistant to the City Manager	City of Ontario	541-881-3248	Peter.hall@ontariooregon.org	
	Ray Rau	Chief of Police	City of Nyssa	541-372-3825	rrau@nyssacity.org	
	Rene Kesler	Investigator / compliance	Lifeways	541-823-9090	rkesler@lifeways.org	
[illegible]	Rich Harriman, Lt.	Emergency Manager	Malheur County	541-473-5120	rharriman@malheurco.org	X

Malheur County Emergency Management Team Meeting

DHS Building, Snake River Conference Room, 186 East Lane, Ontario OR 97914

Thursday, January 10, 2019 @ 9:00 am

PLEASE SIGN IN (Sign your name or add to the list, edit your contact information if needed)

Full Signature	Name	Title	Representing	Phone	Email	Membership Form
	Ricky Bowman	Program Manager Public Health Preparedness	SW Idaho Health District	208-455-5311	Ricky.Bowman@phd3.idaho.gov	
	Ridg Medford	CIT Coordinator	Ontario Police Dept	541-212-3440	Ridg.medford@ontariooregon.org	
	Robert Batcheller		Amateur Radio Emergency Services	541-212-6850	rhbatcheller@hotmail.com	
Terry Leighton	Terry Leighton	Ontario Fire Chief	City of Ontario	208-941-9158	Terry.Leighton@ontariooregon.org	X
	Terry Wilson	PHD3 Planner	SW Idaho Health District	208-455-5326	Terry.Wilson@phd3.idaho.gov	
	Todd Gregory	Asst. Fire Mgmt. Ofcr. (Ops)	Bureau of Land Management	541-473-6264	tgregory@blm.gov	
Tom D	Tom Davis	District 14 Operations Coordinator	ODOT	541-823-4017	Thomas.j.davis@odot.state.or.us	X
Tricia R. Sears	Tricia Sears	Natural Hazards Planner	Oregon Department of Land Conservation & Development	503-934-0031 (office)	tricia.sears@state.or.us	Phoned in
	Troy Lindquist	Service Hydrologist	NOAA / National Weather Service	208-334-9538	Troy.lindquist@noaa.gov	
Jeff Cappe	Jeff Cappe	Liaison	Southwest District Health	208-509-9501	jeff.cappe@phd3.idaho.gov	

Malheur County Emergency Management Team Meeting

aka Local Emergency Planning Committee (LEPC)

Thursday, February 14, 2019   9:00 am

DHS Building, 186 East Lane, Ontario OR – Snake River Conference Room

Agenda

9:00 am   Welcome & Introductions
Lt. Rich Harriman, MCSO Emergency Services Manager

9:05 am   Natural Hazards Mitigation Plan Updates
Tricia Sears, Natural Hazards Planner
OR Dept of Land Conservation & Development

9:15 am   LEPC Update
Lt. Rich Harriman, MCSO Emergency Services Manager

9:20 am   Roundtable _ keep it short!

9:30 am   Stop the Bleed Training
Katherine Sherman, RN / Pam Uyeki, RN

10:30 am Adjourn

Next Meeting: Thursday, March 14, 2019, 9:00am @ DHS Bldg

Upcoming Events:
March 2 – Ontario Volunteer Firefighter's Hawaiian Dance & Dinner, 6-8pm @ FRCC
March 18-22, OR Emergency Preparedness Conference @ River House in Bend
May 4 – Wildfire Community Preparedness Day
May 13-15, OR LEPC Conference in Pendleton
June 16-20, ID READYKAMP for 7-9 grade

Malheur County Emergency Management Plans:
Malheur County Emergency Operation Plan (EOP)
Malheur County Community Wildfire Protection Plan
Malheur County Multi-Jurisdictional Natural Hazard Mitigation Plan

Malheur County Emergency Management Team Meeting

DHS Building, Snake River Conference Room, 186 East Lane, Ontario OR 97914

Thursday, February 14, 2019 @ 9:00 am

PLEASE SIGN IN (Sign your name or add to the list, edit your contact information if needed)

Full Signature	Name	Title	Representing	Phone	Email	Membership Form
[illegible]	Adam Brown	City Manager	City of Ontario	541-709-4001	adam.brown@ontariooregon.org	X
	Adele Dockter	Adrian City Mayor	Malheur County	541-372-2455	cityofadrian@hotmail.com	
[illegible]	Al Crouch	Fire Mitigation/Education Spec.	Bureau of Land Management	541-473-6361	acrouch@blm.gov	X
	Bob Dickinson	Director	Malheur County ASD	541-881-8367	bdickinson@malheurco.org	
	Bob Webb	Adrian Fire Chief	Malheur County	541 372-3246	georgemshop@yahoo.com	
	Brandon Tarvin	Facilities Tech	Lifeways	208-350-9833	btarvin@lifeways.org	
Brittany White	Brittany White	Transportation Project Manager	MCOACS	541-881-0000	Brittany.white@mcoacs.org	X
[illegible]	Brule Lehman	Vegetation & Environmental Coordinator/ SPCC	Owyhee Irrigation District	208-230-0549	brule@owyheeirrigation.org	X
	Chad Cooper	Public Works	City of Vale	541-212-6126	ccooper@cityofvale.com	
	Christine Crysler	Compliance Officer	Lifeways	541-823-9091	cmosier@lifeways.org	
	Craig Geddes	Environmental Health	Malheur County	541-473-5186	craiggeddes@malheurco.org	
[illegible]	Dave Fenstemacher	Emergency Coordinator	Malheur County	541-889-7279 ext 117	Dave.fenstemacher@malheurco.org	X
	Dave Lentzner	Risk MAP Coordinator	Oregon Department of Land Conservation & Development	503-934-0010 (office)	David.lentzner@state.or.us	
	David Tovar	Crisis Supervisor	Lifeways	541-889-9167	dtovar@nnu.edu	
	Don Rotell	Supervisory Natural Resource Spec.	Bureau of Land Management	541-473-6229	drotell@blm.gov	
	Duane Petty	Public Works Lead	City of Nyssa		dpetty@nyssacity.org	
	Dylan Martin		Idaho Power	208-642-6552	dmartin@idahopower.com	
Emily Mateer	Emily Mateer	Safety Compliance Officer	Valley Family Health Care	208-642-9376	emateer@vfhc.org	X
	Eric Menchaca	Nyssa Fire Chief	City of Nyssa	208-739-3639	emenchaca@nyssacity.org	
	Heidi Ragsdale	Independent Living Specialist	Eastern Oregon Center for Independent Living	541-889-3119	heidiragsdale@eoc.org	X
	Jamie Willet	Assistant Planner	Malheur County	541-473-5185	jwillet@malheurco.org	
Jane Padgett	Jane Padgett	Business Integrity/ Community Development	Oregon Department of Human Services	541-889-8657 ext. 563 (office)	Jane.padgett@state.or.us	X
	Jason Simmons	Asst. Fire Mgmt. Ofcr. (Fuels)	Bureau of Land Management	541-473-6336	jsimmons@blm.gov	
	Jay Breidenbach	Warning Coordinator Meteorologist	NOAA / National Weather Service	208-339-9861	Jay.breidenbach@noaa.gov	X

Malheur County Emergency Management Team Meeting

DHS Building, Snake River Conference Room, 186 East Lane, Ontario OR 97914

Thursday, February 14, 2019 @ 9:00 am

PLEASE SIGN IN (Sign your name or add to the list, edit your contact information if needed)

Full Signature	Name	Title	Representing	Phone	Email	Membership Form
	Jay Chamberlain	Manager	Owyhee Irrigation District	541-889-4433 ext. 102 (office)	jay@owyheeirrigation.org	
	Jeff Cappe	Liaison	SW District Health	208-509-9501	Jeff.cappe@phd3.idaho.gov	
	Jess Tolman	Vale Fire Chief	City of Vale	541 212-6868	jesstolman203@hotmail.com	
	Jim Maret	City Manager	City of Nyssa	541-212-2863	jmaret@nyssacity.org	X
	Kaitlyn Kyro	Emergency Manager	Payette County, ID Emergency Management Office	208-642-6006 x 1182	kkyro@payettecounty.org	X
	Kari Ott	Finance Director	City of Ontario	541-881-3217	kott@opgcpa.com	
	Katherine Sherman	RN	St. Alphonsus Medical Center	541-881-7102	Katherine.sherman@saintalphonsus.org	X
	Katy Lamb	City Manager	City of Vale	541-473-3133	klamb@cityofvale.com	
	Kyle McCauley	Engineer Associate	Cascade Natural Gas	541-473-5186	Kyle.mccauley@cngc.com	X
[illegible]	Lacee Salinas	Quality / Regulatory Manager	Lifeways	541-823-9053	lsalinas@lifeways.org	X
	Loni Thomas	Executive Director	Malheur Council on Aging & Community Services	541-889-7651	loni.thomas@mcoacs.org	
	Marie Kershner	Jordan Valley City Mayor	Malheur County	541-586-2240	no email available	
	Mark Peterson	Emergency Preparedness Coordinator	Snake River Correctional Institution	541-881-4527	Mark.e.peterson@doc.state.or.us	
	Mark Redmond	Superintendent	Malheur County Education Service District	541-473-4824	Mark.redmond@malesd.k12.or.us	
	Michael Heffner	Office of State Fire Marshal	Oregon State Police	503-930-2934	Michael.heffner@state.or.us	
	Mike Cantin	Meteorologist	NOAA / National Weather Service			
	Mindy Volmer	Facilities Manager	Valley Family Health Care	208-642-9376	mvolmer@mfhc.org	
Molly Smith	Molly Smith	Public Health Preparedness Health Educator	SW Idaho Health District	208-455-5372 / 208-615-1154	Molly.Smith@phd3.idaho.gov	
	Mysty Boyd	Quality Service Implementation Specialist	Lifeways	541-823-9053	mboyd@lifeways.org	
Pam Uyeki	Pam Uyeki	Trauma/Emergency Preparedness Coordinator	St. Alphonsus Medical Center	541-881-7115	Pamela.uyeki@saintalphonsus.org	X
	Peter Hall	Assistant to the City Manager	City of Ontario	541-881-3248	Peter.hall@ontariooregon.org	
	Ray Rau	Chief of Police	City of Nyssa	541-372-3825	rrau@nyssacity.org	
	Rene Kesler	Investigator / compliance	Lifeways	541-823-9090	rkesler@lifeways.org	
[illegible]	Rich Harriman, Lt.	Emergency Manager	Malheur County	541-473-5120	rharriman@malheurco.org	X

Malheur County Emergency Management Team Meeting

DHS Building, Snake River Conference Room, 186 East Lane, Ontario OR 97914

Thursday, February 14, 2019 @ 9:00 am

PLEASE SIGN IN (Sign your name or add to the list, edit your contact information if needed)

Full Signature	Name	Title	Representing	Phone	Email	Membership Form
	Ricky Bowman	Program Manager Public Health Preparedness	SW Idaho Health District	208-455-5311	Ricky.Bowman@phd3.idaho.gov	
job changed	~~Ridg Medford~~	~~CIT Coordinator~~	~~Ontario Police Dept.~~	~~541-212-3440~~	~~Ridg.medford@ontariooregon.org~~	
	Robert Batcheller		Amateur Radio Emergency Services	541-212-6850	rhbatcheller@hotmail.com	
	Terry Leighton	Ontario Fire Chief	City of Ontario	208-941-9158	Terry.Leighton@ontariooregon.org	X
[illegible]	Terry Wilson	PHD3 Planner	SW Idaho Health District	208-455-5326	Terry.Wilson@phd3.idaho.gov	
Retired!	~~Todd Gregory~~	~~Asst. Fire Mgmt. Ofcr. (Ops)~~	~~Bureau of Land Management~~	~~541-473-6264~~	~~tgregory@blm.gov~~	
[illegible]	Tom Davis	District 14 Operations Coordinator	ODOT	541-823-4017	Thomas.j.davis@odot.state.or.us	X
[illegible]	Tricia Sears	Natural Hazards Planner	Oregon Department of Land Conservation & Development	503-934-0031 (office)	tricia.sears@state.or.us	Phoned in
	Troy Lindquist	Service Hydrologist	NOAA / National Weather Service	208-334-9538	Troy.lindquist@noaa.gov	
[illegible]	Maria Ramos	SWDH Intern EM	SWDH / ISU	208-800-9924	ramomar2@isu.edu	
[illegible]	Robert Metzger	Red CROSS DAT	Red CROSS	541-881-[illegible]	RJM3FZ93R@gmail.com	
[illegible]	Brittany A. Condon	Redcross DAT	Red cross	208-405-8066	madilynn37@gmail.com	
[illegible]	Martin Hersle	Red Cross	Red Cross	208-779-1696		

Malheur County Emergency Management Team Meeting

aka Local Emergency Planning Committee (LEPC)

Thursday, April 11, 2019 9:00 am

DHS Building, 186 East Lane, Ontario OR – Snake River Conference Room

Agenda

9:00 am Welcome & Introductions
Lt. Rich Harriman, MCSO Emergency Services Manager

9:05 am NHMP Update
Tricia Sears, Natural Hazards Planner
OR Dept of Land Conservation & Development

9:15 am LEPC Update
Lt. Rich Harriman, MCSO Emergency Services Manager

9:45 am Roundtable

10:15 am Adjourn

Next Meeting: Thursday, May 9, 2019, 9:00am @ DHS Bldg

Upcoming Events:
April 15-19 – Crisis Intervention Training (CIT) @ DHS Building, 8am-5pm
April 23 – SRCI Functional Drill
May 4 – Wildfire Community Preparedness Day
May 13-15, OR LEPC Conference in Pendleton
May 21-22 – ICS 300 Training @ St Alphonsus Medical Center in Ontario, 8am-5pm
June 16-20, ID READYKAMP for 7-9 grade

Malheur County Emergency Management Plans:
Malheur County Emergency Operation Plan (EOP)
Malheur County Community Wildfire Protection Plan
Malheur County Multi-Jurisdictional Natural Hazard Mitigation Plan

CITsavethedateApril2019.docx   ICS 300 Registration May 2019.docx

Malheur County Emergency Management Team Meeting, DHS Building, Snake River Conference Room, 186 East Lane, Ontario, OR 97914, Thursday, April 11, 2019.

	Name of Attendee/Position	Organization	Signature	Email Address	Phone	Miles Traveled R/T	Federally-Funded? What %
4	Brde Lehman	OID-OFD-HMI4	[signature]	brde@owyheeirrigation.org	541-372-5540		
5	Emily Mateer SCO	VFHC	Emily Mateer	emateer@vfhc.org	208-642-9376		
6	LACEE SALINAS	LIFEWAYS	[signature]	lsalinas@lifeways.org	541-823-4053		—
7	Kathy Sherman	SAMC ontario	K Sherman	Katherine.Sherman@saintalphonsus.org			
8	Kyle McCauley	Cascade Natural Gas	Kyle McCauley	kyle.mccauley@cngc.com	541-823-4016		
9	Pam Wyeni	Saint Alphonsus Medical Center - Ontario	[signature]	[illegible]@saintalphonsus.org	541-[illegible]-5889		

	Name of Attendee/Position	Organization	Signature	Email Address	Phone	Miles Traveled R/T	Federally-Funded? What %
4	Dean Marcum	OHA	Dean Marcum	dean.marcum@state.or.us	541-561-5237		
5	Robert Metzger	Red Cross	[signature]	—	541-881-0291		
6	Martha Hearn	Red Cross	Martha Hearn		208-739-1696		
7	Jim Maret	City of Nyssa	[signature]	jmaret@nyssacity.org	541-212-2865	26	
8	Rich Harriman	Malheur E.M.	[signature]	rharriman@malheurco.org	541 473-5120		
9	J.R. Smith	ODOC-SRCI	J.R. Smith	John.R.Smith@doc.state.or.us	541-881-4572		
10	Jane Padgett	DHS	Jane Padgett	jane.padgett@state.or.us	541 889-8657		
11	Tricia R. Sears	DLCD	Tricia R. Sears	tricia.sears@state.or.us	503-934-0031	on phone for meeting 4/11/19	
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							

Malheur County NHMP Flyer

Malheur County
Natural Hazards Mitigation Plan Update

May 2018

Drought, Floods, Winter Storms, Wildfires…
What Concerns You?

Communities are stronger when they recognize the risks from natural hazards and make efforts to prepare for them and to reduce potential damage.

Malheur County's existing ***Natural Hazards Mitigation Plan*** (NHMP) was updated in May 2014. NHMPs must be updated every five years.

Now, Malheur County is collaborating with the Oregon Department of Land Conservation and Development (DLCD) to update the NHMP again. The updated NHMP will continue the County's eligibility for disaster related funding.

> "To create a disaster-resilient Malheur County by building partnerships, reducing risk, preventing loss, and protecting life, property, and the environment from future natural hazard events."
>
> Malheur County 2014 Natural Hazards Mitigation Plan

A Steering Committee, chaired by the Emergency Manager, is working with DLCD staff to update the NHMP. The NHMP is targeted for completion by August 2019.

For more information and to provide comments:

Lt. Rich Harriman, Emergency Manager | Malheur County | #541-473-5120
Website: https://www.malheurco.org/emergency-management/
Email: rharriman@malheurco.org

Oregon Department of Land Conservation and Development

Emergency preparedness and hazard mitigation planning involve preparing the individual and the community for hazards that may impact them.

Why engage in natural hazard mitigation planning?

- ***To avoid disasters*** by reducing or eliminating long-term risk to people, property, and the environment from natural hazards.
- ***To maintain eligibility*** for disaster related funding.
- ***To increase safety and resiliency*** by integrating hazard mitigation into the plans, programs, and policies.

Malheur County's Natural Hazards

Winter Storms
Wind Storms
Earthquakes
Droughts
Floods
Volcanic Events
Wildfire
Landslides
Extreme Temperature
Dust Storm
Severe Weather – includes flash flood rain events

Participation

This is a multi-jurisdictional Natural Hazards Mitigation Plan (NHMP) involving Malheur County, the City of Ontario, the City of Nyssa, the City of Vale, the BLM and others. Representatives from these jurisdictions and other organizations are actively participating in this NHMP update process.

Malheur County flyer 5-2-18

All photos by Malheur County

Website and Facebook Screen Shots, Water Bill Inserts, and Events

Red, White & Breakfast Event on July 4, 2018

Ontario Water Bill Insert Mailed February 1, 2019

Communities are stronger when they recognize the risks from natural hazards and make efforts to prepare for them and to reduce potential impacts.

Malheur County is collaborating with the Oregon Department of Land Conservation and Development (DLCD) to update their Natural Hazards Mitigation Plan (NHMP). Having an approved NHMP allows the County and the cities to obtain funds from FEMA to prepare for and recover from natural disasters. This effort involves Malheur County, the City of Ontario, the City of Nyssa, the City of Vale, and others. The NHMP is targeted for completion by July 2019.

For more information and to provide comments on the NHMP, please contact:

Lt. Rich Harriman, Emergency Manager, Malheur County
Phone: #541-473-5120 Email: rharriman@malheurco.org

Website: https://www.malheurco.org/emergency-management/

Nyssa Water and Sewer Bill Insert Mailed on January 15, 2019

CITY OF NYSSA
301 MAIN STREET
NYSSA, OR 97913 (541) 372-2264
ADDRESS SERVICE REQUESTED

FIRST CLASS
PRSRT
US POSTAGE
PAID – 1OZ
NYSSA OR 97913
PERMIT NO 1

SERVICE	CHARGES	PAST-DUE	BALANCE
17 E 2nd St 1-2300-03		01/15/2019	413.75

previous read	current read	usage		
0	0	0	Water	32.50
Service dates				
11/30/2018	12/31/2018		Sewer	48.00
			SLite	2.50
			Fire	1.75
			PNLT2	15.00
			Police	5.00
			OnOff	
			OnOff	

Past Due Amount 309.00

Malheur Co. is updating Natural Hazards Mitigation Plan-Rich Harriman 5414735120 @ rharriman@malheurco.org or www.malheurco.org/

Total Amount Due 413.75

01/15/2019 1-2300-03 413.75

customer
PO Box 223
Midvale ID 83645

Malheur County Destination 2026 Festival on August 14, 2018

From:	Richard Harriman
To:	Sears, Tricia
Subject:	RE: Another booth for awareness
Date:	Wednesday, August 15, 2018 7:28:06 AM
Attachments:	Rich Harriman Lt .vcf

It was called "Destination 2026" at SRCI. Here is the e-mail that I got from one of the Lieutenants.

Lieutenant Harriman,

Captain Peterson gave me your contact information so I could contact your for SRCI. SRCI is have a Destination 2026 Festival on August 14, 2018 from 9:30 am to 5:00 pm. This festival is a step in SRCI supporting Department four year goals. The Protect Group that I am part of is promoting activities that will ensure staff are prepared and trained for emergencies at work and home.

We were hoping that Malheur County Emergency Preparedness would be available to join us and have information regarding our staff being prepared for emergencies in the home. It's my hope we are not contacting you too late for you to participate.

I'd like to discuss this with you further.

Please contact me on my state cell phone or call Master Control at 541-881-5018 and ask for me. I have Thursday Friday off and work 6:00 am to 2:30 pm. Looking forward to hearing from you.

Matt Turner
Correctional Lieutenant
Complex 1 Second Shift
Snake River Correctional Institution
(541)216-3805 - Cell
541-881-4607 - Office

Malheur County Fair July 31 to August 4, 2018

Malheur County Emergency Management website 8/15/17

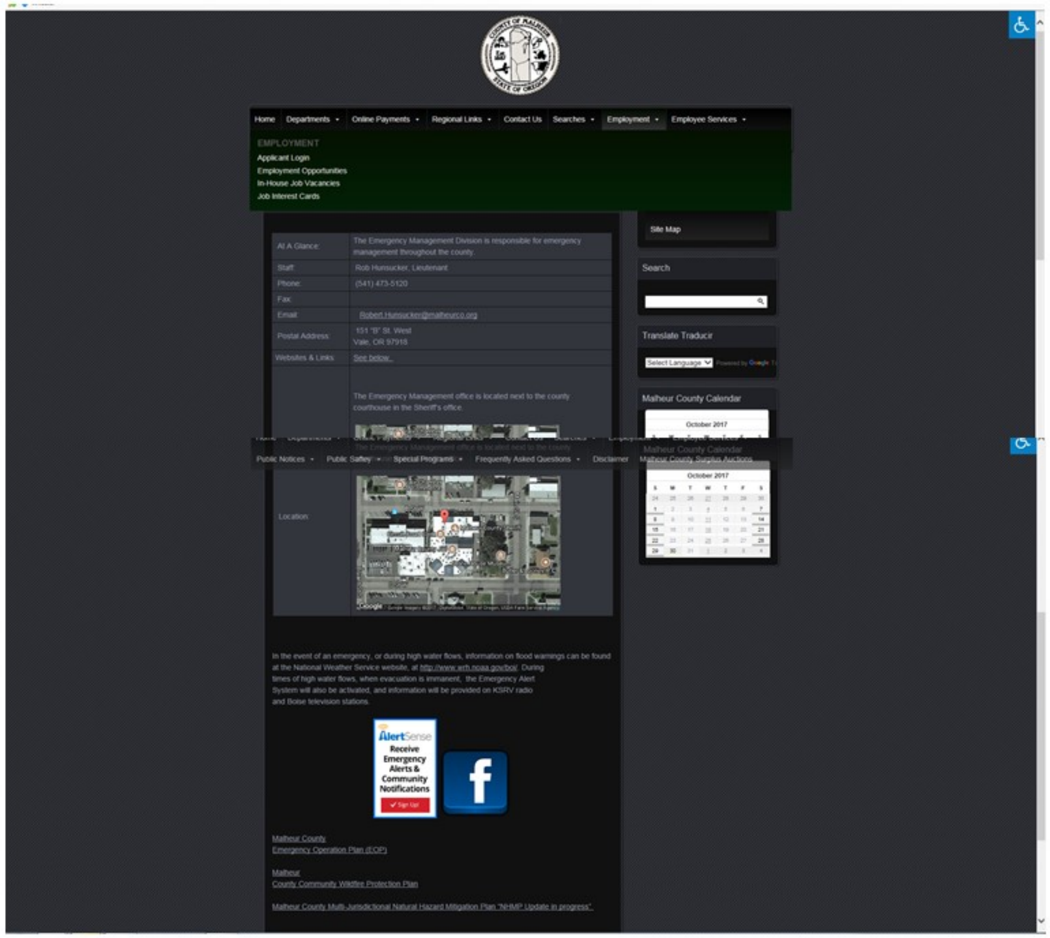
http://www.malheurco.org/emergency-management/

Lists the Emergency Operations Plan, Wildfire Protection Plan, and the Natural Hazards Mitigation Plan with clickable links to each document.

Malheur County Emergency Management website 10/30/17

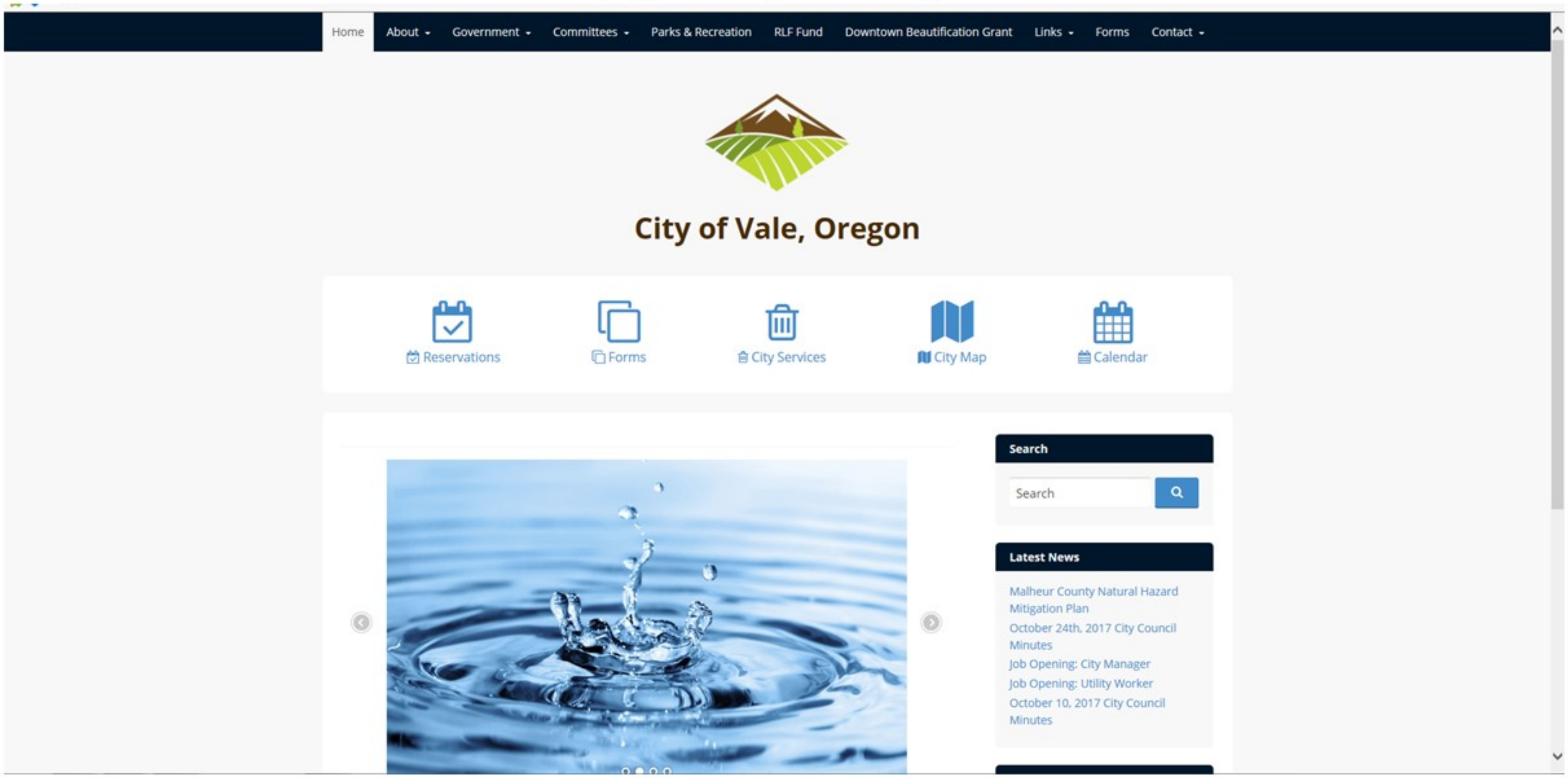
http://www.malheurco.org/emergency-management/

The website lists the Emergency Operations Plan, Wildfire Protection Plan, and the Natural Hazards Mitigation Plan (NHMP) with clickable links to each document. The NHMP has a statement "NHMP update in process" noted on the website.



City of Nyssa website on 11/21/17
http://www.nyssacity.org/

City of Vale, Oregon website on 11/21/17
https://www.cityofvale.com/



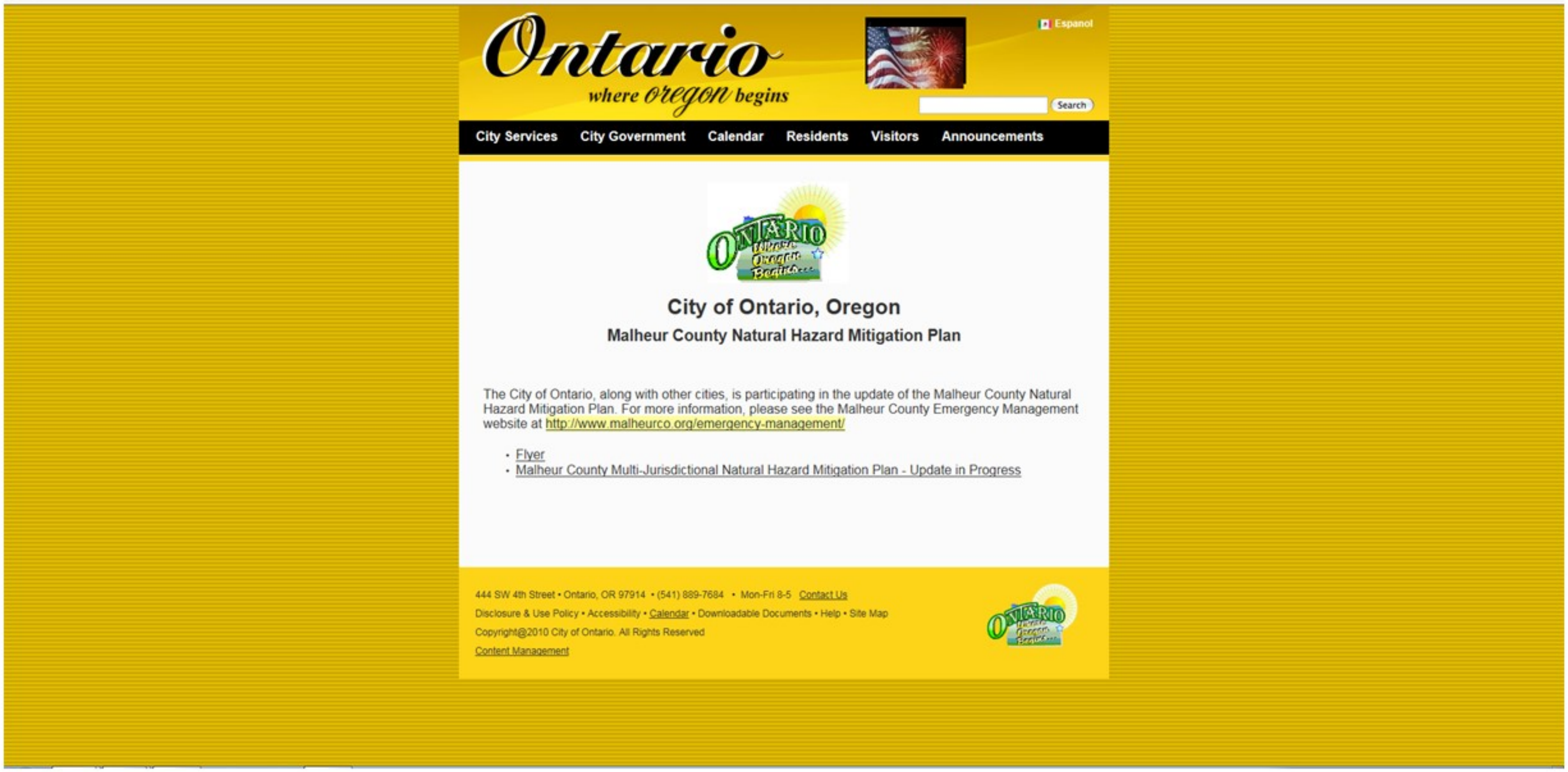
City of Vale, Oregon website on 11/21/17

https://www.cityofvale.com/news-and-information/malheur-county-natural-hazard-mitigation-plan/

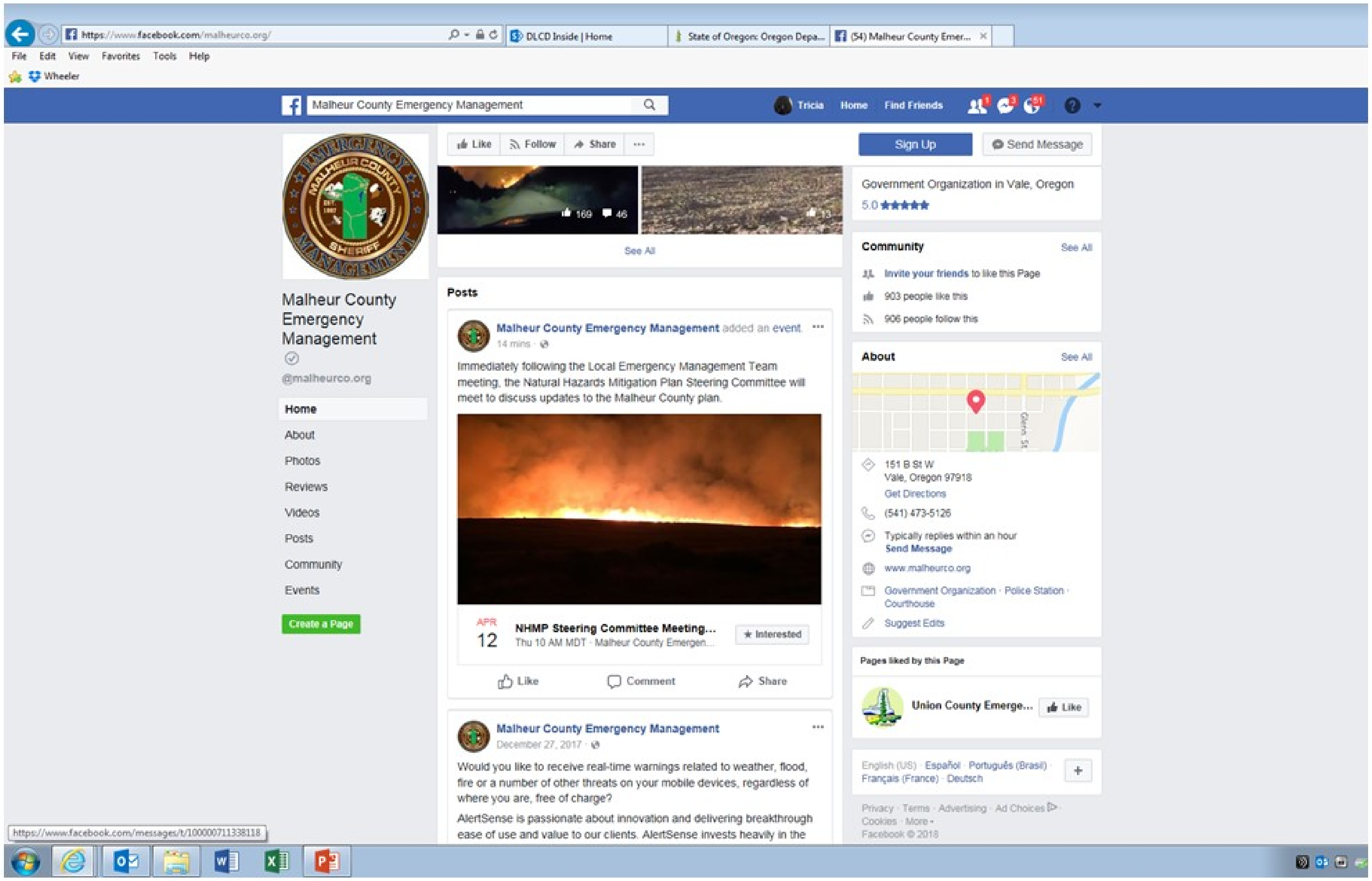
City of Vale, Oregon website on 11/21/17
https://www.cityofvale.com/category/news-and-information/

City of Ontario Website 11/28/17
http://www.ontariooregon.org/

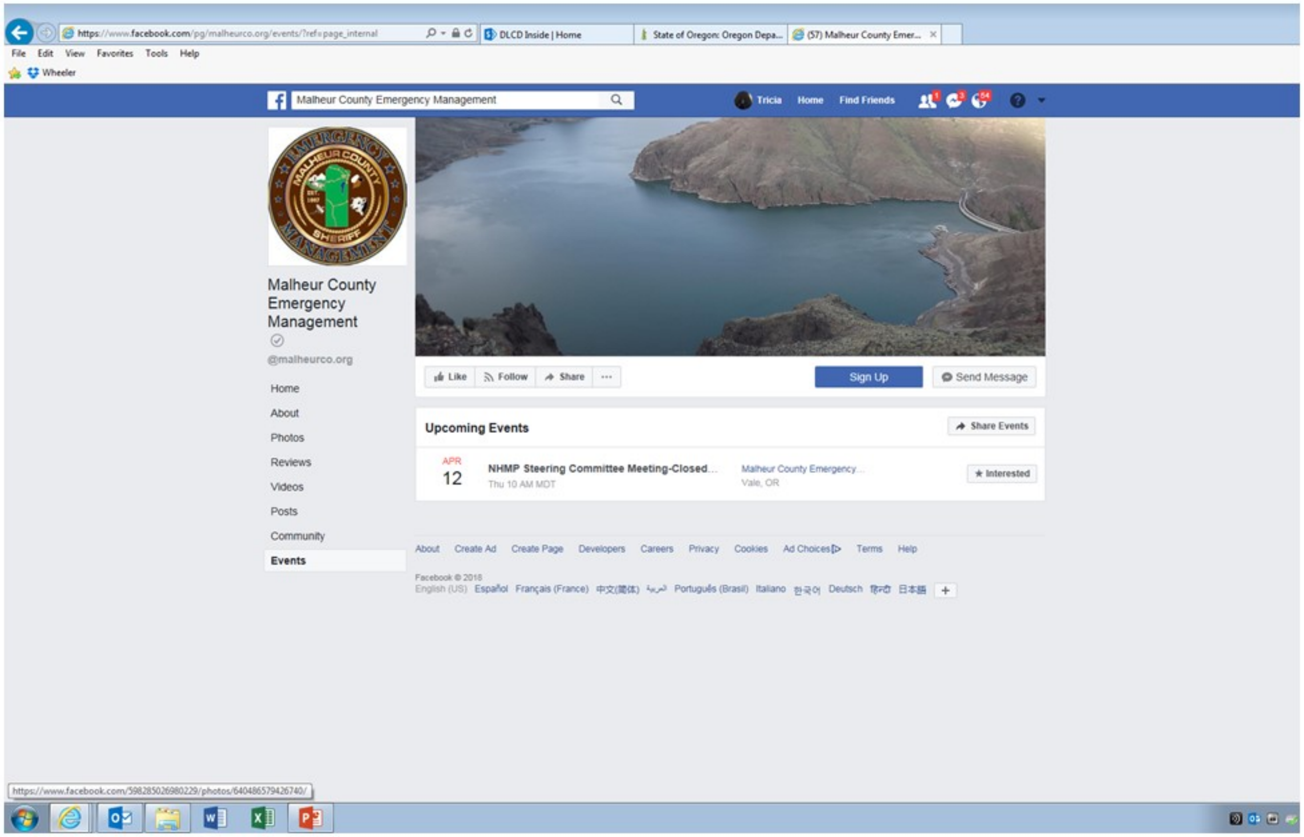
City of Ontario Website 11/28/17
http://www.ontariooregon.org/NaturalHazardMitigationPlan.cfm



Malheur County Emergency Management Facebook Page
2/20/18



Malheur County Emergency Management Facebook Page
2/20/18

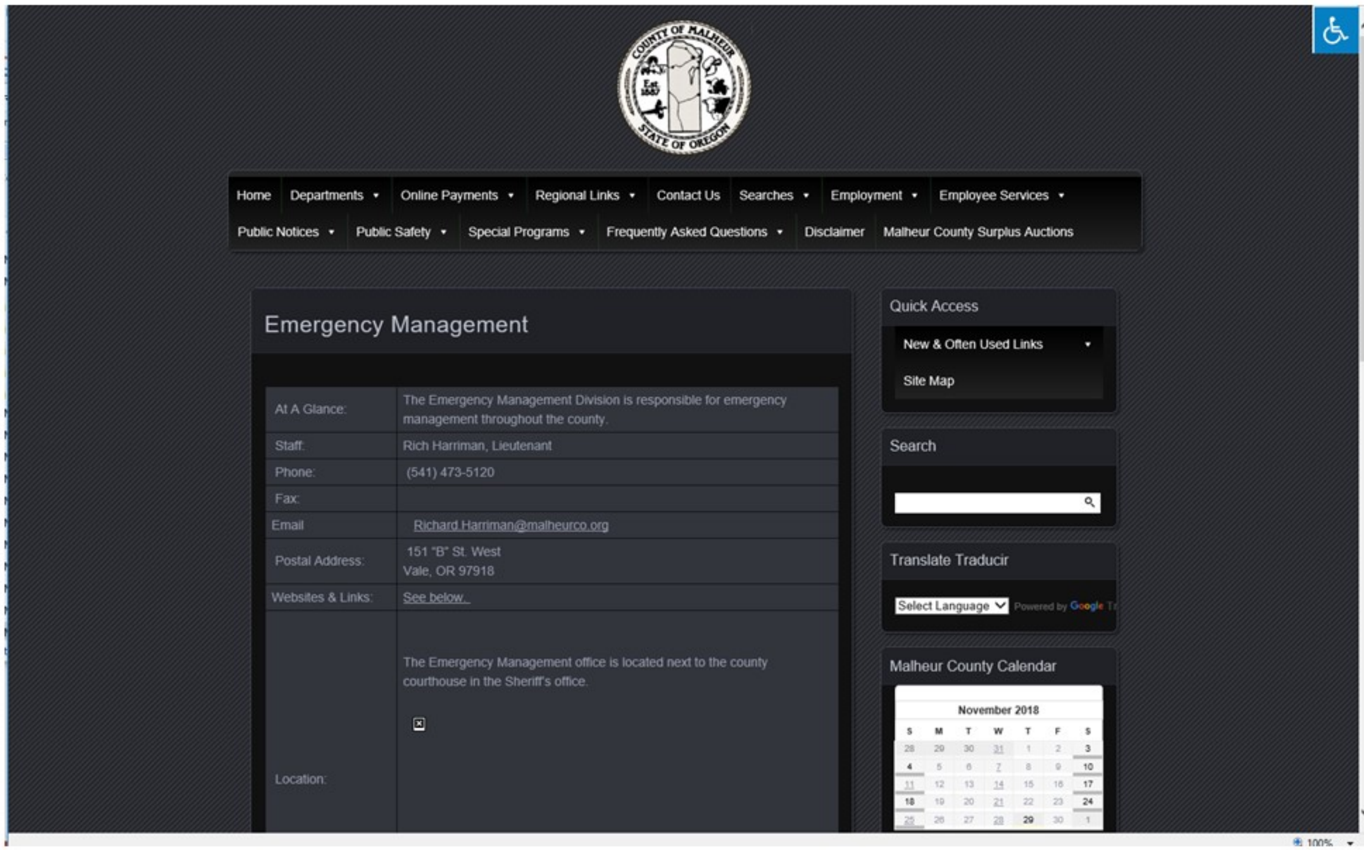


Malheur County Emergency Management Facebook 11/29/18

Malheur County Emergency Management Facebook 11/29/18

Malheur County Emergency Management Website 11/29/18

https://www.malheurco.org/emergency-management/

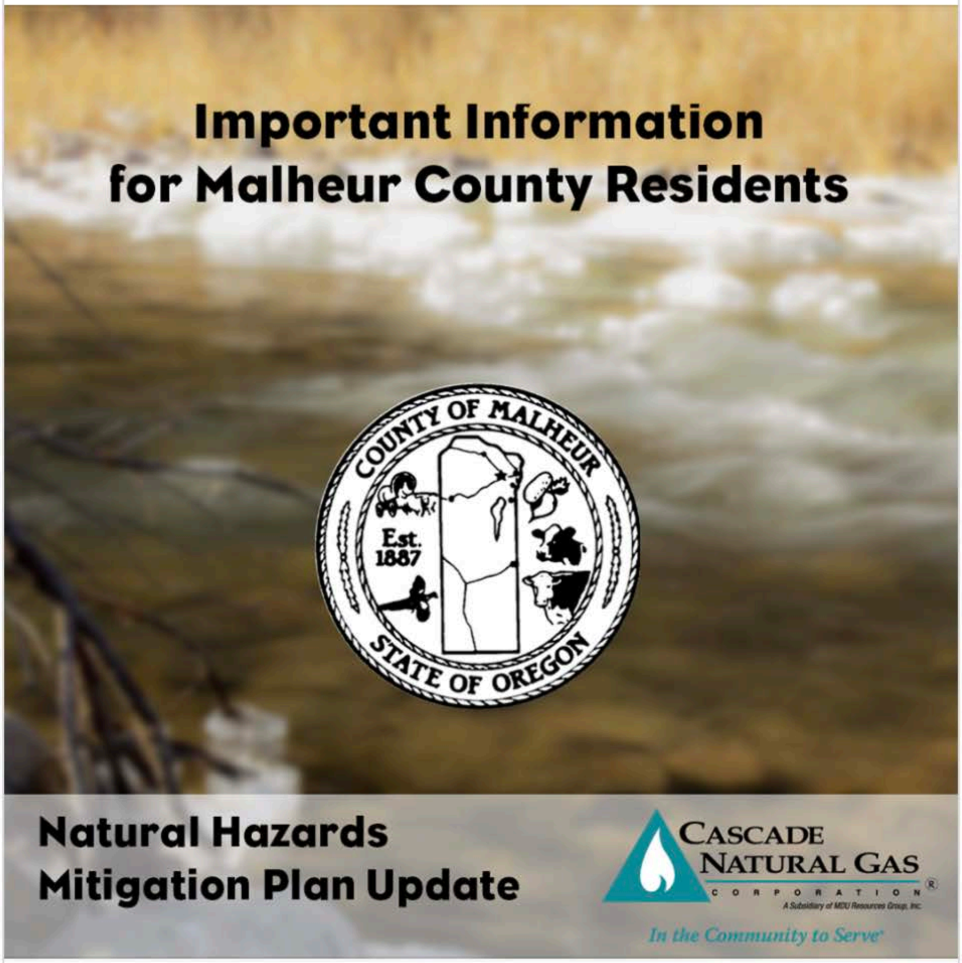


Malheur County Emergency Management Facebook 11/29/18

Posts

Cascade Natural Gas Corporation
Published by Byron Pfordte [?] · 22 hrs ·

Preparation is key to weathering any natural disaster. Malheur County Emergency Management is currently updating the county's Natural Hazards Mitigation Plan. For more information and to learn how you can provide comments, please visit https://www.malheurco.org/emergency-management/ or download their flyer at https://www.malheurco.org/.../Dep.../Sheriff/NHMPFlyer050218.pdf

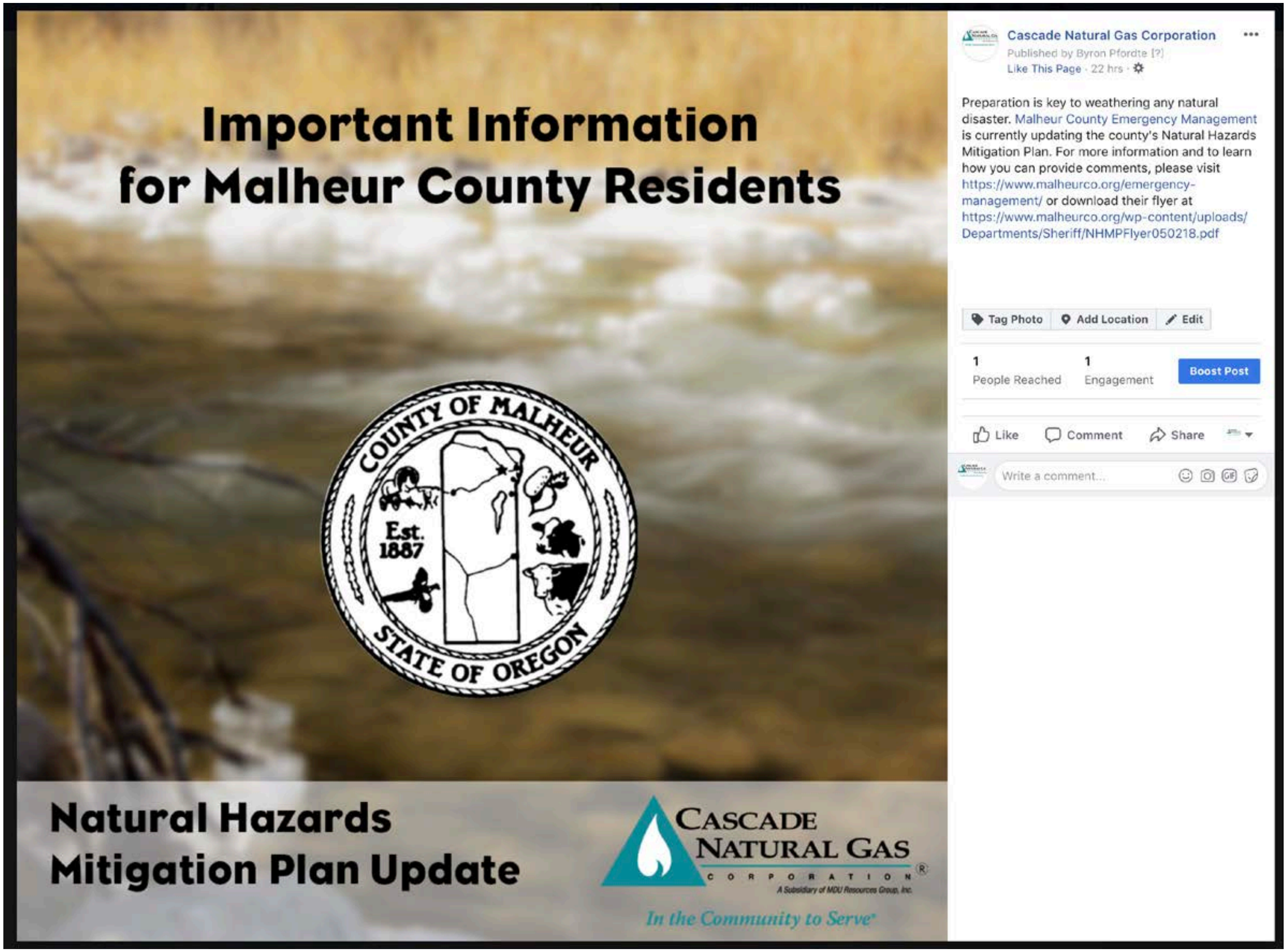


1
People Reached

1
Engagement

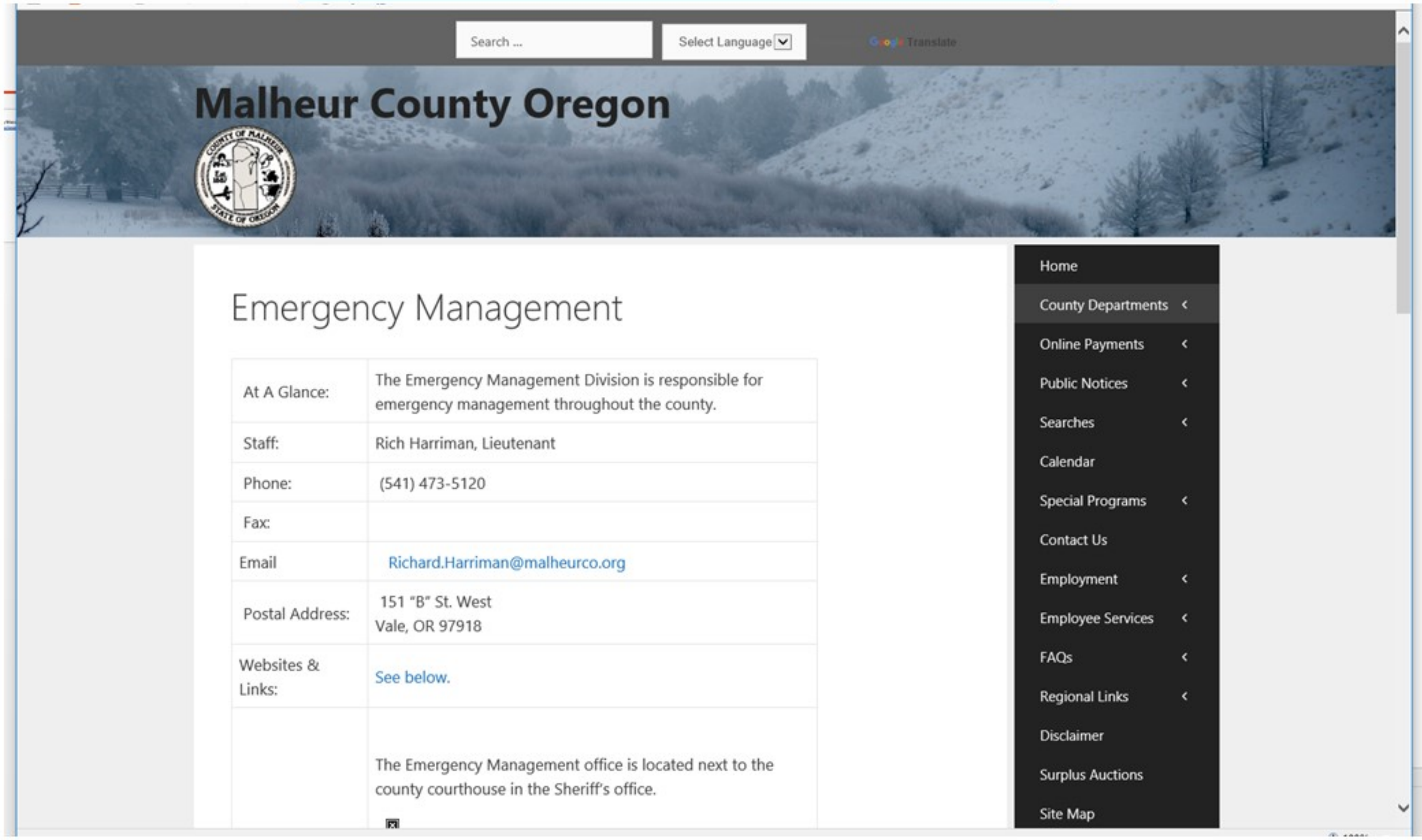
Boost Post

Like Comment Share


Important Information
for Malheur County Residents
COUNTY OF MALHEUR
Est. 1887
STATE OF OREGON
Natural Hazards
Mitigation Plan Update
CASCADE NATURAL GAS CORPORATION
In the Community to Serve
Cascade Natural Gas Corporation
Published by Byron Pfordte [?]
Like This Page · 22 hrs
Preparation is key to weathering any natural disaster. Malheur County Emergency Management is currently updating the county's Natural Hazards Mitigation Plan. For more information and to learn how you can provide comments, please visit https://www.malheurco.org/emergency-management/ or download their flyer at https://www.malheurco.org/wp-content/uploads/Departments/Sheriff/NHMPFlyer050218.pdf
Tag Photo
Add Location
Edit
1
People Reached
1
Engagement
Boost Post
Like
Comment
Share
Write a comment...

Malheur County Emergency Management Website 1/10/19

https://www.malheurco.org/emergency-management/



Search ... Select Language Google Translate

Malheur County Oregon

Emergency Management

At A Glance:	The Emergency Management Division is responsible for emergency management throughout the county.
Staff:	Rich Harriman, Lieutenant
Phone:	(541) 473-5120
Fax:	
Email	Richard.Harriman@malheurco.org
Postal Address:	151 "B" St. West Vale, OR 97918
Websites & Links:	See below.
	The Emergency Management office is located next to the county courthouse in the Sheriff's office.

- Home
- County Departments
- Online Payments
- Public Notices
- Searches
- Calendar
- Special Programs
- Contact Us
- Employment
- Employee Services
- FAQs
- Regional Links
- Disclaimer
- Surplus Auctions
- Site Map

Malheur County Emergency Management Website 1/10/19
https://www.malheurco.org/emergency-management/

In the event of an emergency, or during high water flows, information on flood warnings can be found at the National Weather Service website, at http://www.wrh.noaa.gov/boi/. During times of high water flows, when evacuation is immanent, the Emergency Alert System will also be activated, and information will be provided on KSRV radio and Boise television stations.

Malheur County
Emergency Operation Plan (EOP)

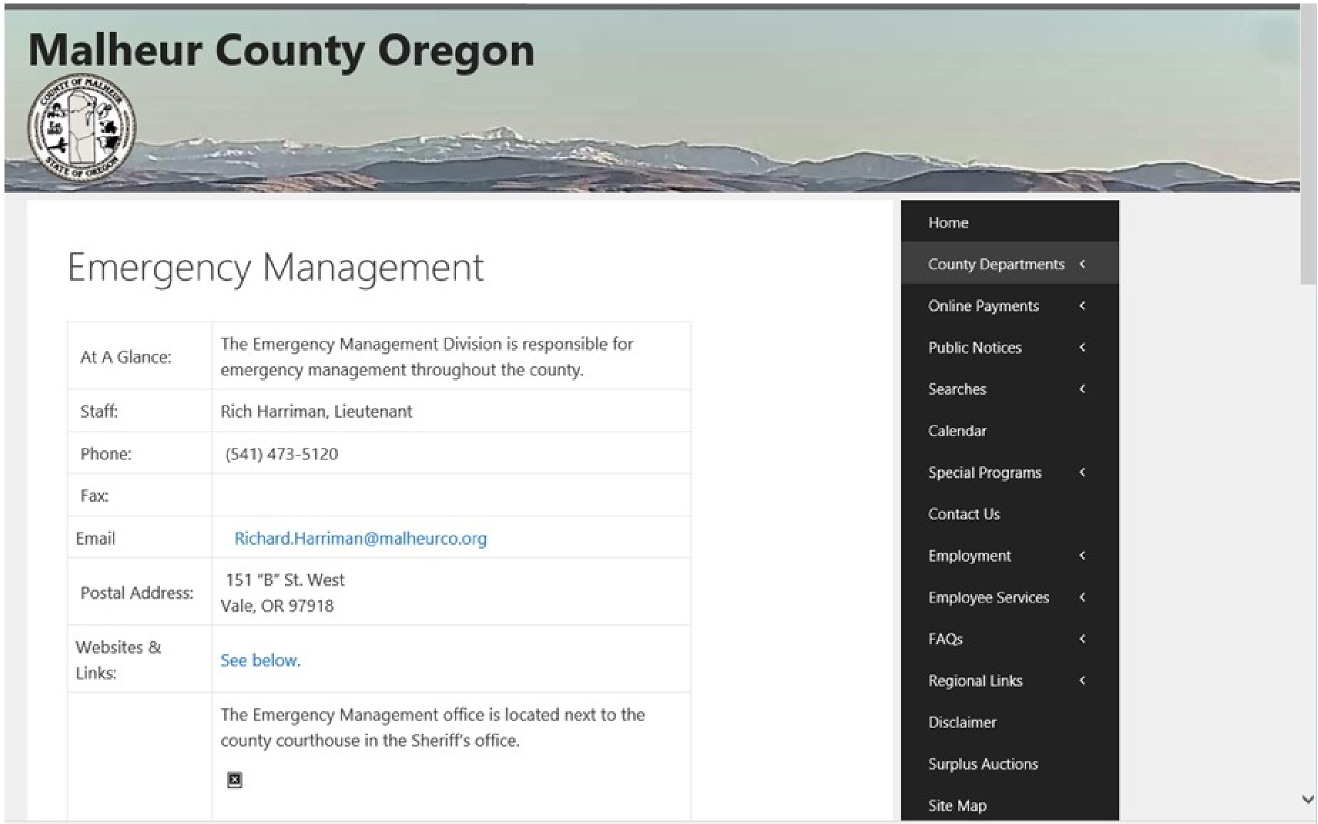
Malheur
County Community Wildfire Protection Plan

Malheur County, the Cities of Ontario, Nyssa, and Vale, as well as other organizations are collaborating with the Oregon Department of Land Conservation and Development (DLCD) to update the Natural Hazards Mitigation Plan (NHMP). Having an approved NHMP allows the County and the cities to obtain funds from FEMA to prepare for and recover from natural disasters. DLCD is providing the funding from a FEMA grant for this NHMP update. See the attached NHMP flyer for additional information or contact Rich Harriman, Malheur County Emergency Manager, at richard.harriman@malheurco.org or 541-473-5120 (office).

Watch for updates on this site.
COMING SOON

NHMP Flyer

Malheur County Emergency Management 3/20/19
https://www.malheurco.org/emergency-management/



Malheur County Oregon

Home
County Departments
Online Payments
Public Notices
Searches
Calendar
Special Programs
Contact Us
Employment
Employee Services
FAQs
Regional Links
Disclaimer
Surplus Auctions
Site Map

Emergency Management

At A Glance:	The Emergency Management Division is responsible for emergency management throughout the county.
Staff:	Rich Harriman, Lieutenant
Phone:	(541) 473-5120
Fax:	
Email	Richard.Harriman@malheurco.org
Postal Address:	151 "B" St. West Vale, OR 97918
Websites & Links:	See below.
	The Emergency Management office is located next to the county courthouse in the Sheriff's office.

Malheur County Emergency Management 3/20/19
https://www.malheurco.org/emergency-management/

In the event of an emergency, or during high water flows, information on flood warnings can be found at the National Weather Service website, at http://www.wrh.noaa.gov/boi/. During times of high water flows, when evacuation is immanent, the Emergency Alert System will also be activated, and information will be provided on KSRV radio and Boise television stations.

AlertSense
Receive Emergency Alerts & Community Notifications
Sign Up!

Malheur County
Emergency Operation Plan (EOP)

Malheur
County Community Wildfire Protection Plan

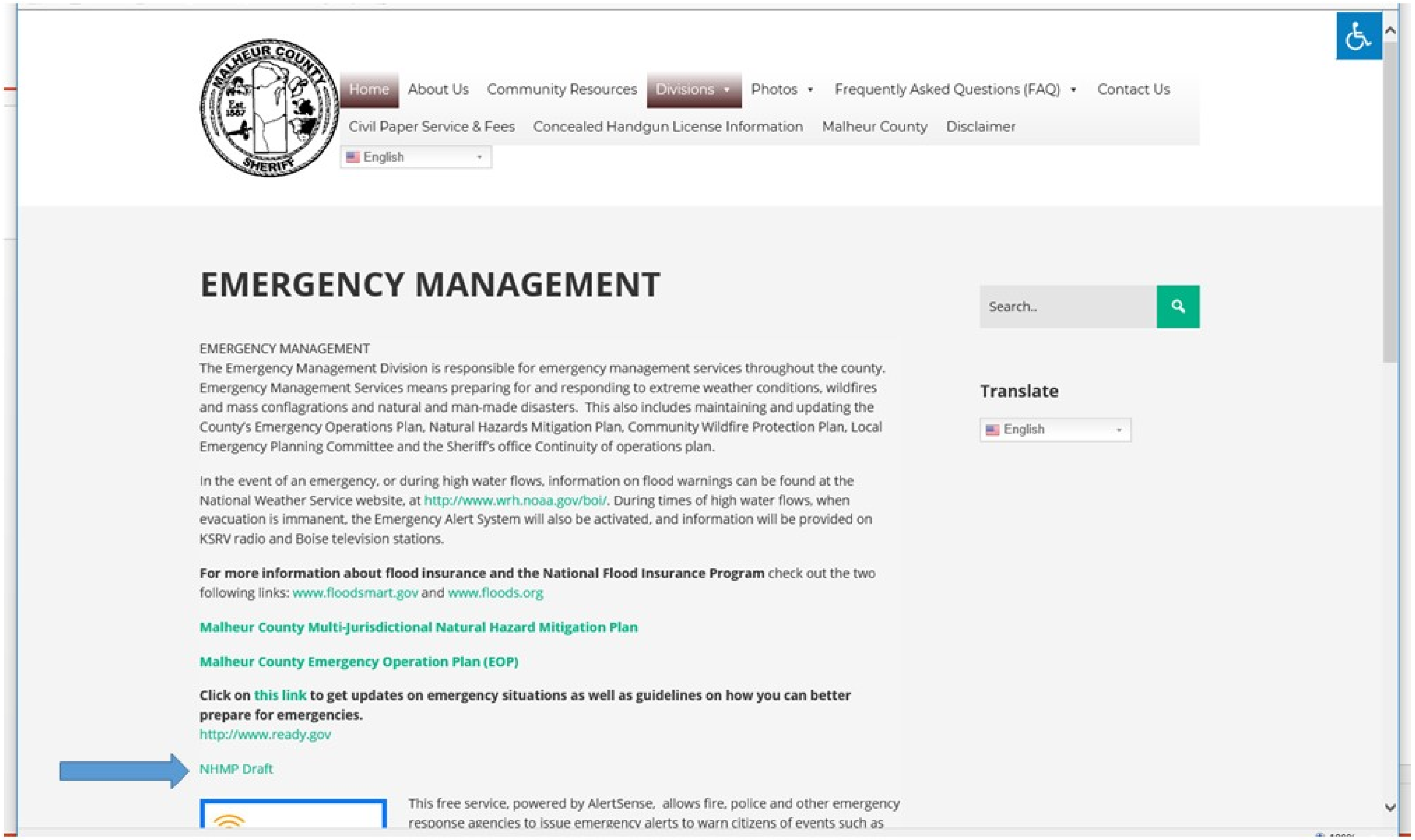
Malheur County, the Cities of Ontario, Nyssa, and Vale, as well as other organizations are collaborating with the Oregon Department of Land Conservation and Development (DLCD) to update the Natural Hazards Mitigation Plan (NHMP). Having an approved NHMP allows the County and the cities to obtain funds from FEMA to prepare for and recover from natural disasters. DLCD is providing the funding from a FEMA grant for this NHMP update. See the attached NHMP flyer for additional information or contact Rich Harriman, Malheur County Emergency Manager, at richard.harriman@malheurco.org or 541-473-5120 (office).

Watch for updates on this site.
COMING SOON

NHMP Draft

NHMP Flyer

Malheur County Sheriff 3/20/19
https://sheriff.malheurco.org/home/divisions/emergency-management/



Home About Us Community Resources Divisions Photos Frequently Asked Questions (FAQ) Contact Us

Civil Paper Service & Fees Concealed Handgun License Information Malheur County Disclaimer

English

EMERGENCY MANAGEMENT

Search..

Translate

English

EMERGENCY MANAGEMENT

The Emergency Management Division is responsible for emergency management services throughout the county. Emergency Management Services means preparing for and responding to extreme weather conditions, wildfires and mass conflagrations and natural and man-made disasters. This also includes maintaining and updating the County's Emergency Operations Plan, Natural Hazards Mitigation Plan, Community Wildfire Protection Plan, Local Emergency Planning Committee and the Sheriff's office Continuity of operations plan.

In the event of an emergency, or during high water flows, information on flood warnings can be found at the National Weather Service website, at http://www.wrh.noaa.gov/boi/. During times of high water flows, when evacuation is immanent, the Emergency Alert System will also be activated, and information will be provided on KSRV radio and Boise television stations.

For more information about flood insurance and the National Flood Insurance Program check out the two following links: www.floodsmart.gov and www.floods.org

Malheur County Multi-Jurisdictional Natural Hazard Mitigation Plan

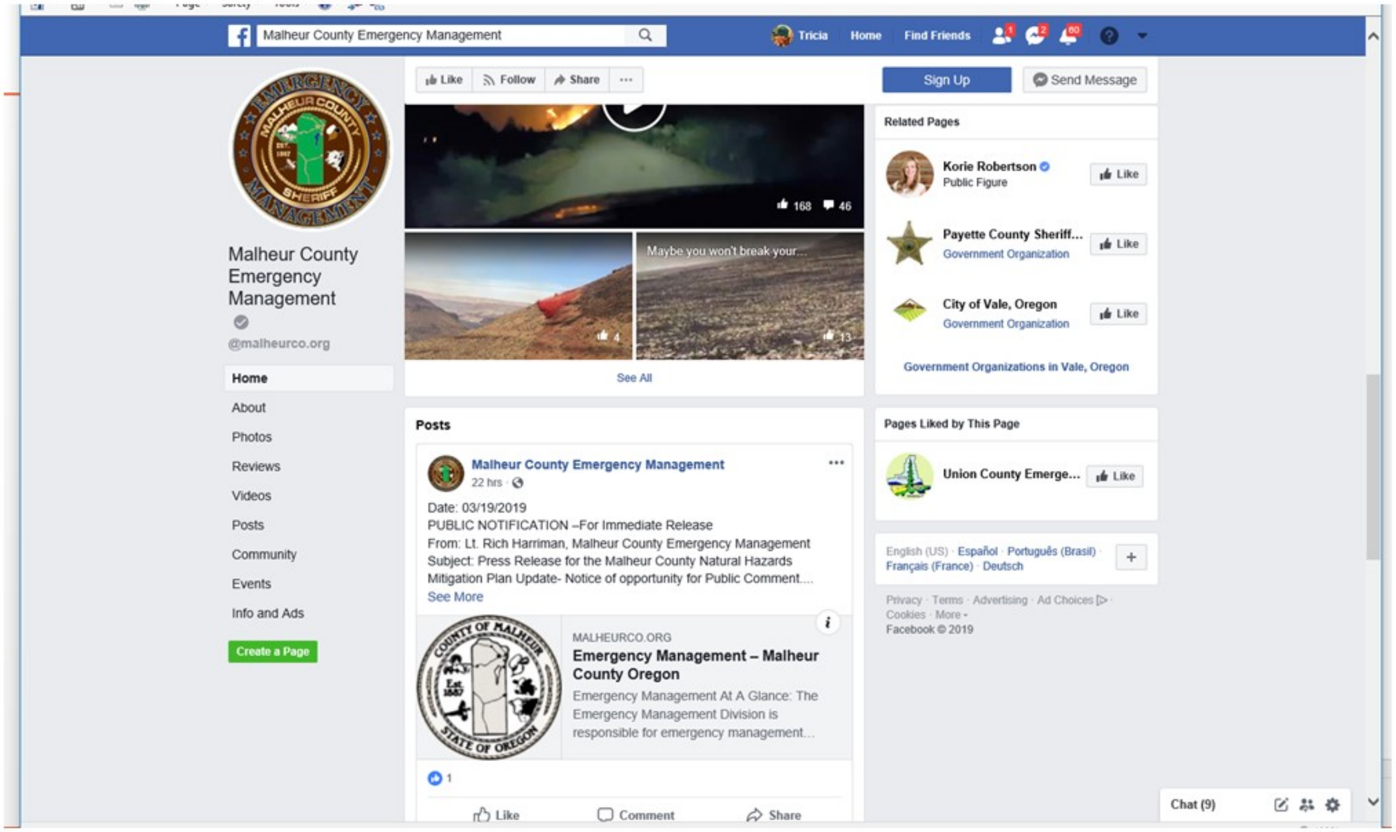
Malheur County Emergency Operation Plan (EOP)

Click on this link to get updates on emergency situations as well as guidelines on how you can better prepare for emergencies.
http://www.ready.gov

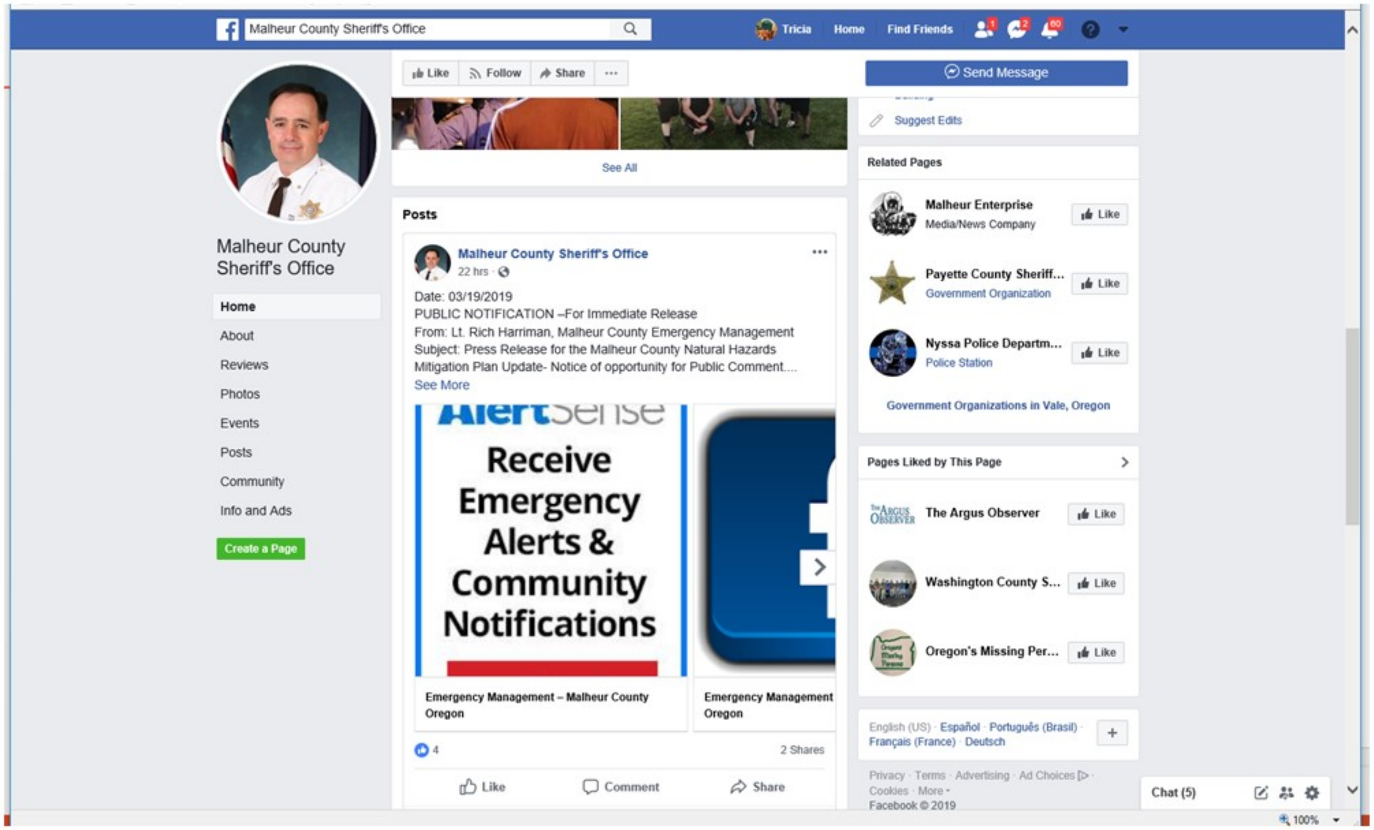
NHMP Draft

This free service, powered by AlertSense, allows fire, police and other emergency response agencies to issue emergency alerts to warn citizens of events such as

Malheur County Emergency Management Facebook 3/20/19



Malheur County Sheriff Facebook 3/20/19



Malheur County Emergency Management Press Release re: Draft NHMP for Review

Malheur County Sheriff

Brian E. Wolfe

Travis Johnson — *Undersheriff*
Rachel Reyna — *Jail Commander*
Rich Harriman — *Emergency Services/911 Commander*
Jim St. Michell — *Community Corrections Commander*

Date: 03/19/2019
PUBLIC NOTIFICATION –For Immediate Release
From: Lt. Rich Harriman, Malheur County Emergency Management
Subject: Press Release for the Malheur County Natural Hazards Mitigation Plan Update- Notice of opportunity for Public Comment.

Malheur County seeks additional public input on the update of the Natural Hazards Mitigation Plan

Malheur County is currently in the process of updating the existing Natural Hazards Mitigation Plan (NHMP). This work is being performed in cooperation with the Oregon Department of Land Conservation and Development, Oregon Emergency Management and the Federal Emergency Management Agency (FEMA), Pre-disaster Mitigation Grant Program. With re-adoption of the plan, Malheur County will maintain its eligibility to apply for federal funding toward natural hazard mitigation projects. This local planning process includes a wide range of representatives from city and county government and emergency management personnel. This NHMP also affects the City of Nyssa, the City of Ontario, and the City of Vale.

A natural hazards mitigation plan provides communities with a set of goals, mitigation action items and resources designate to reduce risk form 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.

A draft version of our updated plan can be found at https://www.malheurco.org/emergency-management/ or at https://sheriff.malheurco.org/home/divisions/emergency-management/ Public comment will be taken until April 9, 2019.

To comment on this Natural Hazards Mitigation Plan, please contact Lt. Rich Harriman at Malheur County Emergency Management at (541) 473-5120, rharriman@malheurco.org ; or Tricia Sears at the Oregon Department of Land Conservation and Development at (503) 934-0031, tricia.sears@state.or.us .

151 'B' STREET WEST • VALE, OREGON 97918
Dispatch (541) 473-5126 • Jail (541) 473-5510 • Administration (541) 473-5126 • Fax (541) 473-5504

Malheur County Public Notice in the Ontario Argus Observer on March 22, 2019

MALHEUR COUNTY EMERGENCY MANAGEMENT
PUBLIC NOTICE

Malheur County seeks additional public input on the update of the Natural Hazards Mitigation Plan.

Malheur County is currently in the process of updating the existing Natural Hazards Mitigation Plan (NHMP). This work is being performed in cooperation with the Oregon Department of Land Conservation and Development, Oregon Emergency Management and the Federal Emergency Management Agency (FEMA), Pre-disaster Mitigation Grant Program. With re-adoption of the plan, Malheur County will maintain its eligibility to apply for federal funding toward natural hazard mitigation projects. This local planning process includes a wide range of representatives from city and county government and emergency management personnel. This NHMP also affects the City of Nyssa, the City of Ontario, and the City of Vale.

A natural hazards mitigation plan provides communities with a set of goals, mitigation action items and resources designated 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.

A draft version of our updated plan can be found at https://www.malheurco.org/emergency-management/ or at
https://sheriff.malheurco.org/home/divisions/emergency-management/
Public comment will be taken until April 9, 2019.

To comment on this Natural Hazards Mitigation Plan, please contact Lt. Rich Harriman at Malheur County Emergency Management at (541) 473-5120, rharriman@malheurco.org ; or Tricia Sears at the Oregon Department of Land Conservation and Development at (503) 934-0031, tricia.sears@state.or.us .

Legal Number- 145455
Publikshed: March 22, 2019

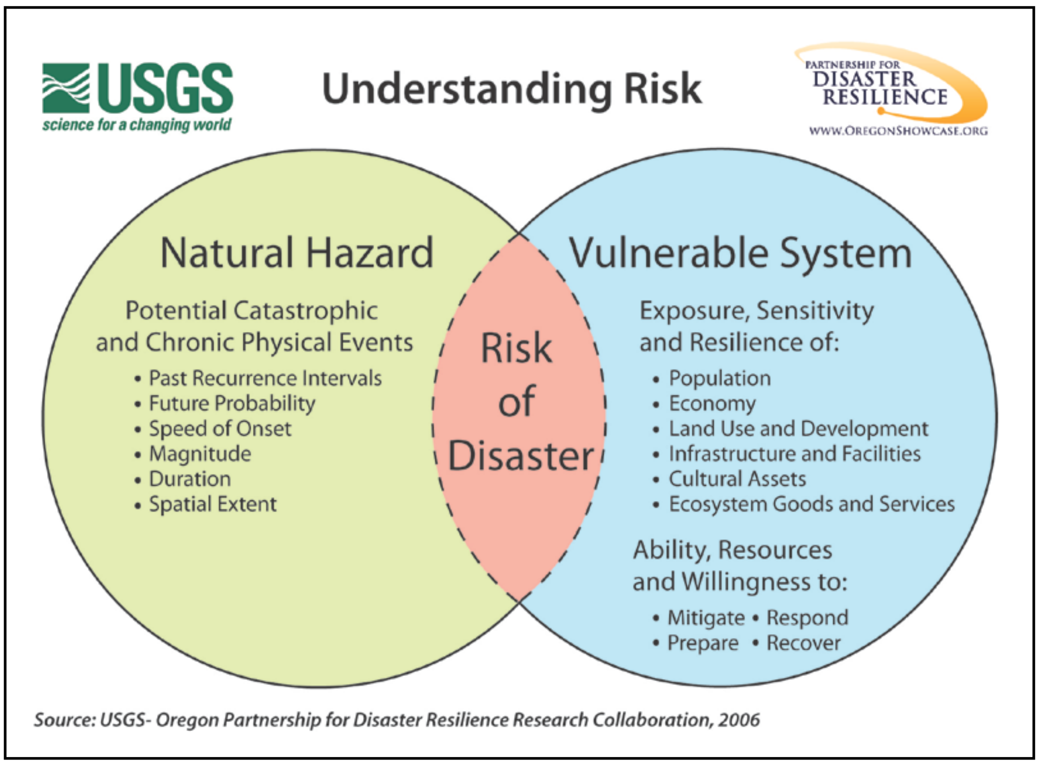
APPENDIX C: COMMUNITY PROFILE

Community resilience can be defined as the community's ability to manage risk and adapt to natural hazard impacts. It is the ability to use available resources to respond to, withstand, and recover from adverse situations.[1] To help define and understand Malheur County's and the Cities' resilience to natural hazards, the following capacities are examined in this Community Profile:

- Natural Environment,
- Socio-Demographic,
- Regional Economic,
- Built or Infrastructure,
- Community Connectivity, and
- Political.

The Community Profile provides a snapshot in time when the NHMP was updated. It assists in establishing mitigation actions and in preparation of a more resilient community. The identification of mitigation actions that reduce Malheur County's and the Cities' sensitivity and exposure, and increases its resiliency, assists in reducing overall risk of disaster. See Figure C-1.

Figure C-1 Understanding Risk



Source: *2014 Malheur County NHMP*, Oregon Partnership for Disaster Resilience, 2006.

[1] Wikipedia, *Community Resilience*, https://en.wikipedia.org/wiki/Community_resilience

Natural Environment Capacity

Natural environment capacity is the geography, climate, and land cover of the area such as, urban, water, and forested lands that maintain clean water, air, and a stable climate.[2] Natural resources such as wetlands and forested hill slopes play significant roles in protecting communities and the environment from natural hazards, such as flooding and landslides. However, natural systems are often impacted or depleted by human activities adversely affecting community resilience.

Geography

Malheur County is located in the southeast corner of Eastern Oregon, covering 9,926 square miles. It is the second largest county in Oregon. The region is diverse and comprised of high desert, mountain ranges, plateaus, river valleys, grasslands, and partly forested mountains, with elevations ranging from 2,000 to 8,000 feet above sea level.

Malheur County is located within two eco-regions: the Northern Basin and Range and the Snake River Plain. The Northern Basin and Range eco-region includes lava plains, rolling hills, alluvial fans, and valleys and scattered mountains. The Snake River Plain is lower and less rugged than the surrounding areas.[3] Slopes in Malheur County are generally flat, though there are few areas susceptible to landslide. Flash floods are common in arid and semi-arid regions where there is steep topography, little vegetation, and short but intense rainfall. Notable geographic areas include Owyhee Plateau, Trout Creek Mountains, and Sheepshead Mountains.

The Owyhee Plateau was created by volcanic activity and is centered at the intersection between Oregon, Idaho, and Nevada borders. The collision of the North American Plain with the Yellowstone mantle plume is considered to the responsible for the creation of the Owyhee Plateau.[4]

The Trout Creek Mountains are located in southern Malheur County and extend into Nevada. The highest peak is Orevada View Benchmark (8,506 feet). The area has very little human development and is primarily managed by the Bureau of Land Management (BLM). Grazing allotments are provided throughout the mountains.

The Sheepshead Mountains are located in the west central part of Malheur County east of the Alford Desert. The area has very little human development and is primarily managed by the Bureau of Land Management (BLM). Grazing allotments are provided throughout the mountains.

Current and Projected Climate

Many places in Malheur County receive relatively low levels of precipitation, approximately 10 inches per year (see Table C-1), except for a few more mountainous areas. This is in sharp contrast to the 37 to 50 inches normally seen in other parts of the Pacific Northwest. There is large annual temperature variation from high temperatures of 80 to 90 degrees F from June to September to average highs of low teens in the winter months (see Table C-2). In most winters, there are frequent

---

[2] Mayunga, J. 2007, *Understanding and Applying the Concept of Community Disaster Resilience: A Capital-Based Approach*. Summer Academy for Social Vulnerability and Resilience Building.

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

[4] *2014 Malheur County NHMP*, Owyhee Plateau-Snake River Plain-Yellowstone Plateau, http://www.clas.ufl.edu/users/pciesiel/gly3150/snake.html, accessed March 2013 (link broken).

and severe winter storms characterized by temperature, wind velocity, ground saturation, and snow pack. Winter storms can slow or halt traffic, damage power lines, and kill livestock. Summer precipitation is very low, increasing the risk of wildfire and requiring irrigation for crops.

See Volume II Hazard Annexes on hazard-specific information. The Severe Weather Annex also includes climate information. See Appendix G for the *Future Climate Projections* report produced by the Oregon Climate Change Research Institute (OCCRI).

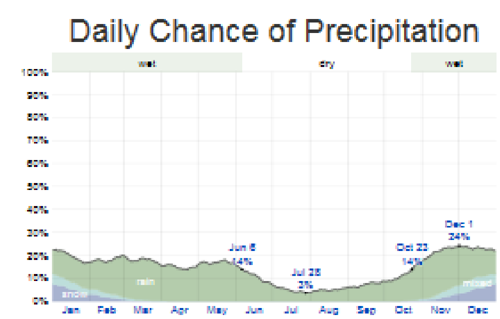
Precipitation, Rainfall, and Snowfall

The average annual precipitation is comparable at different NOAA stations throughout Malheur County. Precipitation includes snowfall unless otherwise specified. Table C-1 shows the monthly average and the annual average precipitation for five locations in Malheur County. Figures that illustrate that include Figure C-2 which shows the average daily chance of precipitation throughout the year in Ontario, and Figure C-3 which shows the average monthly rainfall in Ontario throughout the year.

Precipitation

A wet day is one with at least 0.04 inches of liquid or liquid-equivalent precipitation. The chance of wet days in Ontario varies throughout the year. The wetter season lasts 7.4 months, from October 23 to June 6, with a greater than 14% chance of a given day being a wet day. The chance of a wet day peaks at 24% on December 1. Among wet days, there is a distinction between those that experience rain alone, snow alone, or a mixture of the two. Based on this categorization, the most common form of precipitation throughout the year is rain alone, with a peak probability of 19% on November 10. The drier season lasts 4.5 months, from June 6 to October 23. The smallest chance of a wet day is 3% on July 28.[5]

Figure C-2 Daily Chance of Precipitation



The percentage of days in which various types of precipitation are observed, excluding trace quantities: rain alone, snow alone, and mixed (both rain and snow fell in the same day).

Source: Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

[5]Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

Table C-1 Average Precipitation (Inches) for Five Locations in Malheur County

Month	Ontario	Nyssa	Vale	Owyhee Dam	Danner
January	1.18	1.22	1.05	.92	1.15
February	.8	.92	.82	.76	.79
March	1.01	.99	.99	.89	1.06
April	.8	.89	.84	.96	1.12
May	1.28	1.16	1.17	1.16	1.41
June	.69	.86	.86	.92	.96
July	.30	.25	.38	.43	.32
August	.18	.27	.27	.38	.30
September	.41	.46	.46	.45	.51
October	.63	.69	.65	.64	.67
November	1.10	1.16	1.07	.92	1.14
December	1.68	1.5	1.46	1.25	1.47
Annual	10.06	10.37	10.02	9.68	10.9

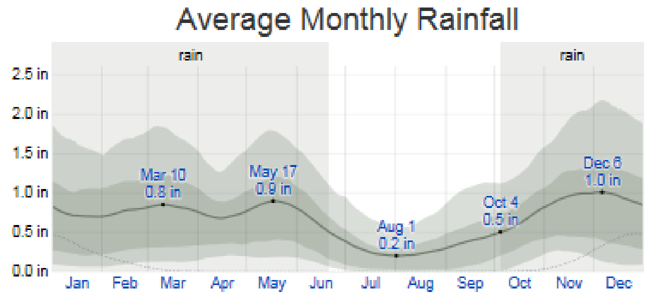
Source: NOAA Centers for Environmental Information, Data Tools: 1981-2010 Normals, https://www.ncdc.noaa.gov/cdo-web/datatools/normals, accessed March 8, 2019.

Rainfall

To show variation within the months and not just the monthly totals, Figure C-3 shows the rainfall accumulated over a sliding 31-day period centered around each day of the year. Ontario experiences some seasonal variation in monthly rainfall. The rainy period of the year lasts for 8.5 months, from October 4 to June 21, with a sliding 31-day rainfall of at least 0.5 inches. The most rain falls during the 31 days centered around December 6, with an average total accumulation of 1.0 inches. The rainless period of the year lasts for 3.5 months, from June 21 to October 4. The least rain falls around August 1, with an average total accumulation of 0.2 inches.[6]

[6]Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

Figure C-3 Average Monthly Rainfall



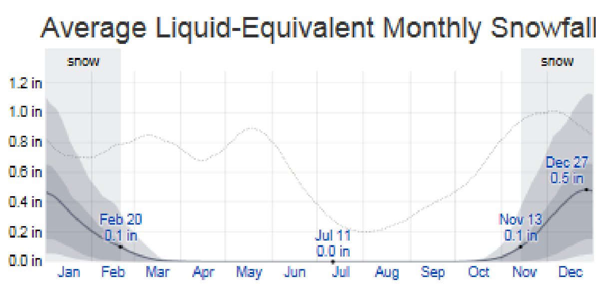
The average rainfall (solid line) accumulated over the course of a sliding 31-day period centered on the day in question, with 25th to 75th and 10th to 90th percentile bands. The thin dotted line is the corresponding average liquid-equivalent snowfall.

Source: Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

Snowfall

Snowfall is shown in Figure C-4 in liquid-equivalent terms. The actual depth of new snowfall is typically between 5 and 10 times the liquid-equivalent amount, assuming the ground is frozen. Colder, drier snow tends to be on the higher end of that range and warmer, wetter snow on the lower end. As with rainfall, the snowfall accumulated over a sliding 31-day period centered around each day of the year. Ontario experiences some seasonal variation in monthly liquid-equivalent snowfall. The snowy period of the year lasts for 3.2 months, from November 13 to February 20, with a sliding 31-day liquid-equivalent snowfall of at least 0.1 inches. The most snow falls during the 31 days centered around December 27, with an average total liquid-equivalent accumulation of 0.5 inches. The snowless period of the year lasts for 8.8 months, from February 20 to November 13. The least snow falls around July 11, with an average total liquid-equivalent accumulation of 0.0 inches. [7]

Figure C-4 Average Liquid-Equivalent Monthly Snowfall



The average liquid-equivalent snowfall (solid line) accumulated over the course of a sliding 31-day period centered on the day in question, with 25th to 75th and 10th to 90th percentile bands. The thin dotted line is the corresponding average rainfall.

Source: Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

[7] Mote, Philip W., et. al., *Variability and trends in Mountain Snowpack in Western North America*, http://cses.washington.edu/db/pdf/moteetalvarandtrends436/pdf, accessed February 2013, link broken as of March 5, 2019.

Total precipitation in the Pacific Northwest region may remain similar to historic levels but climate projections indicate the likelihood of increased winter precipitation and decreased summer precipitation. Increasing temperatures affects hydrology in the region. Spring snowpack has substantially decreased throughout the Western part of the United States, particularly in areas with milder winter temperatures, such as the Cascade Mountains. In other areas of the West, such as east of the Cascades Mountains, snowfall is affected less by the increasing temperature because it temperatures are already cold and more by precipitation patterns.[8]

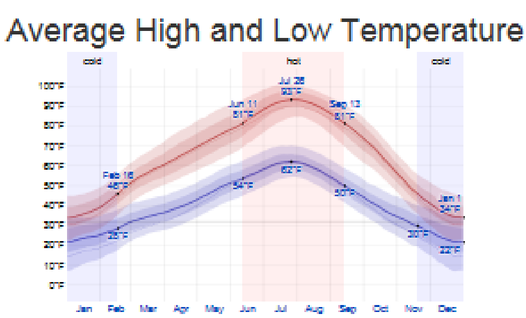
Temperature

There is a large temperature range in Malheur County. At the Malheur Branch Experimental Station near Ontario, extreme temperatures vary from a low of -24 degrees to a high of 106 degrees. The table below shows the average annual temperature (elevation approximately 2,260 feet).

Temperatures in the Pacific Northwest region increased in the 20th Century by about 1.5 degrees Fahrenheit. Climate projection models indicate that temperatures could increasingly rise by an average of 0.2 degrees to 1.0 degrees Fahrenheit per decade. Average temperature change is projected to be 3.2 degrees Fahrenheit by 2040 and 5.3 degrees Fahrenheit by 2080. Temperature increases will occur throughout all seasons, with the greatest different in summer months.[9]

The hot season lasts for 3.0 months, from June 11 to September 13, with an average daily high temperature above 81°F. The hottest day of the year is July 26, with an average high of 93°F and low of 62°F. The cold season lasts for 2.9 months, from November 20 to February 16, with an average daily high temperature below 46°F. The coldest day of the year is January 1, with an average low of 22°F and high of 34°F.[10]

Figure C-5 Average High and Low Temperature in Ontario, Oregon



The daily average high (red line) and low (blue line) temperature, with 25th to 75th and 10th to 90th percentile bands. The thin dotted lines are the corresponding average perceived temperatures.

Source: Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

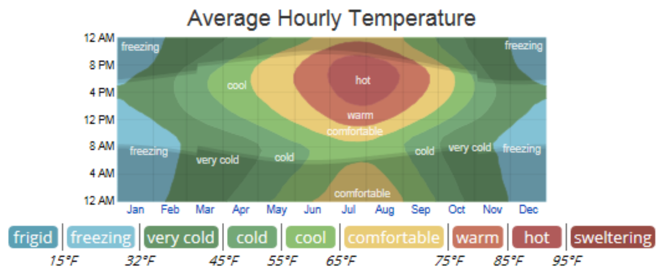
[8] Ibid.

[9] Climate Impacts Group, *Climate Change*, http://cses.washington.edu/cig/pnwc/cc.shtml#anchor6, accessed February 2013, re-confirmed March 5, 2019.

[10] Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

Figure-6 shows a compact characterization of the hourly average temperatures for the quarter of the year centered on November. The horizontal axis is the day, the vertical axis is the hour of the day, and the color is the average temperature for that hour and day.

Figure C-6 Average Hourly Temperature in Ontario, Oregon



The average hourly temperature, color coded into bands. The shaded overlays indicate night and civil twilight.

Source: Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

Table C-2 Average Temperature (Degrees F) for Five Locations in Malheur County

Month	Ontario	Nyssa	Vale	Owyhee Dam	Danner
January	27.5	28.3	28.4	29.7	27.4
February	33.3	34.1	34.6	34.5	31.5
March	43.4	43.9	44.3	43.1	38.9
April	50.4	51.1	50.6	49.6	44.3
May	59.4	59.3	59.8	57.8	52.3
June	67.9	67.2	67.7	65.7	59.7
July	76.1	75.1	75.9	73.3	67.7
August	73.3	73.1	73.5	71.9	66.1
September	63.0	62.8	63.0	62.7	57.0
October	50.3	50.7	50.1	51.3	45.8
November	37.1	37.8	37.4	38.2	34.8
December	27.8	28.6	28.3	29.3	27.0
Annual	50.9	51.1	51.2	50.7	46.1

Source: NOAA Centers for Environmental Information, Data Tools: 1981-2010 Normals, https://www.ncdc.noaa.gov/cdo-web/datatools/normals, accessed March 8, 2019

Table C-3 Min/Max Temperature (Degrees F) for Five Locations in Malheur County

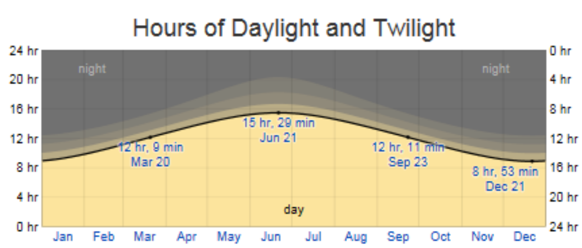
Month	Ontario	Nyssa	Vale	Owyhee Dam	Danner
January	19.6/35.4	20.8/35.8	21.5/35.3	20.4/39.1	17.3/37.4
February	23.2/43.4	23.9/44.3	25.3/43.8	23.2/45.8	19.8/43.1
March	30.4/56.4	31.2/56.6	32.8/55.8	29.6/56.6	26.5/51.3
April	35.9/64.8	36.9/65.3	37.4/63.9	34.6/64.6	29.8/58.7
May	1.28/74.5	45.0/73.7	45.7/73.8	41.6/73.9	1.41/67.0
June	52.2/83.6	52.1/82.4	52.8/82.5	48.1/83.3	43.9/75.5
July	58.4/93.7	58.5/91.8	58.9/93.0	53.4/93.3	48.9/86.6
August	44.8/91.9	55.7/90.5	56.0/90.9	51.8/92.1	46.6/85.5
September	44.8/81.2	45.7/79.8	46.0/80.0	44.1/81.3	38.2/75.8
October	34.3/66.2	35.4/65.9	36.1/64.0	35.1/67.5	28.9/62.6
November	1.10/48.0	27.4/48.2	28.2/46.7	26.3/50.1	23.0/46.7
December	1.68/36.0	20.8/36.4	20.8/35.7	19.5/39.2	17.0/37.1
Annual	37.1/64.7	37.8/64.3	38.5/63.9	35.7/65.7	31.5/60.7

Source: NOAA Centers for Environmental Information, Data Tools: 1981-2010 Normals, https://www.ncdc.noaa.gov/cdo-web/datatools/normals, accessed March 8, 2019

Sun

The length of the day in Ontario varies significantly during the year. In 2019, the shortest day is December 21, with 8 hours, 53 minutes of daylight; the longest day is June 21, with 15 hours, 29 minutes of daylight.[11]

Figure C-7 Hours of Daylight and Twilight in Ontario, Oregon



The number of hours during which the Sun is visible (black line). From bottom (most yellow) to top (most gray), the color bands indicate: full daylight, twilight (civil, nautical, and astronomical), and full night.

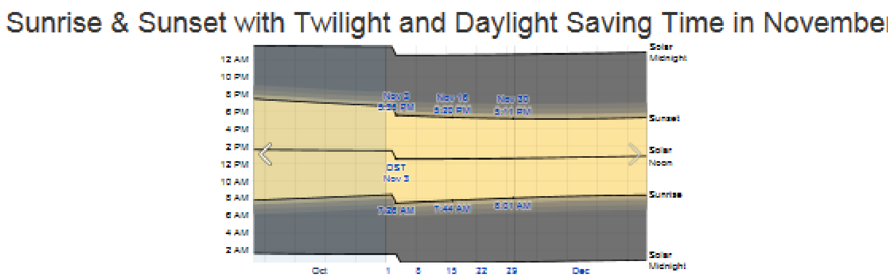
Source: Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

[11] Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

The earliest sunrise is at 6:04 AM on June 15, and the latest sunrise is 2 hours, 21 minutes later at 8:25 AM on November 2. The earliest sunset is at 5:09 PM on December 10, and the latest sunset is 4 hours, 25 minutes later at 9:34 PM on June 26.[12]

Daylight saving time (DST) is observed in Ontario during 2019, starting in the spring on March 10, lasting 7.8 months, and ending in the fall on November 3.[13]

Figure C-8 Sunrise and Sunset with Twilight and Daylight Savings Time in November



The solar day over the course of November. From bottom to top, the black lines are the previous solar midnight, sunrise, solar noon, sunset, and the next solar midnight. The day, twilights (civil, nautical, and astronomical), and night are indicated by the color bands from yellow to gray. The transitions to and from daylight saving time are indicated by the 'DST' labels.

Source: Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

Humidity

The humidity comfort level is based on the dew point, as it determines whether perspiration will evaporate from the skin, thereby cooling the body. Lower dew points feel drier and higher dew points feel more humid. Unlike temperature, which typically varies significantly between night and day, dew point tends to change more slowly, so while the temperature may drop at night, a muggy day is typically followed by a muggy night.[14]

The chance that a given day will be muggy in Ontario is essentially constant during November, remaining around 0% throughout. For reference, on August 3, the muggiest day of the year, there are muggy conditions 0% of the time, while on September 23, the least muggy day of the year, there are muggy conditions 0% of the time.[15]

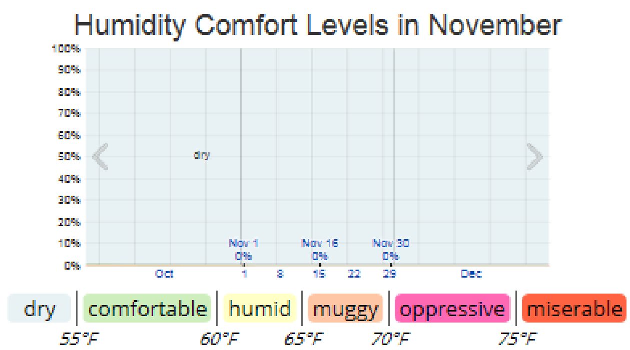
[12] Ibid.

[13] Ibid.

[14] Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

[15] Ibid.

Figure C-9 Humidity Comfort Levels in November



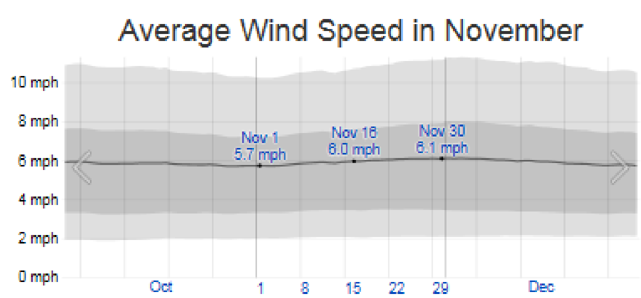
The percentage of time spent at various humidity comfort levels, categorized by dew point.

Source: Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

Wind

This section discusses the wide-area hourly average wind vector (speed and direction) at 10 meters above the ground. The wind experienced at any given location is highly dependent on local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages. The average hourly wind speed in Ontario is essentially constant during November, remaining within 0.2 miles per hour of 5.9 miles per hour throughout. For reference, on April 11, the windiest day of the year, the daily average wind speed is 7.3 miles per hour, while on January 10, the calmest day of the year, the daily average wind speed is 5.6 miles per hour.[16]

Figure C-10 Average Wind Speed in November



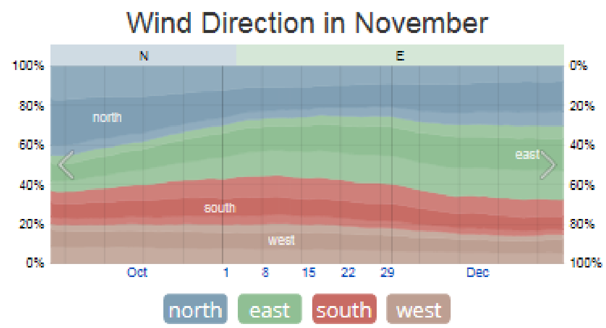
The average of mean hourly wind speeds (dark gray line), with 25th to 75th and 10th to 90th percentile bands.

Source: Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

[16] Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

The wind direction in Ontario during November is predominantly out of the north from November 1 to November 3 and the east from November 3 to November 30.[17]

Figure C-11 Wind Direction in November



The percentage of hours in which the mean wind direction is from each of the four cardinal wind directions, excluding hours in which the mean wind speed is less than 1.0 mph. The lightly tinted areas at the boundaries are the percentage of hours spent in the implied intermediate directions (northeast, southeast, southwest, and northwest).

Source: Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

Hazard Severity

As described in the introduction to the Hazard Annexes (HA), the state climate change information in the *2015 Oregon NHMP* indicates that hazards projected to be impacted by climate change in Malheur County include drought and wildfire. Climate models project warmer drier summers and a decline in mean summer precipitation for Oregon. Winter storms and wind storms also affect Malheur County. There is an increasing amount of research on how climate change influences these hazards and others in the Pacific Northwest.

As part of the PDM 16 grants, the Department of Land Conservation and Development (DLCD) contracted with the Oregon Climate Change Research Institute (OCCRI) to provide an analysis of climate change influences on natural hazards. The details of this information are provided in Appendix F Future Climate Projections Reports: *Future Climate Projections: Malheur County* and *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports.*

Table HA-2 provides an overview of expected climate change impacts for Malheur County. The table shows the direction of change (increasing, decreasing, and unchanging) and indicates the level of confidence in direction of change (high, medium, and low).

According to the OCCRI reports:

- There is high confidence that heat waves will increase and that cold waves will decrease.
- There is medium confidence that heavy rains, river flooding, wildfire, droughts, prevalence of invasive species, and loss of wetland ecosystems will increase.

[17] Weather Spark, *Average Weather in Ontario*, Oregon, https://weatherspark.com/y/2166/Average-Weather-in-Ontario-Oregon-United-States-Year-Round#Sections-Precipitation, accessed March 5, 2019.

Of note, the climate metrics used by OCCRI do not exactly match the natural hazards identified by Malheur County.

Land Use

The majority of Malheur County has a low population density. Over half of the population resides in the five incorporated cities. Four of those incorporated cities are located in the northeastern corner of the County and all five are within 30 miles from the Idaho border. The majority of land within Malheur County is rangeland (94%). The Bureau of Land Management owns 72.8% of the land in Malheur County as shown in Table C-4.[18] Other land uses are irrigated agriculture and mining activity. The Western Treasure Valley, located in the northeastern corner of the County, is a center for intensive and diverse farming on irrigated fields.[19]

Drought is a significant risk in the region due to limited annual rainfall and threatens the economic reliance on agriculture activity. Therefore, the County relies on the functionality of irrigation systems. Wildfires pose a threat for the many rangeland areas as they are part of the high desert Western ecosystem and pass quickly through grasslands. As described in Volume I Section 2 Risk Assessment, for the eleven identified natural hazards impacting Malheur County and the Cities, drought had the highest risk score in the Hazard Vulnerability Assessment (HVA), with winter storms second, wind storms third, floods fourth, and wildfire was fifth. See Table 2-5 for details.

Table C-4 Land Ownership in Malheur County

BLM Socioeconomic Profile

Malheur County, OR

Land Ownership

Land Ownership, Acres	Malheur County, OR	United States
Total Area	6,354,985	2,301,106,907
Private Lands	1,408,432	1,383,075,581
Federal Lands	4,642,777	649,455,740
BLM	4,626,851	242,951,818
Forest Service	3,803	192,507,338
Other Federal	12,123	213,996,584
Tribal Lands	18,219	66,666,114
State, City, County, Other	285,556	201,909,462
Percent of Total		
Private Lands	22.2%	60.1%
Federal Lands	73.1%	28.2%
BLM	72.8%	10.6%
Forest Service	0.1%	8.4%
Other Federal	0.2%	9.3%
Tribal Lands	0.3%	2.9%
State, City, County, Other	4.5%	8.8%

Source: BLM Socioeconomic Profile for Malheur County, accessed March 11, 2019, https://headwaterseconomics.org/tools/blm-profiles/

Synthesis

The physical geography, weather, climate, land use, and land cover of an area represent various interrelated systems that affect overall risk and exposure to natural hazards. The projected climate

[18] The Oregon Climate Service, George Taylor, State Climatologist, *1971-2000 Climate of Malheur County*, http://www.ocs.orst.edu/county_climate/Malheur_files/Malheur.html#table1, link broken, March 6, 2019.

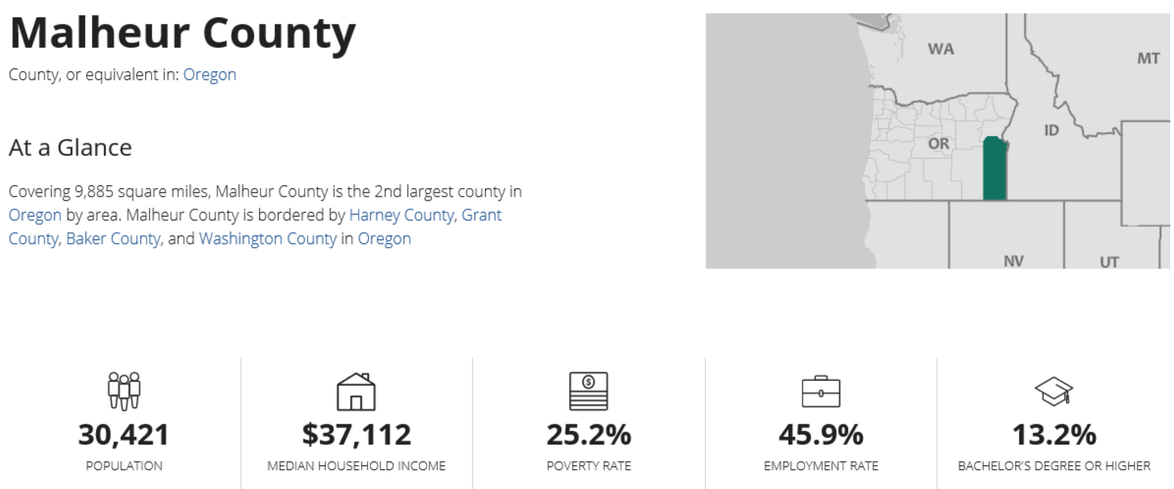
[19] About Malheur County, http://www.malheurco.org/about, accessed March 2013., link broken, March 6, 2019.

change models for Eastern Oregon indicate the potential for increased impacts of hazards. These factors combined with population growth and development intensification can lead to increasing risk levels of hazards which may have impacts including the loss of life, property, and environment.

Socio Demographic Capacity

Socio demographic capacity is a significant indicator of community resilience. The characteristics of the community population such as language, race and ethnicity, age, income, educational attainment, and health are significant factors that can influence the community's ability to cope, adapt to, and recover from natural disasters. Vulnerabilities can be reduced with outreach and community planning.

Figure C-12 Malheur County at a Glance



Source: U.S. Census Bureau, Malheur County At a Glance, https://data.census.gov/cedsci/geoprofile?q=Malheur%20County,%20Oregon&g=0500000US41045&ps=, accessed March 6, 2019

Population

In Malheur County the population in unincorporated areas (12,843) is less than the number of people (18,168) that reside in the five cities in Table C-5.[20] Table C-5 shows that population growth between 2000 and 2019 occurred in the Cities of Adrian and Nyssa while population decline occurred in the Cities of Ontario, Jordan Valley, and Vale. The population of unincorporated areas decreased between 2000 and 2019.

The State of Oregon Employment Department describes that from 2010-2015 the population of Malheur County grew 2.2%; all of its population growth resulted from natural increase, as net migration was negative.[21] Malheur County's total population is forecast to grow by a little more than 400 persons (1.3 percent) from 2016 to 2066, which translates into a total countywide population of

[20] Portland State University, Population Research Center, *Oregon Population Forecast Program Regional Forecast Meeting October 24, 2018*, https://www.pdx.edu/prc/current-documents-and-presentations, accessed March 6, 2019.

[21] Oregon Employment Department, *The Employment Landscape of Rural Oregon*, May 2017, https://www.qualityinfo.org/documents/10182/13336/The+Employment+Landscape+of+Rural+Oregon?version=1.0

31,994 in 2066. Population growth is forecast to be modest, becoming increasingly so as time progresses through the forecast period.[22] Table C-4 shows the historic and forecasted populations of Malheur County in the incorporated and unincorporated areas according to Portland State University's Population Research Center. The population sizes are different for the two sources.

Table C-4 Historic and Forecast Population Growth for Malheur County Communities

Historical and Forecast Populations for Malheur County and its Sub-Areas

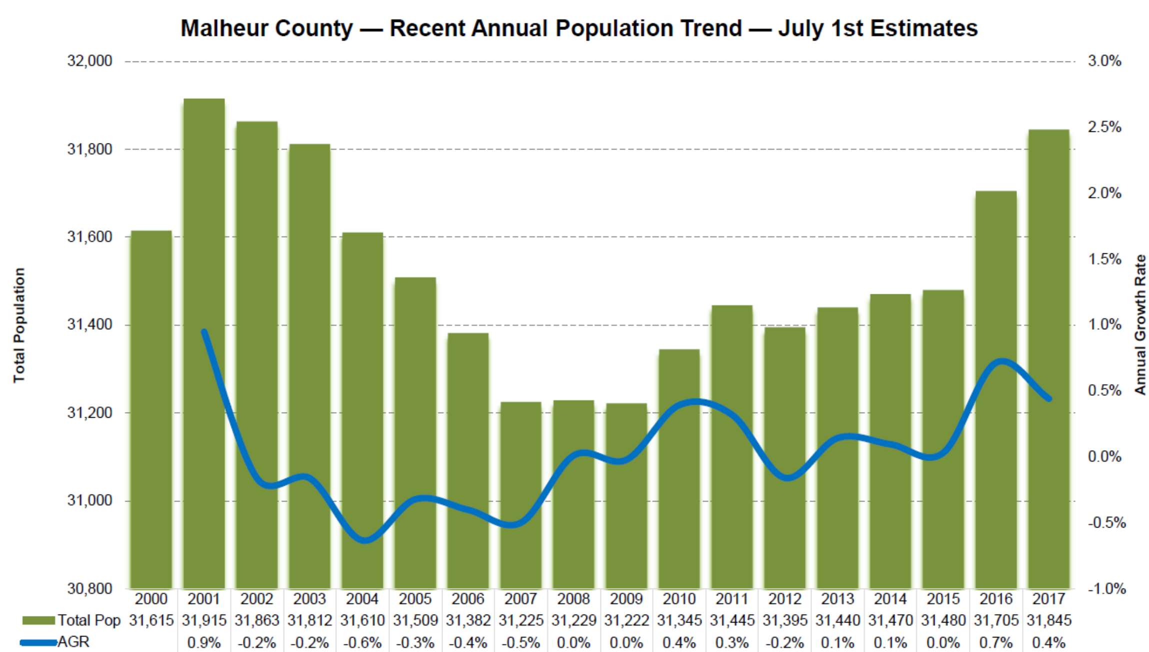
	Historical			Forecast					
	2000	2010	AAGR (2000-2010)	2019	2044	2069	AAGR (2010-2019)	AAGR (2019-2044)	AAGR (2044-2069)
Malheur County	**31,615**	**31,313**	***-0.1%***	**31,011**	**30,356**	**29,392**	***-0.1%***	***-0.1%***	***-0.1%***
Adrian	147	177	*1.9%*	179	184	186	*0.1%*	*0.1%*	*0.0%*
Jordan Valley	239	181	*-2.7%*	160	145	129	*-1.3%*	*-0.4%*	*-0.5%*
Nyssa	3,380	3,455	*0.2%*	3,463	3,523	3,555	*0.0%*	*0.1%*	*0.0%*
Ontario	12,267	12,296	*0.0%*	12,207	12,256	12,149	*-0.1%*	*0.0%*	*0.0%*
Vale	2,206	2,141	*-0.3%*	2,159	2,199	2,208	*0.1%*	*0.1%*	*0.0%*
Outside UGBs	13,376	13,063	*-0.2%*	12,843	12,049	11,165	*-0.2%*	*-0.3%*	*-0.3%*

Sources: U.S. Census Bureau, 2000 and 2010 Censuses; Forecast by Population Research Center (PRC).

Note: For simplicity each UGB is referred to by its primary city's name.

Source: Portland State University, Population Research Center, *Oregon Population Forecast Program Regional Forecast Meeting March 11, 2019*, https://www.pdx.edu/prc/sites/www.pdx.edu.prc/files/R2_Malheur_032019.pdf, accessed March 6, 2019.

Figure C-13 Malheur County Population Trends 2000-2017 by One-Year Intervals



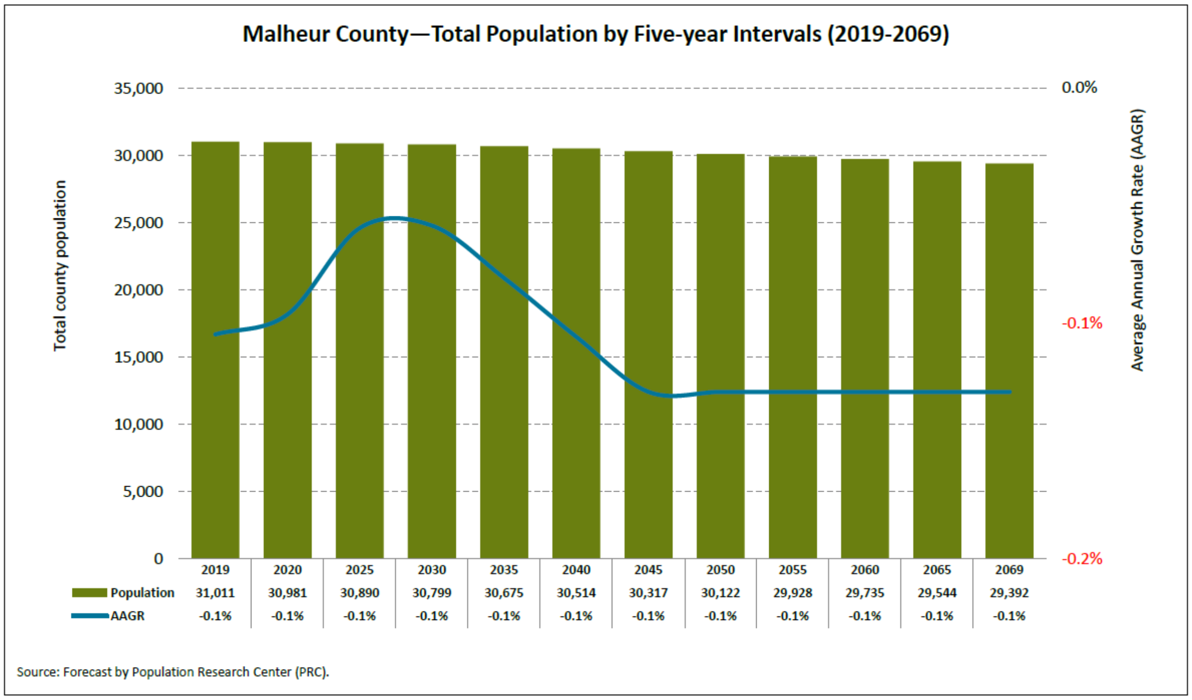
Source: Population Research Center Annual Estimates 2000-2017. Calculated by Population Research Center (PRC).

Source: Portland State University, Population Research Center, *Oregon Population Forecast Program Regional Forecast Meeting October 24, 2018*, https://www.pdx.edu/prc/current-documents-and-presentations, accessed March 6, 2019.

[22] Portland State University, Population Research Center, *Coordinated Population Forecast for Malheur County, its Urban Growth Boundaries (UGB), and Outside UGBs 2016-2066*, https://www.pdx.edu/prc/sites/www.pdx.edu.prc/files/Malheur_Draft_Report_201603.pdf

Figure C-14 shows the trend of population growth in Malheur County between 2019 and 2069. The graph shows that in more recent years, the population is increasing, albeit in small yearly amounts.

Figure C-14 Malheur County Population Trends 2019-2069 by Five-Year Intervals



Source: Portland State University, Population Research Center, *Oregon Population Forecast Program Regional Forecast Meeting March 11, 2019*, https://www.pdx.edu/prc/sites/www.pdx.edu.prc/files/R2_Malheur_032019.pdf, accessed March 13, 2019.

Urban and rural growth patterns can impact how agencies, cities and counties prepare for natural disasters and emergencies, because changes in development can increase risk associated with hazards. According to *The Employment Landscape of Rural Oregon*, Oregon's rural communities are growing but at a slower pace than in urban areas. Rural counties added 14,500 new residents between 2010 and 2015, a growth rate of 2.2%. Urban counties expanded by 5.3 % over the same period. In the *Employment Landscape*, there are 23 rural counties out of 36 counties in Oregon; urban counties are defined as part of a "metropolitan statistical area."[23]

Essentially, new residents account for all of the population growth in rural Oregon between 2010 and 2015. In total from 2010 to 2015, Oregon's rural counties had a combined natural increase of 10 residents. Natural increase is births minus deaths and net migration is in-migrants minus out-migrants. Births across rural Oregon were nearly evenly matched by deaths. In urban counties, natural increase accounted for 38% of population gains between 2010 and 2015. Overall, once the natural population change and net migration have been taken into account, three Oregon counties lost population between 2010 and 2015; all of them rural: Harney, Grant, and Coos Counties.[24]

[23] Oregon Employment Department, *The Employment Landscape of Rural Oregon*, May 2017, https://www.qualityinfo.org/documents/10182/13336/The+Employment+Landscape+of+Rural+Oregon?version=1.0

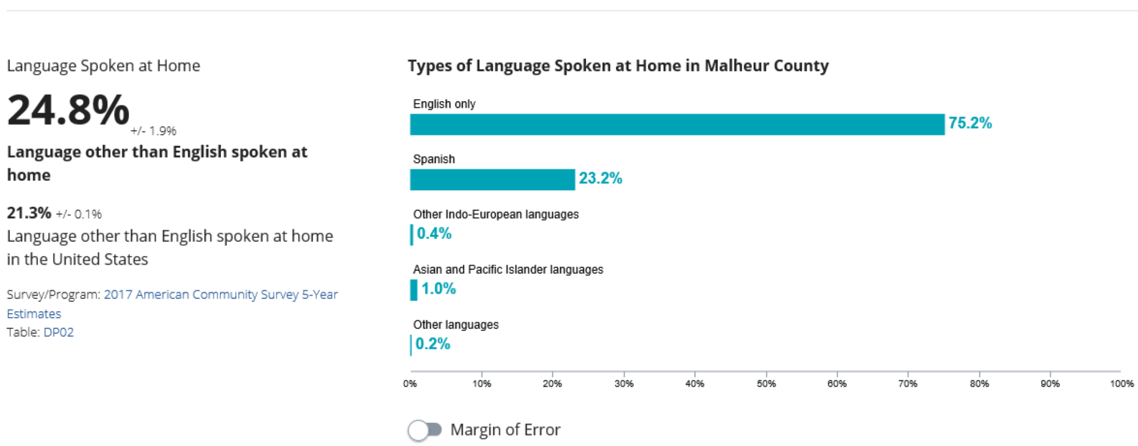
[24] Ibid.

Population size itself is not an indicator of vulnerability. More important is the location, composition, and capacity of the population within the community. Research by social scientists demonstrates that human capital indices such as language, race, age, income, education and health can affect the resilience of a community; these may impact community resilience to natural hazards.

Language

When disseminating hazard planning and mitigation resources to the general public, consideration should be given to populations who do not speak English as their primary language. Materials should be translated to other languages and culturally appropriate outreach techniques should be used.[25] The three primary languages spoken in Malheur County are English (75.2%), Spanish (23.2%), and Asian and Pacific Islander (1%).

Figure C-15 Malheur County Languages



Source: U.S. Census Bureau, Malheur County People and Population, https://data.census.gov/cedsci/geoprofile?q=Malheur%20County,%20Oregon&g=0500000US41045&ps=, accessed March 6, 2019

Race

The impact in terms of loss and the ability to recover may also vary among minority population groups following a disaster. Studies have shown that racial and ethnic minorities can be more vulnerable to natural disaster events. Historic patterns of inequality along racial or ethnic divides have often resulted in minority communities that are more likely to have inferior building stock, degraded infrastructure, or less access to public services. Table C-6 shows that the Hispanic or Latino population of Malheur County has increased from 2000 to 2010. But they remain a minority population within the total population. Figure C-16 provides an illustration of race categories in Malheur County.

[25] DLCD, *2015 Oregon Natural Hazards Mitigation Plan*, Region 4 Southwest Oregon Regional Profile, https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP.pdf

Table C-6 Malheur County Race Categories 2000-2010

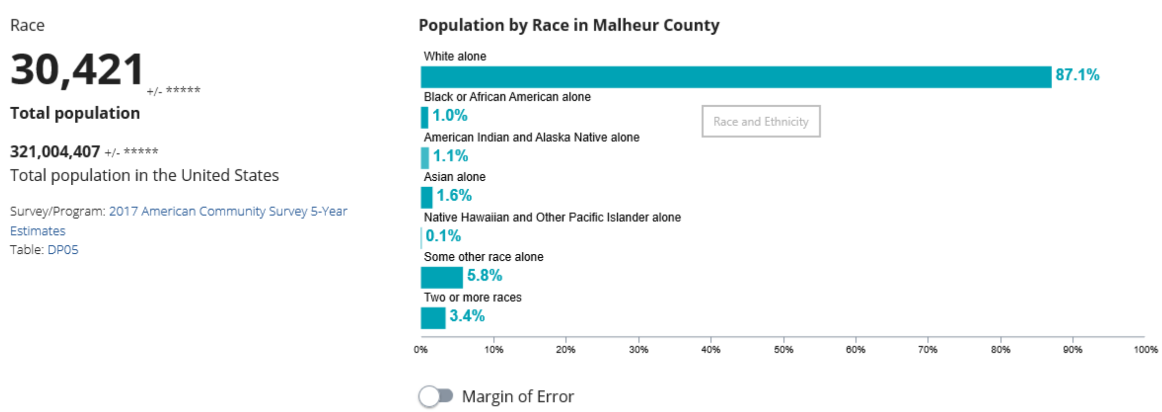
Malheur County—Hispanic or Latino and Race (2000 and 2010)

Hispanic or Latino and Race	2000		2010		Absolute Change	Relative Change
Total population	*31,615*	*100.0%*	*31,313*	*100.0%*	*-302*	*-1.0%*
Hispanic or Latino	8,099	25.6%	9,867	31.5%	1,768	21.8%
Not Hispanic or Latino	23,516	74.4%	21,446	68.5%	-2,070	-8.8%
White alone	21,752	68.8%	19,906	63.6%	-1,846	-8.5%
Black or African American alone	369	1.2%	331	1.1%	-38	-10.3%
American Indian and Alaska Native alone	273	0.9%	235	0.8%	-38	-13.9%
Asian alone	608	1.9%	511	1.6%	-97	-16.0%
Native Hawaiian and Other Pacific Islander alone	18	0.1%	12	0.0%	-6	-33.3%
Some Other Race alone	37	0.1%	21	0.1%	-16	-43.2%
Two or More Races	459	1.5%	430	1.4%	-29	-6.3%

Sources: U.S. Census Bureau, 2000 and 2010 Censuses.

Source: Portland State University, Population Research Center, *Oregon Population Forecast Program Regional Forecast Meeting October 24, 2018*, https://www.pdx.edu/prc/current-documents-and-presentations, accessed March 6, 2019.

Figure C-16 Malheur County Race Categories 2017



Source: U.S. Census Bureau, Malheur County Race and Ethnicity, https://data.census.gov/cedsci/geoprofile?q=Malheur%20County,%20Oregon&g=0500000US41045&ps=, accessed March 6, 2019

The majority of the population in Malheur County is racially white (87.1%). However, as noted above in the languages section, it is important for the County and Cities to identify specific ways to support all portions of the community through culturally appropriate and effective outreach.

The Cities within Malheur County differ from County demographics with regard to race and Hispanic origin. Notably, the Cities of Nyssa, Ontario, and Vale have higher percentages of population that are Hispanic than the other cities of Adrian and Jordan Valley.[26]

Age

Of the factors influencing socio demographic capacity, the most significant indicator in Malheur County may be age of the population.

In Table C-7 there are several age dependency ratios identified for the County and the Cities of Ontario, Nyssa, and Vale.

The dependency ratio is an age-population ratio of those typically not in the labor force (the *dependent* part ages 0 to 14 and 65+) and those typically in the labor force (the *productive* part ages 15 to 64). It is used to measure the pressure on the productive population. In published statistics, the dependent part usually includes those under the age of 15 and over the age of 64.The productive part makes up the population in between, ages 15 – 64. It is normally expressed as a percentage. The (total) dependency ratio can be decomposed into the child dependency ratio and the aged dependency ratio. [27]

Figure C-17 Age Dependency Formulas

$$\text{(Total) Dependency ratio} = \frac{(\text{number of people aged 0 to 14}) + (\text{number of people aged 65 and over})}{\text{number of people aged 15 to 64}} \times 100$$

$$\text{Child dependency ratio} = \frac{\text{number of people aged 0 to 14}}{\text{number of people aged 15 to 64}} \times 100$$

$$\text{Aged dependency ratio} = \frac{\text{number of people aged 65 and over}}{\text{number of people aged 15 to 64}} \times 100^{[3]}$$

Source: Wikipedia, *Age Dependency Ratio*, https://en.wikipedia.org/wiki/Dependency_ratio

As the ratio increases there may be an increased burden on the productive part of the population to maintain the upbringing and pensions of the economically dependent. This results in direct impacts on financial expenditures on things like social security, as well as many indirect consequences. For establishing natural hazard mitigation actions, increasing community resilience, furthering emergency preparedness, and doing recovery planning, it is important to notice the number of people and their location in these categories.

Table C-7 Population Age Ratios 2017

Jurisdiction	Malheur County	Ontario	Nyssa	Vale
Median Age	36.1	32.5	26.7	32.2
Sex Ratio (males per 100 females)	118.7	86.1	97.0	108.0
Age Dependency Ratio	70.6	82.2	96.9	78.6
Old Age Dependency Ratio	27.3	31.3	20.1	23.3
Child Dependency Ratio	43.4	51.0	76.8	55.3

Source: U.S. Census Bureau, American Fact Finder, Table S0101, Age and Sex, 2013-2017, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml

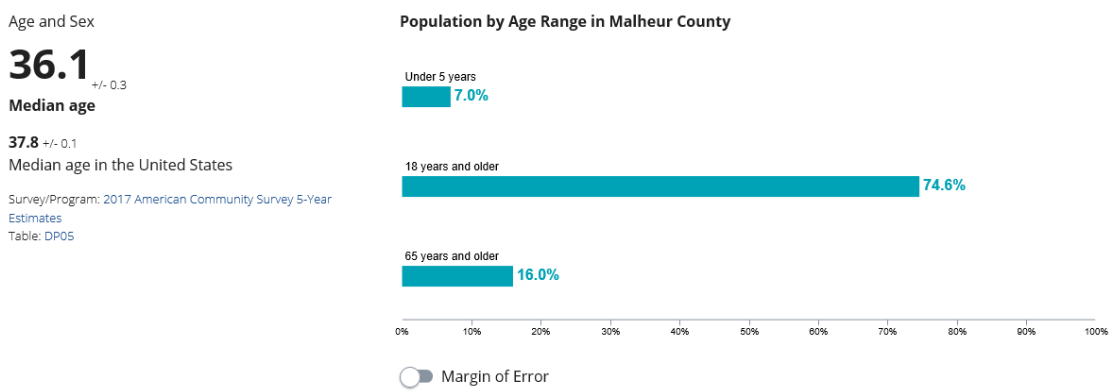
[27] Wikipedia, *Age Dependency Ratio*, https://en.wikipedia.org/wiki/Dependency_ratio

The age profile of an area has an impact on what actions are prioritized for mitigation and how response to hazard incidents is carried out. A larger youth population in an area will increase the importance of outreach to schools and parents on effective ways to teach children about fire safety, earthquake response, evacuation plans, and other hazard related information. Typically, children and older populations are more vulnerable to the heat and cold, have few transportation options, and require assistance to access medical facilities.[28] Older populations may require assistance in evacuation due to limited mobility or health issues. They may require special medical equipment or medications, and can lack the social and economic resources needed for post-disaster recovery.[29]

Other important considerations for vulnerable populations are the number of people over the age of 64 living alone and single parent households with children under 18.

Figure C-18 and Figure C-19 are two illustrations of population in Malheur County; C-18 shows the median age and the distribution of ages in three categories based on 2017 statistics and C-19 shows the population distribution in multiple 5-year increments in the years 2019, 2030, and 2044.

Figure C-18 Population by Three Age Range Categories

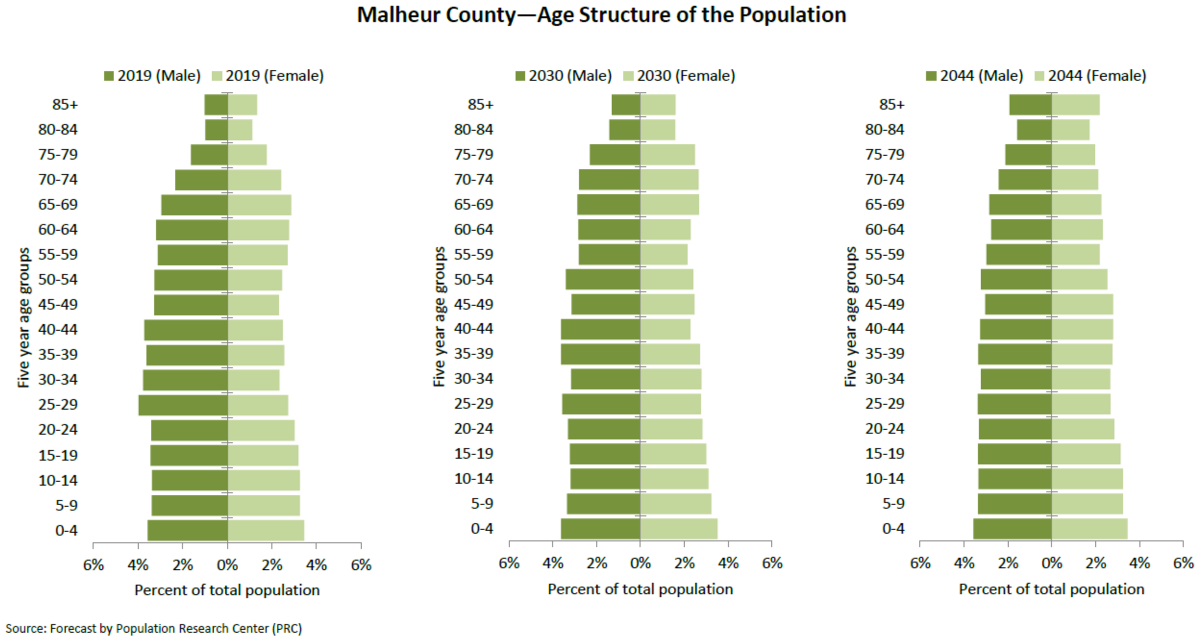


Source: U.S. Census Bureau, Malheur County People and Population, https://data.census.gov/cedsci/geoprofile?q=Malheur%20County,%20Oregon&g=0500000US41045&ps=, accessed March 6, 2019

[28] DLCD, *2015 Oregon Natural Hazards Mitigation Plan*, Region 4 Southwest Oregon Regional Profile,. https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP.pdf

[29] Wood, Nathan. *Variations in City Exposure and Sensitivity to Tsunami Hazards in Oregon.* U.S. Geological Survey, Reston, VA, 2007, https://pubs.usgs.gov/sir/2007/5283/

Figure C-19 Population by Distribution of Age in 5 Year Increments



Source: Portland State University, Population Research Center, *Oregon Population Forecast Program Regional Forecast Meeting March 11, 2019*, https://www.pdx.edu/prc/sites/www.pdx.edu.prc/files/R2_Malheur_032019.pdf, accessed March 13, 2019.

Income

Household income and poverty status are indicators of socio-demographic capacity and the stability of the local economy. Household income can be used to compare economic areas as a whole, but does not reflect how the income is divided among the area residents.[30] Table C-8 shows both the median and mean income for Malheur County and the Cities. The median income is the middle number or value between the low and the high values, and the mean is the average of all the values.

Table C-8 Median and Mean Amount of Household Income in Malheur County

Jurisdiction	Median Amount	Mean Amount
Malheur County	$46,571	$58,310
Ontario	$36,178	$51,355
Nyssa	$41,423	$47,482
Vale	$37,448	$49,533

Source: U.S. Census Bureau, American Fact Finder, Table DP03, Selected Economic Characteristics, 2013-2017, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml

[30] DLCD, *2015 Oregon Natural Hazards Mitigation Plan*, Region 4 Southwest Oregon Regional Profile, https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP.pdf

Rural counties tend to have a lower per capita personal income (PCPI) than urban counties. The per capita income is the total personal income in an area divided by the population. Wages and salaries are typically the largest source of personal income. Area with large youth populations or large retirement populations have lower per capita income because a larger share of their population isn't working and earning income.[31]

Table C-9 Per Capita Personal Income in Metro and Non-Metro Areas in Oregon and the U.S. 2015

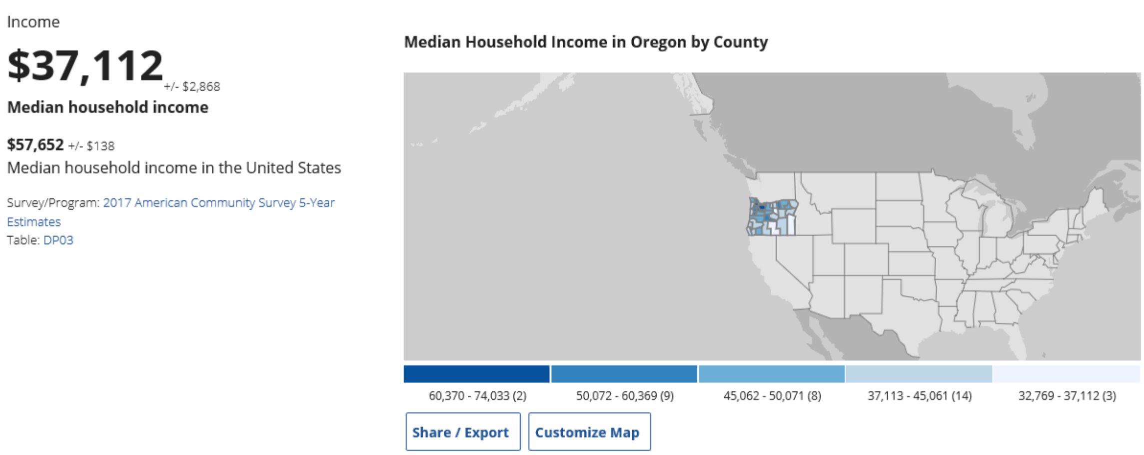
Per Capita Personal Income in Metro and Nonmetro Areas in Oregon and the U.S., 2015

	Total	Metro	Nonmetro
Per capita personal income			
United States	$48,112	$49,827	$37,866
Oregon	$43,783	$45,040	$37,332
Per capita net earnings			
United States	$30,729	$32,260	$21,584
Oregon	$26,467	$27,911	$19,058
Per capita transfer receipts			
United States	$8,334	$8,118	$9,624
Oregon	$8,861	$8,406	$11,196
Per capita dividends, interest, and rent			
United States	$9,049	$9,449	$6,658
Oregon	$8,455	$8,723	$7,078

Source: U.S. Bureau of Economic Analysis

Source: Oregon Employment Department, *The Employment Landscape of Rural Oregon*, May 2017, https://www.qualityinfo.org/documents/10182/13336/The+Employment+Landscape+of+Rural+Oregon?version=1.0

Figure C-21 Median Household Income in Malheur County in 2017

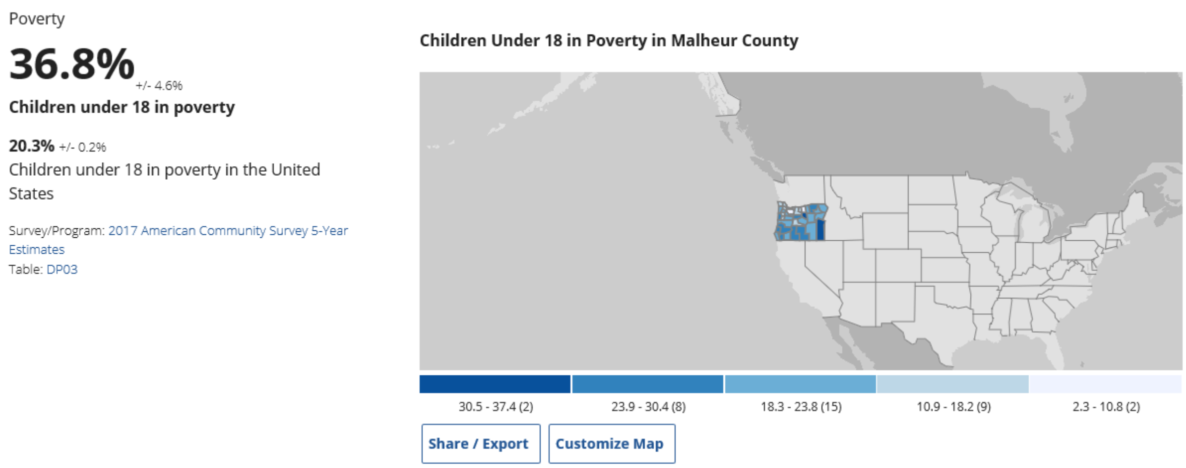


Source: U.S. Census Bureau, Malheur County Income and Poverty, accessed March 6, 2019 https://data.census.gov/cedsci/geoprofile?q=Malheur%20County,%20Oregon&g=0500000US41045&ps=

[31] Source: Oregon Employment Department, *The Employment Landscape of Rural Oregon*, May 2017, https://www.qualityinfo.org/documents/10182/13336/The+Employment+Landscape+of+Rural+Oregon?version=1.0

Figure C-22 provide a visual showing 36.8% of people under 18 are in poverty in Malheur County while there are 20.3% in the United States. Table C-10 provides another view of poverty level statistics and the percent of total is lower than the one show in C-22; however, it is still higher than the rest of the U.S. The information includes the number of individuals and families living in poverty as reported by the Census' American Community Survey (ACS) 5-year estimates. The 2017 estimate is based on data collected between 2013 and 2017.

Figure C-22 Individuals Under 18 below Poverty Level in Malheur County



Source: U.S. Census Bureau, Malheur County Income and Poverty, accessed March 6, 2019 https://data.census.gov/cedsci/geoprofile?q=Malheur%20County,%20Oregon&g=0500000US41045&ps=

Table C-10 Poverty Statistics in Malheur County

BLM Socioeconomic Profile

Malheur County, OR

Poverty (Identifying Environment Justice Populations)

Poverty, 2017*	Malheur County, OR	United States
People	26,832	313,048,563
Families	6,976	78,298,703
People Below Poverty	6,761	45,650,345
Families below poverty	1,315	8,253,388
Percent of Total		
People Below Poverty	25.2%	14.6%
Families below poverty	18.9%	10.5%

High Reliability: Data with coefficients of variation (CVs) < 12% are in black to indicate that the sampling error is relatively small.
Medium Reliability: Data with CVs between 12 & 40% are in orange to indicate that the values should be interpreted with caution.
Low Reliability: Data with CVs > 40% are displayed in red to indicate that the estimate is considered very unreliable.

Source: BLM Socioeconomic Profile for Malheur County, accessed March 11, 2019, https://headwaterseconomics.org/tools/blm-profiles/

Income is a resiliency indicator, as higher incomes are often associated with increased self-reliance, and ability to prepare oneself if an emergency does occur. The higher the poverty rate, the increased assistance the community will likely need in the event of a disaster, in the form of sheltering, medical assistance and transportation. Notably, higher income populations often have less mobility following significant hazard events because their assets may be rooted in the local community. Conversely, lower income members of the population may find it easier to relocate.

Education

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

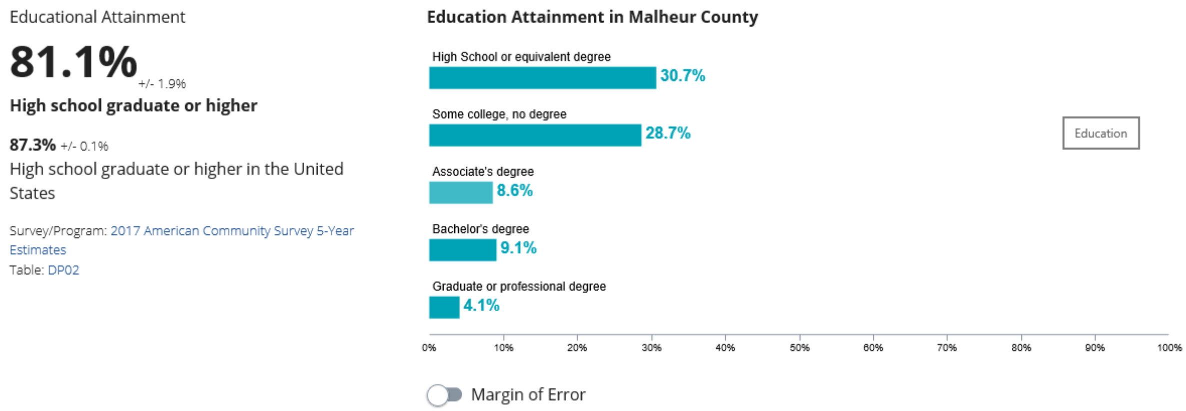
Table C-11 Educational Attainment in Malheur County and Cities 2017

	Malheur County	Ontario	Nyssa	Vale
Total Population >25 Years	19,716	6,425	1661	1323
Less than 9th Grade	1,156	619	293	97
9th-12th Grade, No Diploma	2,163	745	166	132
High School Graduate, GED, or Equivalent	6,043	1,881	506	372
Some College, No Degree	5,667	1,769	414	379
Associate's Degree	1,686	526	147	120
Bachelor's Degree	1,796	556	85	183
Graduate or Professional Degree	805	329	50	40
Percent High School Graduate or Higher	81.1%	78.8%	72.4%	82.7%

Source: U.S. Census Bureau, American Fact Finder, Table 1501, Educational Attainment, 2013-2017, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml

As shown in Table C-11 and Figure C-23, according to the U.S. Census, 81.1% of the Malheur County population over 25 years of age has graduated from high school or received a high school equivalency.

Figure C-23 Educational Attainment in Malheur County in 2017



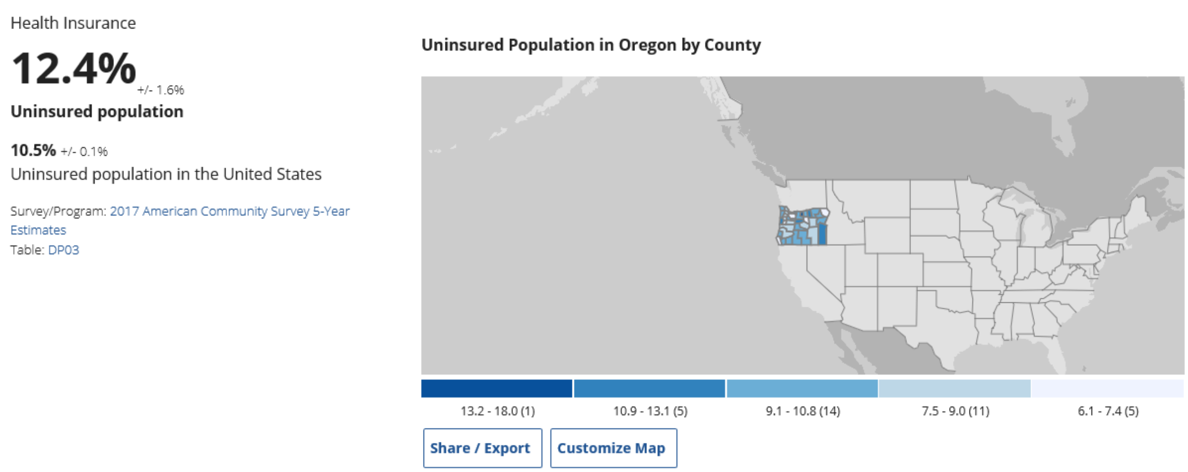
Source: U.S. Census Bureau, Malheur County Education, https://data.census.gov/cedsci/geoprofile?q=Malheur%20County,%20Oregon&g=0500000US41045&ps=, accessed March 6, 2019

Health

Individual and community health play an integral role in community resiliency, as indicators such as health insurance, people with disabilities, dependencies, homelessness and crime rate paint an overall picture of a community's well-being. These factors translate to a community's ability to prepare, respond,,,, and cope with the impacts of a disaster.

In Figure C-24, that the percentage of population in Malheur County without health insurance in 2017 is 12.4%. For planning purposes, this should be taken into consideration with the high dependency ratio in Malheur County shown in Table C-7, and the lower median income shown in Table C-8. Malheur County may need to provide services to the dependent population if their families do not have insurance, or cannot afford to care for them following a natural disaster.

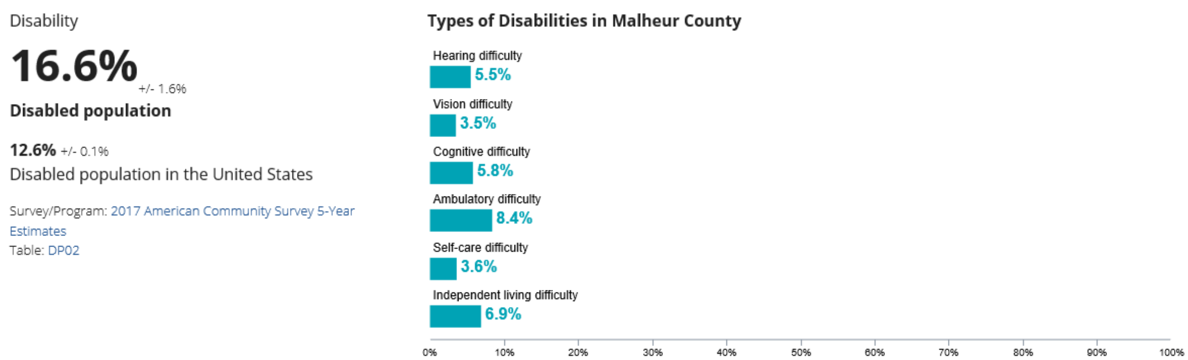
Figure C-24 Health Insurance Coverage in 2017



Source: U.S. Census Bureau, Malheur County Health, https://data.census.gov/cedsci/geoprofile?q=Malheur%20County,%20Oregon&g=0500000US41045&ps=, accessed March 6, 2019

Figure C-25 describes disability status of the population. As of 2017, 16.6% of the County's population identifies with one or more disabilities; this rate is above the national rate. Table C-12 illustrates the utilization of mental health and substance abuse services in Malheur County.

Figure C-25 Types of Disabilities in Malheur County



Source: U.S. Census Bureau, Malheur County Health, https://data.census.gov/cedsci/geoprofile?q=Malheur%20County,%20Oregon&g=0500000US41045&ps=, accessed March 6, 2019

In 2017, Oregon Housing and Community Services (OHCS) conducted a homeless count to identify the number of homeless, their age and their family type. The OHCS study found 151 individuals in Malheur County identify as homeless; 46 are under 18 years old, 30 are between 18-24 years old, and 75 are over 24 years old.[32] The homeless have little resources to rely on, especially during an emergency. It will likely be the responsibility of the County and local non-profit entities to provide services such as shelter, food and medical assistance. Therefore, it is critical to foster collaborative relationships with agencies that will provide additional relief such as the American Red Cross and homeless shelters. As well, it will be important to identify how to communicate with these populations, since traditional means of communication may not be appropriate or available.

[32] Oregon Housing and Community Services, *2017 Point in Time Homeless Count*, https://public.tableau.com/profile/oregon.housing.and.community.services#!/vizhome/InformationDashboardPITCount_1/Point-in-TimeCount

Table C-12 Behavior Health Profile

Malheur County Behavioral Health Profile, 2015

	County	Oregon
Population Statistics	**County**	**Oregon**
Population	31,470	3,962,710
Growth Rate	-1.3%	4.1%
Poverty Rate (all ages)	28.4%	16.7%
Poverty Rate (ages 5 to 17)	36.7%	20.1%
Unemployment Rate	6.5%	5.7%
Percent on Medicaid	44.2%	31.8%
Identified Mental Health (MH) or Substance Use (SU) Conditions, Medicaid Population		
Children under 12 with MH Condition	23.0 %	27.7 %
Youth (12 to 17) with MH Condition	27.5%	33.9%
Youth (12 to 17) Identified SU Condition	6.6 %	7.5 %
Young Adults (18 to 25) with Mild to Moderate MH Condition	20.0%	26.7%
Young Adults (18 to 25) with Serious MH Condition	7.1%	8.3%
Young Adults (18 to 25) with SU Condition	20.2 %	20.2 %
Adults (26 and older) with Mild to Moderate MH Condition	20.7%	27.6%
Adults (26 and older) with Serious MH Condition	13.1%	14.0%
Adults (26 and older) with SU Condition	5.8%	7.6%
Count of Persons Admitted to Oregon State Hospital		
Civil Commitments	1	470
Aid & Assist	4	674
Guilty Except for Insanity	2	299
Per Capita Public Funding		
OHP Funding	$151.62	$140.91
Other Medicaid Funding	$90.00	$53.97
State and Local Investments	$105.15	$55.00
Total Per Capita Public Behavioral Health Funding	$346.77	$249.88
CCO Plan(s)		
Eastern Oregon Coordinated Care Org.		

Source: Oregon Health Authority, *Malheur County Behavioral Health Profile*, 2015, https://www.oregon.gov/oha/HSD/AMH/BH%20Mapping%20Profiles/Malheur%20County%20BH%20Profile.pdf

Synthesis

It is essential Malheur County consider both immediate and long-term socio-demographic implications of hazard resilience. Immediate concerns regard the growing elderly population and language barriers associated with a culturally diverse community. The current status of other socio-demographic capacity indicators such as low graduation rate and poverty level higher and median household income lower than the rest of Oregon can have long-term impacts on the economy and stability of the community ultimately affecting future resilience.

Regional Economic Capacity

Regional economic capacity refers to the financial resources present and revenue generated in the community to achieve a higher quality of life. Income equality, housing affordability, economic diversification, employment and industry are measures of economic capacity. Economic resilience to natural disasters is far more complex than restoring employment or income in the local community. Building a resilient economy requires an understanding of how the components of employment sectors, workforce, resources, and infrastructure are interconnected in the existing economic picture. Once inherent strengths or systematic vulnerabilities become apparent, the public and private sectors can take action to increase the resilience of the local economy.

Regional Affordability

The evaluation of regional affordability supplements the identification of socio-demographic capacity indicators, i.e. median income, and is an analysis tool to understanding the economic status of a community. If the community reflects high-income inequality or housing cost burden, the potential for home owners and renters to implement mitigation can be reduced.

Income Equality

Income equality is a measure of the distribution of economic resources, as measured by income, across a population. It is a statistic defining the degree to which all persons have a similar income.

The Gini Index is a summary measure of income inequality. The Gini coefficient incorporates the detailed shares data into a single statistic, which summarizes the dispersion of income across the entire income distribution. The Gini coefficient ranges from 0, indicating perfect equality (where everyone receives an equal share), to 1, perfect inequality (where only one recipient or group of recipients receives all the income). The Gini is based on the difference between the Lorenz curve (the observed cumulative income distribution) and the notion of a perfectly equal income distribution.[33]

Based on social science research, a region's cohesive response to a hazard event may be affected by the distribution of wealth in communities that have less income equality.[34]

According to one report, Malheur County ranks 10th out of the top 25 counties in Oregon on the Gini Index.[35] An Oregon State University and The Oregon Community Foundation report from 2015 describes that compared to all other states, Oregon has average levels of income inequality. Nationally, Oregon ranks 22nd among the 50 states and Washington D.C., where ranking 1st means having the lowest inequality and ranking 51st means having the highest inequality. Oregon's level of inequality is slightly below the national average. It also describes that Malheur County's income inequality is moderate and the change in inequality is worsening. [36]

---

[33] U.S. Census Bureau, *Income Inequality, The Gini Index*, https://www.census.gov/topics/income-poverty/income-inequality/about/metrics/gini-index.html

[34] Susan Cutter, Christopher G. Burton, and Christopher T. Emrich. 2010, *Disaster Resilience Indicators for Benchmarking Baseline Conditions*, Journal of Homeland Security and Emergency Management 7, no.1: 1-22, http://resiliencesystem.com/sites/default/files/Cutter_jhsem.2010.7.1.1732.pdf

[35] Town Charts, *Top 25 Oregon Counties Ranked by the Gini Index,* http://www.towncharts.com/Oregon/Top-25-Counties-in-Oregon-ranked-by-The-Gini-Index.html.

[36] Oregon State University and The Oregon Community Foundation, *TOP: Tracking Oregon's Progress: A Focus on Income Inequality*, https://www.oregoncf.org/Templates/media/files/reports/top_indicators_2015.pdf.

According to an Oregon Employment Department article dated July 24, 2018, "The degree of wage inequality in Oregon has generally increased since 1990, though not steadily. The state's Gini coefficient for all year-round workers rose from 1991 through the mid-1990s, and then was largely flat before rising to a peak in 2000. Since 2000, the coefficient fell slightly in 2001 and 2002, during the first economic slowdown of the decade. Afterwards, it began a steady rise to a second peak in 2007, as the state's economy recovered from the recession earlier in the decade. The coefficient decreased a little again in 2008 and 2009 and subsequently rose to reach its highest point in 2015. It dropped slightly in 2016 and remained essentially unchanged in 2017".[37]

Housing Affordability

Housing affordability is a measure of economic security gauged by the percentage of a metropolitan area's households paying less than 35% of their income on housing.[38] Households spending more than 35% are considered housing cost burdened.

Table C-13 shows the percentage of households in Malheur County, Ontario, Nyssa, and Vale that are paying more than 35% of their income on housing. Among homeowners without a mortgage, Ontario has the greatest rate of households with housing cost burdens. Among homeowners with a mortgage, Ontario has the highest rates of housing cost burden. Among renters, Vale residents have the greatest rates of households with housing cost burdens.

In general, the population that spends more of their income on housing has proportionally fewer resources and less flexibility for alternative investments and expenditures in times of crisis.[39] The high percentage of homeowners and renters paying more than 35% of their income on housing poses challenges for a community recovering from a disaster as housing costs may exceed the ability of local residents to repair or move to a new location. These populations may live paycheck to paycheck and are extremely dependent on their employer. In the event their employer is also detrimentally impacted it will further the hardship experienced by these individuals and families.

Table C-13 Households Spending > 35% of Income on Housing

Jurisdiction	Owners		Renters
	With Mortgage	Without Mortgage	
Malheur County	27.9%	8.6%	44.2%
Ontario	21.8%	12%	44.7%
Nyssa	17.6%	8.9%	44.9%
Vale	16.6%	11.7%	46.6%

Source: U.S. Census Bureau, American Fact Finder, Table DP04, Selected Housing Characteristics, 2013-2017, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml

[37] Oregon Employment Department, *Wage Inequality in Oregon: The Widening Gap*, https://www.qualityinfo.org/-/wage-inequality-in-oregon-the-widening-gap

[38] MacArthur Foundation, *Research Network on Building Resilient Regions*, https://www.macfound.org/networks/research-network-on-building-resilient-regions/

[39] Ibid.

Economic Overview and Diversity

Economic diversity is a general indicator of an area's fitness for weathering difficult financial times, but it is not a guarantor of economic vitality or resilience. [40]

Anticipated job growth in rural areas of Oregon, according to employment projections covering the 2014 to 2024 period, is muted compared with anticipated growth in metro areas. Between 2014 and 2024, statewide growth is anticipated to be about 14 percent. In the eight-county Eastern Oregon region, growth is pegged at 6 percent – less than half the statewide rate.[41]

One of the slowest growing areas of the state is Southeast Oregon (Harney and Malheur Counties); projections show job growth of 4 percent by 2024, with 600 openings anticipated due to growth and another 3,800 job openings anticipated due to replacement needs. Government, education and health services, and retail trade are the top sources of projected replacement openings – each industry will need to replace about 700 workers by 2024. In addition, high-wage and high-demand occupations with the most total openings projected between 2014 and 2024 include occupations in corrections and protective service, health care, transportation, and agriculture.[42]

No matter what the size of the local economy, a certain level of demand for workers exists. Approaching opportunity through the lens of high-wage and high-demand jobs or the level of replacement openings in an area illustrates how varied job opportunities are in rural Oregon.[43]

More than 40 percent of rural Oregon employment is concentrated in natural resources, leisure, and hospitality (tourism), and government. Together those three sectors make up around 27 percent of the employment in urban Oregon. Manufacturing employment in Oregon has decreased 8 percent between 1990 and 2016, and it has shifted with more happening in the Portland metro area and less in the rural counties. In addition, rural Oregon's historic reliance on resource extraction has shifted as timber harvest levels have declined.[44]

The Distressed Counties List is used to highlight Oregon communities that may need additional support. The distressed designation may provide a community with an advantage if it applies for funds from state and federal sources. Business Oregon gives priority when funding technical assistance, programs and projects to geographic areas determined to be economically distressed as prescribed by Oregon law. On the Malheur County is listed as a distressed area.[45]

Figures C-26 and C-27 show the number of employer establishments and the number of firms in Malheur County.

---

[40] Business Oregon, *Distressed Areas in Oregon*, https://www.oregon4biz.com/Publications/Distressed-List/

[41] Oregon Employment Department, *The Employment Landscape of Rural Oregon*, May 2017, https://www.qualityinfo.org/documents/10182/13336/The+Employment+Landscape+of+Rural+Oregon?version=1.0

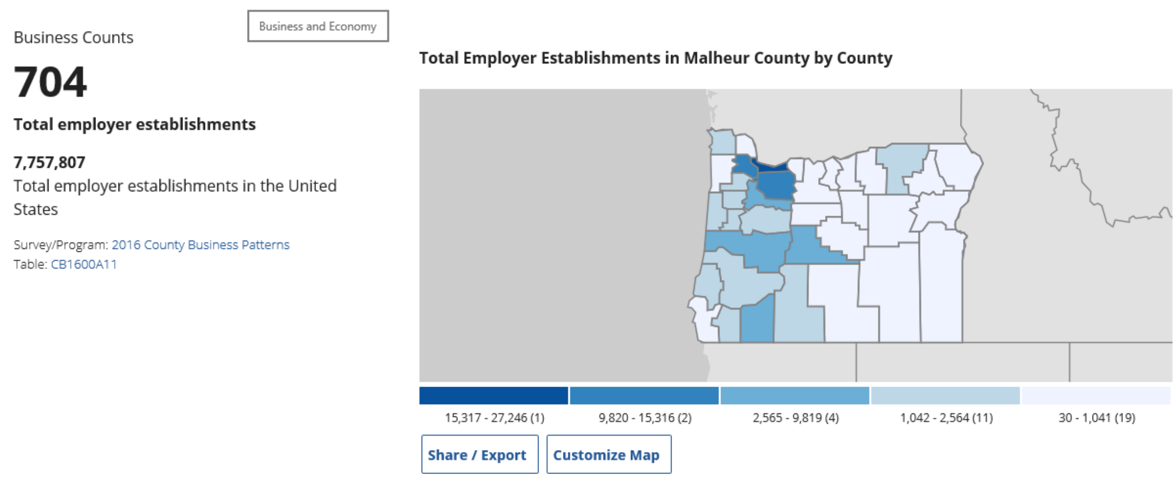
[42] Ibid.

[43] Ibid.

[44] Oregon Employment Department, *The Employment Landscape of Rural Oregon*, May 2017, https://www.qualityinfo.org/documents/10182/13336/The+Employment+Landscape+of+Rural+Oregon?version=1.0

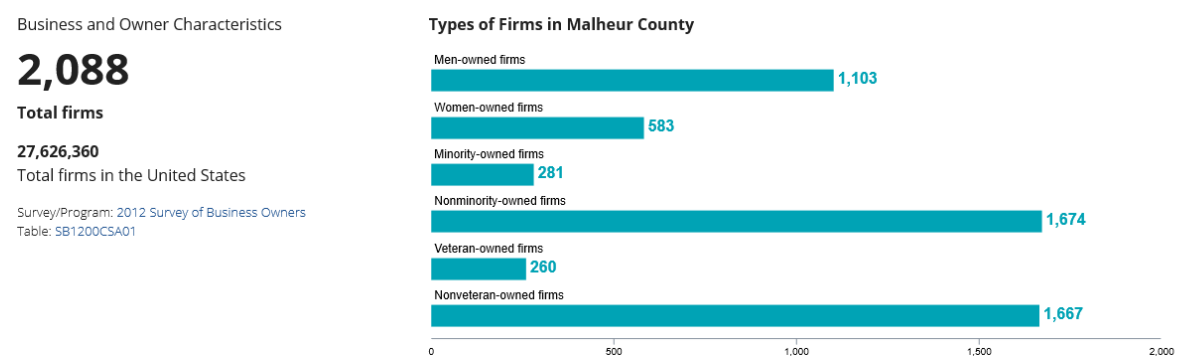
[45] Business Oregon, *Distressed Areas in Oregon*, https://www.oregon4biz.com/Publications/Distressed-List/

Figure C-26 Total Number of Employer Establishments in Malheur County



Source: U.S. Census Bureau, Malheur County Business and Economy, accessed March 6, 2019 https://data.census.gov/cedsci/geoprofile?q=Malheur%20County,%20Oregon&g=0500000US41045&ps=

Figure C-27 Total Number of Firms in Malheur County



Source: U.S. Census Bureau, Malheur County Business and Economy, accessed March 6, 2019 https://data.census.gov/cedsci/geoprofile?q=Malheur%20County,%20Oregon&g=0500000US41045&ps=

Employment and Wages

According to the Oregon Employment Department, unemployment has reduced since the high in 2009. Table C-14 shows Malheur County's unemployment rate from 2006 to 2017. Table C-17 shows several socioeconomic factors for Malheur County as of 2017, including the unemployment rate which was 4.7%.

Table C-14 Malheur County Unemployment Rate 2006-2017

Year	% Rate
2006	6.3
2007	5.6
2008	7.5

2009	10.9
2010	9.7
2011	9.4
2012	9.4
2013	8.5
2014	8.0
2015	6.5
2016	5.6
2017	4.7

Source: Oregon Employment Department, *The Employment Landscape of Rural Oregon*, May 2017, https://www.qualityinfo.org/documents/10182/13336/The+Employment+Landscape+of+Rural+Oregon?version=1.0 and BLM Socioeconomic Profile for Malheur County, https://headwaterseconomics.org/tools/blm-profiles/, accessed March 11, 2019.

Table C-9 showed the per capita personal income (PCPI) for metro and non-metro (urban and rural) areas in Oregon and compared to the U.S. Table C-15 shows the components of PCPI for Malheur County in 2015.

Table C-15 PCPI and Components of PCPI in Malheur County in 2015

Per Capita Personal Income	Per Capita Net Earnings	Per Capita Personal Current Transfer Receipts	Per Capita Dividends, Interest, and Rent
$30,255	$14,511	$10,423	$5,321

Source: Oregon Employment Department, *The Employment Landscape of Rural Oregon*, May 2017, https://www.qualityinfo.org/documents/10182/13336/The+Employment+Landscape+of+Rural+Oregon?version=1.0

Table C-16 Socioeconomic Indicators for Malheur County

BLM Socioeconomic Profile

Malheur County, OR

Other Socioeconomic Indicators

	Malheur County, OR	United States
Unemployment		
Avg. Annual Unemployment Rate, 2017	4.7%	4.4%
Median Age		
Median Age, 2010*	36.0	36.9
Median Age, 2017*	36.1	37.8
Housing		
Total Housing Units, 2017*	11,806	135,393,564
Occupied	86.9%	87.8%
Vacant	13.1%	12.2%
Seasonal, recreational, occasional	3.1%	4.0%
Commuting		
Workers 16 years and over, 2017*	10,612	148,432,042
Worked in county of residence	81.2%	72.4%
Mean travel time to work (minutes)	18	25
Education		
Total Population 25 yrs or older	19,716	216,271,644
Bachelor's degree or higher	13.2%	30.9%

High Reliability: Data with coefficients of variation (CVs) < 12% are in black to indicate that the sampling error is relatively small.
Medium Reliability: Data with CVs between 12 & 40% are in orange to indicate that the values should be interpreted with caution.
Low Reliability: Data with CVs > 40% are displayed in red to indicate that the estimate is considered very unreliable.

Source: BLM Socioeconomic Profile for Malheur County, https://headwaterseconomics.org/tools/blm-profiles/, accessed March 11, 2019.

Industry

Major Regional Industry

Key industries are those that represent major employers and are significant revenue generators. Different industries face distinct vulnerabilities to natural hazards. Identifying key industries in the region enables communities to target mitigation activities towards those industries' specific sensitivities. The impact that a natural hazard event has on one industry can reverberate throughout the regional economy.[46] These cascading impacts should also be considered.

This is of specific concern when the businesses belong to the basic sector industry. Basic sector industries are those that are dependent on sales outside of the local community; they bring money into a local community via employment. The farm and ranch, information, and wholesale trade industries are all examples of basic industries. Non-basic sector industries are those that are dependent on local sales for their business, such as retail trade, construction, and health services.[47]

Employment by Industry

Economic resilience to natural disasters is particularly important for the major employment industries in the region. If these industries are negatively impacted by a natural hazard, such that

[46] Ibid.

[47] Ibid.

employment is affected, the impact will be felt throughout the regional economy.[48] Thus, understanding and addressing the sensitivities of these industries is a strategic way to increase the resiliency of the entire regional economy.[49]

Table C-18 identifies employment by industry. The top industry sectors in Malheur County with the most employees, are Services Related (7,163), Non-Services Related (2,599), and Government (3,244).

Particularly in rural areas, some of the highest wage jobs are in the manufacturing and natural resource dependent industries (e.g. forestry, oil and gas drilling and support services, and mining) that are often associated public lands. Usually, these high wage industries employ fewer people than other sectors. Some services-related industries also offer high wages (e.g., information, financial activities, and professional and business services). Furthermore, even if the average wages for a given sector are relatively low, that sector may still be an important driver of the local economy if it supports a significant share of the total jobs in the area. Finally, wages provide a good counter-part to the per capita income figure. In some areas per capita income can be high (sometimes driven by a high proportion of non-labor income) while wages are low. A good indicator of an overall strong local economy is when both per capita income and wages are relatively high.[50]

Table C-17 Wages by Industry in Malheur County

BLM Socioeconomic Profile

Malheur County, OR

Wages by Industry

Employment and Wages in 2017, Aggregated Region	Wage & Salary Employment	% of Total Wage & Salary Employment	Avg. Annual Wages (2018 $s)	United States Avg. Annual Wages (2018 $s)
Total	13,006		$36,352	$56,719
Private	9,761	75.0%	$32,598	$56,666
Non-Services Related	2,599	20.0%	$35,059	$65,496
Natural Resources and Mining	1,284	9.9%	$31,262	$58,223
Agriculture, forestry, fishing & hunting	na	na	na	$35,292
Mining (incl. fossil fuels)	na	na	na	$104,581
Construction	259	2.0%	$37,370	$62,193
Manufacturing (Incl. forest products)	1,056	8.1%	$39,109	$68,444
Services Related	7,163	55.1%	$31,700	$54,814
Trade, Transportation, and Utilities	2,995	23.0%	$32,736	$47,259
Information	198	1.5%	$63,931	$108,259
Financial Activities	285	2.2%	$43,034	$95,153
Professional and Business Services	433	3.3%	$29,843	$74,266
Education and Health Services	1,626	12.5%	$38,286	$50,382
Leisure and Hospitality	1,204	9.3%	$15,734	$23,744
Other Services	419	3.2%	$23,263	$38,215
Unclassified	2	0.0%	$116,971	$57,228
Government	3,244	24.9%	$47,658	$57,022
Federal Government	206	1.6%	$63,444	$82,362
State Government	1,267	9.7%	$61,725	$60,213
Local Government	1,771	13.6%	$35,758	$50,913

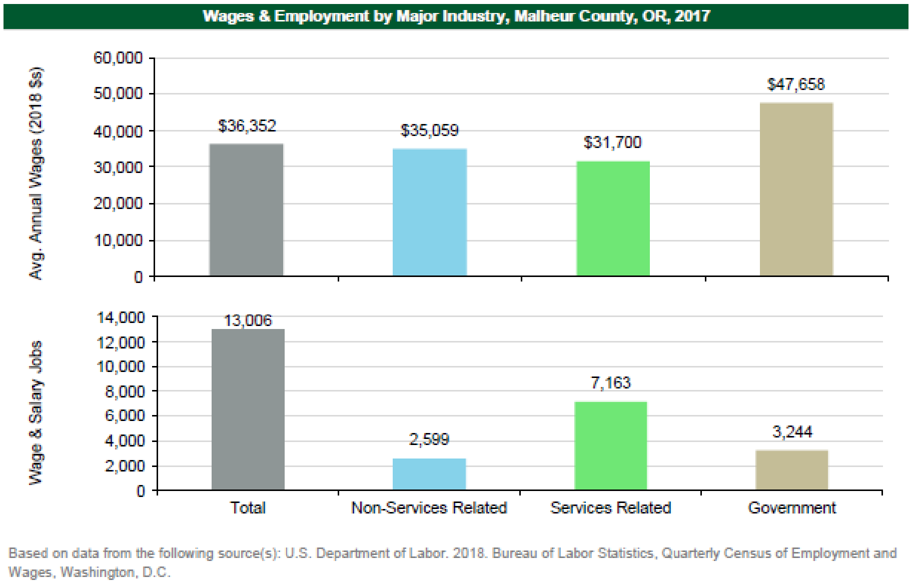
Source: BLM Socioeconomic Profile for Malheur County, accessed March 11, 2019, https://headwaterseconomics.org/tools/blm-profiles/

[48] Ibid.

[49] Ibid.

[50] BLM Socioeconomic Profile for Malheur County, accessed March 11, 2019, https://headwaterseconomics.org/tools/blm-profiles/

Figure C-28 Wages and Employment by Industry in Malheur County



Source: BLM Socioeconomic Profile for Malheur County, accessed March 11, 2019, https://headwaterseconomics.org/tools/blm-profiles/

Future Employment in Industry

Sectors that are anticipated to be major employers in the future also warrant special attention in the hazard mitigation planning process. Between 2010 and 2020, the largest employment growth is anticipated within Professional and Business Services (21%), Education and Health Services (17%) and Leisure and Hospitality (13%).[51] The basic industries, Natural Resources, Mining and Construction, are expected to increase by ten-percent. Considering that some projected industries (shown in the tables above) are among those that generate high revenue and/or income (e.g. Education and Health Services), the above mentioned issues should be incorporated into future hazard mitigation planning.

Table C-18 County Workforce by Age Group in Malheur County

Age	Number
All Ages 14-99	12,756
55-64	2,447
65-99	884
Share 55+	26%

Source: Oregon Employment Department, *The Employment Landscape of Rural Oregon*, May 2017, https://www.qualityinfo.org/documents/10182/13336/The+Employment+Landscape+of+Rural+Oregon?version=1.0

[51] Oregon Employment Department, *Employment Projections by Industry and Occupations: 2010-2020 Oregon and Regional Summary*, http://qualityinfo.org/pubs/projections/projections.pdf, accessed March 2013, link broken March 2019.

Recap of 2018

The following is excerpted from the Oregon Employment Department's article *A Glance Back at Eastern Oregon in 2018*, dated March 14, 2019.

Total nonfarm employment growth slowed to 0.5 percent in Eastern Oregon in 2018 from 1.0 percent the year prior. Nonfarm employment reached 67,875 jobs as the private sector increased and the public sector decreased. A surface level comparison of annual average employment shows the private sector expanded by 2.1 percent, a gain of 1,038 jobs and double the 2017 growth rate. Meanwhile, the public sector dropped by 3.7 percent or 680 jobs. Beneath the surface, much of this shift was due to the reclassification of home care workers from state government to private-sector education and health services.

Malheur County shed 43 nonfarm jobs over the year for a loss of 0.4 percent. Private employment slipped by 18 jobs for a loss of 0.2 percent. Malheur took a big hit in wholesale trade. Combined, wholesale and retail trade dropped 120 jobs (-4.7%). Professional and business services dropped 30 jobs (-6.8%). The goods-producing industry picked up some slack with a gain of 40 jobs (+2.7%). Local government education added 80 jobs for a gain of 6.0 percent.[52]

Synthesis

The current and anticipated financial conditions of a community are strong determinants of community resilience, as a strong and diverse economic base increases the ability of individuals, families and the community to absorb disaster impacts for a quick recovery. Considering the high regional unemployment, high housing cost burden, and an economy heavily dependent on a single or few key industries, Malheur County may experience a more difficult time in recovering after a disaster than one with a more diverse economic base.[53] It is important to consider what might happen to the County economy if the largest revenue generators and employers are impacted by a disaster. It is imperative that Malheur County recognizes that economic diversification is a long-term issue; more immediate strategies to reduce vulnerability should focus on risk management for the dominant industries.[54]

Built Capacity

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

[52]State of Oregon Employment Department, *A Glance Back at Eastern Oregon in 2018*, https://www.qualityinfo.org/-/a-glance-back-at-eastern-oregon-in-2018?inheritRedirect=true&redirect=%2Feastern-oregon

[53] DLCD, *2015 Oregon Natural Hazards Mitigation Plan*, Region 4 Southwest Oregon Regional Profile, https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP.pdf

[54] Ibid.

surrounding cities and counties due to infrastructure failure. These conditions force communities to rely on local and immediately available resources.

Housing Building Stock

In addition to location, the characteristics of the housing stock affect the level of risk posed by natural hazards. Table C-19 identifies the types of housing most common throughout the county. Of particular interest are mobile homes and other non-permanent housing structures, which account for about 17% of the housing in Malheur County. Vale's percent of mobile home housing is considerably higher than Nyssa and Ontario's. Mobile structures are particularly vulnerable to certain natural hazards, such as wind storms, and special attention should be given to securing the structures, because they are more prone to wind damage than wood-frame construction.[55]

Table C-19 Malheur County Housing Profile

Jurisdiction	Total Housing Units	Single-Family		Multiple-Family		Mobile Homes or Other	
		Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Malheur County	11,806	7,741	65%	2,036	17.2%	2,018	17.1%
Ontario	4,775	2,731	57.2%	1,512	31.7	532	11.1%
Nyssa	1,133	827	73%	180	15.9%	126	11.1%
Vale	858	489	57%	184	21.4%	174	20.3%

Source: U.S. Census Bureau, American Fact Finder, Table DP04, Selected Housing Characteristics, 2013-2017, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml, accessed March 15, 2019.

Age of housing is another characteristic that influences a structure's vulnerability to hazards. Generally, the older the home is, the greater the risk of damage. Structures built after the late 1960's in the Pacific Northwest utilized earthquake resistant designs and construction. Communities began implementing flood elevation ordinances in the 1970's, with the local FEMA flood insurance study completed in the mid-1980s, and in 1990 Oregon again upgraded seismic standards to include earthquake loading in the building design.[56]

Knowing the age of the structure is helpful in targeting outreach regarding retrofitting and insurance for owners of older structures.[57] Based on U.S. Census data, 43.2% of Malheur County housing was built prior to 1980 and the implementation of flood elevation requirements. There is a need to identify if these homes are located in a floodplain, and target outreach to the property owners to encourage appropriate flood mitigation. The data shows 33.5% of the housing units in the County

[55] Ibid.

[56] Wang Yumei and Bill Burns, *Case History on the Oregon GO Bond Task Force: Promoting Earthquake Safety in Public Schools and Emergency Facilities*, National Earthquake Conference, January 2006.

[57] DLCD, *2015 Oregon Natural Hazards Mitigation Plan*, Region 4 Southwest Oregon Regional Profile,. https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP.pdf

were built after 1980 and 23.4% after 1990 when more stringent building codes were put in place. Prior to 1990 the housing stock may have questionable seismic stability. In addition to single-family households, it is also important to consider the structural integrity of multi-unit residences, as these structures will have an amplified impact on the population. Table C-20 shows the numbers for single-family, multi-family, and mobile home housing stock.

Table C-20 Malheur County Housing Year Built

Date Constructed	Malheur County	Ontario	Nyssa	Vale
Total Housing Units	11,806	4775	1133	858
Pre 1980	5106	3227	874	601
1980 to 1989	1200	540	57	80
1990 and Later	2760	1008	202	177

Source: U.S. Census Bureau, American Fact Finder, Table DP04, Selected Housing Characteristics, 2013-2017, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml, accessed March 15, 2019.

Commercial Building Stock

Critical Infrastructure, Critical Facilities, and Lifelines

Critical infrastructure, critical facilities, and lifelines are those systems, structures, and facilities that are essential to government response and recovery activities (e.g., hospitals, police, fire and rescue stations, utilities, communications lines, sewer and water lines, dams, levees, school districts, and higher education institutions). The interruption of service or destruction of any of these would have a debilitating effect on the community.

Malheur County and the surrounding counties primarily receive oil and gas from fields in the Rocky Mountains. Most of the natural gas consumed originates in Alberta, Canada. Avista Utilities owns the main natural gas transmission pipeline. Idaho Power and Harney Electric Cooperative operate the network of electricity transmission lines running through the Southeast Oregon region. Primarily, Pacific Power, through 161-230 kV electrical transmission lines supplies electricity in the County. The vast majority of energy generating plants in Oregon are hydroelectric. The electric, oil, and gas lifelines that run through Malheur County are both municipally and privately owned. These lines may be vulnerable to severe, but infrequent natural hazards, such as earthquakes. [58]

Critical infrastructure, critical facilities, and lifelines in Malheur County are identified in Volume I Section 2 Risk Assessment. This information provides the basis for informed decisions that can be used to reduce the vulnerability of the County and Cities to natural hazards.

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

Dependent Facilities

In addition to the critical infrastructure, critical facilities, and lifelines mentioned above, there are other facilities that are vital to the continued delivery of health services and may significantly impact the public's ability to recover from emergencies. Assisted living centers, nursing homes, residential mental health facilities, and psychiatric hospitals are important to identify within the community because of the dependent nature of the residents. Also these facilities can serve as secondary medical facilities as they are equipped with nurses, medical supplies and beds.

Malheur County has four assisted living centers; one in Vale, one in Nyssa, and two in Ontario. There are four residential care facilities and three adult foster homes in in Ontario. There are two adult foster homes in Vale and one in Nyssa. There is one nursing home in Vale. There are no psychiatric hospitals.[59]

Correctional Facilities

Correctional facilities are incorporated into physical infrastructure as they play an important role in everyday society by maintaining a safe separation from the public. There are two correctional facilities located in Malheur County.

The Malheur County Correctional Facility, located in Vale and adjacent to the courthouse, is part of the sheriff's office management. It is a modern facility completed in 1996 and has 104 beds.[60]

The Snake River Correctional Institution (SRCI) is a multi-security facility which opened in August 1991. Although sited for 3,000 beds, only 576 medium security and 72 minimum security beds were constructed in Phase I. In 1994, the Oregon Legislative Assembly approved construction of the remaining 2,352 beds at a cost of $175 million; it was the largest state general funded public works project in state history. Many SRCI inmates worked in construction activities.

SRCI is the largest prison in Oregon with 2,336 medium-security beds, 154 minimum-security beds and 510 special housing beds. It also has Administrative Segregation, Disciplinary Segregation, Intensive Management, and Infirmary areas. SRCI has several unique features such as decentralized inmate services that enable the department to separate various offenders into discrete housing units. It also has a comprehensive corridor system connecting housing, program, and work areas so that inmates can move from one area to another under all types of weather conditions.[61]

Physical Infrastructure

Physical infrastructure such as dams, levees, roads, bridges, railways and airports support Malheur County communities and economies. This physical infrastructure plays a fundamental role in both pre and post-disaster situations. Much of the physical infrastructure is also part what communities consider their critical infrastructure, critical facilities, and lifelines.

---

59 Jaime Mordhorst, Oregon DHS Transition Coordinator, personal communication, March 12, 2019.

60 Malheur County, *Jail*, https://www.malheurco.org/jail/ accessed March 12, 2019 and Rich Harriman, Malheur County, Emergency Manager, personal communication, March 13, 2019.

61 DOC Operations Division: *Prison Locations*, Snake River Correctional Institution, https://www.oregon.gov/doc/about/Pages/prison-locations.aspx, accessed March 12, 2019.

Dams

Dam failures can occur rapidly and with little warning. Fortunately most failures result in minor damage and pose little or no risk to life safety.[62] However, the potential for severe damage still exists and should be considered in mitigation planning efforts. See the Flood Hazard Annex for more information about dams and levees located in Malheur County.

Railways

Railroads are major providers of regional and national cargo trade flows. The Union Pacific Railroad runs along the Oregon and Idaho border in the northeastern corner of Malheur County. Branching from Union Pacific rail tracks, the Wyoming and Colorado, Eastern Oregon Division, Railroad runs into the northeastern corner of Malheur County through Vale.[63]

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

In September 2018, a rezone and urban growth boundary amendment (UGB) was discussed by the Malheur County Planning Department. The applicant was the City of Nyssa. They sought a Comprehensive Plan amendment to expand the City's UGB to include 290.35 acres of lands then zoned Exclusive Farm Use (EFU) and 67.7 acres then zoned Heavy Industrial by Malheur County. The City of Nyssa submitted the proposal to accommodate a rail-dependent, truck-to-railroad reload facility, referred to as the Treasure Valley Reload Center (TVRC).[64] The proposal was approved.[65]

Airports

Malheur County has five public airports, nine private airports, and one private heliport.[66] The heliport is owned by Holy Rosary Medical Center. Of the public airports, two are municipal airports, respectively owned and operated by the City of Vale and City of Ontario. There is no commercial service airport in the County. Access to these facilities could become closed in the event of natural hazards. Another important consideration in identifying area air resources is the type and condition of runway surfaces at these various facilities, as they will impact the ability to utilize the airport.

---

[62] Federal Emergency Management Agency, *Dam Failure Information*, . https://www.fema.gov/dam-failure-information, accessed March 12, 2019.

[63] Oregon Department of Transportation, *State of Oregon, Oregon Railroads*, https://www.oregon.gov/ODOT/ROW/Documents/railroads.pdf, accessed March 12, 2019.

[64] Malheur County, *Report and Recommendation for City of Nyssa Urban Growth Boundary Amendment and Rezone Planning Application 2018-08-013*, https://www.malheurco.org/wp-content/uploads/Departments/Planning/Documents/2018-08-013.pdf, accessed March 12, 2019.

[65] Jim Maret, City of Nyssa, City Manager, personal communication, March 12, 2019.

[66] FAA Airport Master Record. 2011, http://www.faa.gov/airports/airport_safety/airportdata_5010/menu/index.cfm, accessed March 2013. FAA website not available but information was confirmed at Tollfree Airlines, *Malheur County Public and Private Airports*, http://www.tollfreeairline.com/oregon/malheur.htm, accessed March 12, 2019.

Power Plants

The majority of electrical power in Oregon is generated through hydropower. Owyhee Dam is in Malheur County. It provides irrigation water supply to a large area. See the Flood Hazard Annex. No hydroelectric generation facilities or other types of power plants are located in Malheur County.[67]

Roads and Bridges

The region's major expressway is Interstate 84. It bisects the most northeastern corner of Malheur County and is a main passage for automobiles and trucks traveling from states to the east of Oregon. I-84 runs from Utah and Idaho to Portland, Oregon. Other major highways in this region include:

- Highway 20 connects Ontario to Vale, to Burns in Harney County, and Idaho;
- Highway 26 connects Vale to Portland, a distance of 378 miles;
- Highway 20 and 26 merge and connect to Interstate 84 in Ontario;
- Highway 95 runs from the southern border to the northeastern corner of the County and connects Nevada to Malheur County to Idaho; and
- Highway 78 intersects with Hwy 95 in the southern half of the County and runs northwest to Burns in Harney County.

Daily, transportation infrastructure capacity in the Southeast Oregon region is stressed because of needed maintenance and lack of infrastructure in some areas. For example, some roads are too narrow for fire equipment vehicles. Natural hazards can further disrupt automobile traffic and create gridlock; this is of extra concern in periods of evacuation and when there are few alternative routes, especially in remote parts of the County.[68]

The existing condition of bridges in the region is also a factor that affects risk from natural hazards and potential impacts to the communities. Bridge failure can have immediate and long-term implications in the response and recovery of a community. Incapacitated bridges can disrupt traffic, limit the ability of services to be provided, and exacerbate economic losses. This is due to the inability to transport products and services in and out of the area.[69]

Each year the Oregon Department of Transportation (ODOT) evaluates and assesses the bridges in Oregon. This information is shared in published yearly Bridge Condition Report and Tunnel Data. Much of ODOT's work has focused on seismic upgrades.

ODOT measures bridge conditions based on Key Performance Measure (KPM) 16 – Percent of Bridges Not Distressed (%ND). The KPM 16 includes two categories of bridges: 1) the percent of bridges not structurally deficient (SD) as defined by the Federal Highway Administration (FHWA) and 2) the percent of bridges without other deficiencies (OD) as defined by ODOT. SD and OD components capture different characteristics of bridge conditions as shown. A condition of distressed indicates that the bridge is rated as SD or has at least one OD. ODOT considers both SD

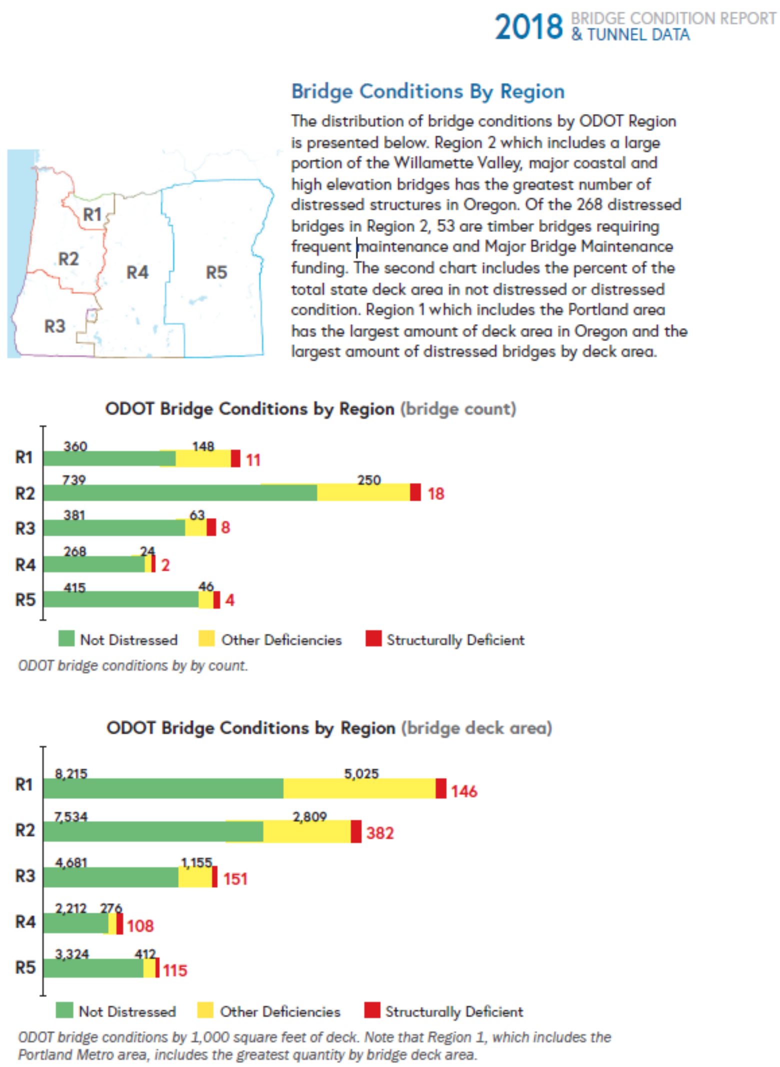
[67] Loy, W. G., ed. 2001. *Atlas of Oregon*, 2nd Edition. Eugene, OR: University of Oregon Press and Oregon Department of Energy, *Energy in Oregon, Hydropower*, https://www.oregon.gov/energy/energy-oregon/Pages/Hydropower.aspx, accessed March 12, 2019.

[68] DLCD, *2015 Oregon Natural Hazards Mitigation Plan*, Region 4 Southwest Oregon Regional Profile,. https://www.oregon.gov/LCD/NH/Documents/Approved_2015ORNHMP.pdf

[69] Ibid.

and OD aspects in determining bridge needs and selecting projects for the statewide Transportation Improvement Program (STIP).[70] Figure C-29 includes several graphics that demonstrate the status of bridges and bridge deck areas in three categories: not distressed, other deficiencies, and structural deficiencies by regions in Oregon. Malheur County is in Region 5.

Figure C-29 ODOT 2018 Bridge Conditions by Region



Source: Oregon Department of Transportation, *2018 Bridge Condition Report and Tunnel Data*, https://www.oregon.gov/ODOT/Bridge/Documents/Bridge-Condition-Report-2018.pdf

Synthesis

Given the unique dependent, rural nature of Malheur County, maintaining the quality of built capacity throughout the area is critical. Some of the most significant considerations for the County

[70] Oregon Department of Transportation, *2018 Bridge Condition Report and Tunnel Data*, https://www.oregon.gov/ODOT/Bridge/Documents/Bridge-Condition-Report-2018.pdf

are contingency planning for medical resources and lifeline systems due to the imminent need for these resources. As mentioned above, functionality of hospitals and dependent care facilities are a significant priority in providing for Malheur County residents. One factor is the availability of medical beds in local hospitals and dependent care facilities. In the event of a disaster, medical beds may be at a premium. Some of these facilities may run at almost full capacity on a daily basis. It may be useful for hospitals to consider surge planning and develop memorandums with surrounding counties for medical transport, treatment, and supplies. Additional consideration for memorandums of agreements with other counties could include those to support use of utility lifelines and transportation lifelines such as, airports, railways, roads and bridges.

While these elements are traditionally recognized as part of response and recovery from a natural disaster, it is essential to continue building relationships and establishing contractual agreements with entities that may be critical in supporting community resilience.

Community Connectivity Capacity

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

Social Systems and Service Providers

Social systems include community organizations and programs that provide social and community-based services, such as employment, health, senior and disabled services, professional associations and veterans' affairs for the public. In planning for natural hazard mitigation, it is important to know what social systems exist within the community because of their existing connections to the public.

Often, mitigation actions identified in the NHMP involve communicating with the public or specific subgroups within the population (e.g. elderly, children, low income, etc.). The County can use existing social systems as resources for implementing such communication-related activities because these service providers already work directly with the public on a number of issues. The presence of these services are more predominantly located in urbanized areas of Malheur County.

The following is a brief explanation of how the communication process works and how the community's existing social service providers could be used to provide natural hazard related messages to their clients. This information has been retained from the *2014 Malheur County NHMP*; there is no reference citation for it.

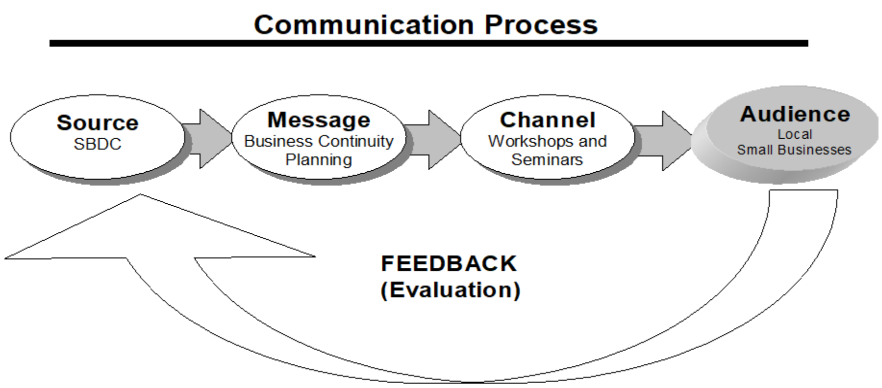
There are five essential elements for communicating effectively to a target audience:

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

An example of an existing social system whose communication system can be linked to natural hazard mitigation is the Ontario Chamber of Commerce. The Chamber (the source) provides local businesses (the audience) with information on business contingency planning (the message) through speakers at meetings (the channel). To target small businesses, Malheur County can provide the Chamber with information on developing business continuity plans and strategies for recovering from a natural hazard. This example is graphically presented in Figure C-30.

Malheur County and the Cities recognized the importance of collaborating with the Chamber and on business continuity planning. Multi-hazard mitigation action #1 is "Conduct Business Continuity Plan Development and information sharing through presentations, workshops, and other methods for small businesses, local nonprofits, governments, and human services organizations." The action is a high priority. In addition, another high priority mitigation action is multi-hazard action #3 which is "Develop an education program for Malheur County to raise awareness of natural hazards and potential mitigation activities." See Table 3-3 for a list of all the mitigation actions.

Figure C-30 Communication Process



Source: *2014 Malheur County NHMP*, adapted from the U.S. Environmental Protection Agency, Radon Division's outreach program

The *2014 Malheur County NHMP* had a table called Malheur County Social Service Providers. That provided a list of existing social systems within Malheur County; it included each organization or program's service area, types of services offered, populations served, and how the organization or program could be involved in natural hazard mitigation. That table has been deleted due to it being outdated. The three involvement methods identified in the *2014 Malheur County NHMP* are retained and include the following:

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

The involvement methods can be used to implement the mitigation actions which are listed in Table 3-3 and in Appendix A.

Civic Engagement

Civic engagement and involvement in local, state and national politics are important indicators of community connectivity. Those who are more invested in their community may have a higher tendency to vote in political elections. Other indicators such as volunteerism, participation in formal community networks and community charitable contributions are examples of other civic engagement that may increase community connectivity.

Cultural Resources

Historic Places

Historic and cultural resources such as historic structures and landmarks can help to define a community and may also be sources for tourism revenue. Protecting these resources from the impact of disasters is important because they have a role in defining and supporting the community.

According to the National Register Bulletin, "a contributing resource is a building, site, structure, or object adds to the historic associations, historic architectural qualities, or archeological values for which a property is significant because it was present during the period of significance, related to the documented significance of the property, and possesses historical integrity or is capable of yielding important information about the period; or it independently meets the National Register criteria."[71] If a structure does not meet these criteria, it is considered to be non-contributing.

Table C-21 identifies the number of eligible/significant (ES), eligible/contributing (EC), non-eligible/out of period (NP), and non-eligible/non-contributing (NC) historic sites in Malheur County. The table also shows how many sites are located and in incorporated cities. Overall, there are a total of 46 historically registered places in Malheur County.

Table C-21 Malheur County Historic Places

Eligible Sites	Total Sites (46)	Located in Incorporated Cities
ES-Significant	18	13
EC-Contributing	17	0
NP-Non-Eligible/Out of Period and NC-Non-Eligible and Non-Contributing	11	0

Source: Oregon Historic Sites Database, http://heritagedata.prd.state.or.us/historic/

Libraries and Museums

Libraries and museums develop cultural capacity and community connectivity as they are places of knowledge and recognition, they are common spaces for the community to gather, and can serve critical functions in maintaining the sense of community during a disaster. They are recognized as safe places and reflect normalcy in times of distress. The Cities of Ontario, Nyssa, and Vale have public libraries. There are two museums in Malheur County: the Old Stone House in Vale and the Al

[71] U.S. Department of the Interior, National Park Service, Cultural Resources, *National Register Bulletin 16A: How to Complete the National Register Registration Form*, https://www.nps.gov/nr/publications/bulletins/nrb16a/

Thompson and Sons Feed and Seed Company which is the home of the Oregon Trail Agriculture Museum and is located in Nyssa.[72]

Cultural Events

Other institutions that can strengthen community connectivity are the presence of festivals and organizations that engage diverse cultural interests. Examples of events include the 4th of July Rodeo in Vale; Nyssa's annual Christmas parade and community dinner; the annual Great Owyhee Ride Against Hunger which starts in Ontario, and the Malheur County Fair. These events bring revenue into the community, and they enhance the sense of place. Cultural connectivity is important to community resilience, as people may be more inclined to remain in the community because they feel part of the community and culture.

Community Stability

Residential Geographic Stability and Homeownership

Community stability is a measure of rootedness in place. It is hypothesized that resilience to a disaster stems in part from familiarity with place, not only for navigating the community during a crisis, but also accessing services and other supports for economic or social challenges.[73]

Often homeownership is associated with greater resilience as it is a measure of place attachment and commitment. Homeownership is an indicator that residents will return to a community post-disaster, as these people are economically and socially invested in the community. Similar to communities with higher median household income, homeownership can reflect an increased resource capacity to prepare, respond, and cope with a crisis situation.

Table C-22 identifies housing tenure which is demonstrated by identifying the number of occupied households and within that, the number of owner occupied and renter occupied households.

Table C-22 Homeownership in Malheur County

Jurisdiction	Occupied Households	Owner Occupied	Percent Owner Occupied	Renter Occupied	Percent Renter Occupied
Malheur County	10,262	5,953	58	4,309	42
Ontario	4,324	2,083	48.2	2,241	51.8
Nyssa	1,016	581	57.2	435	42.8
Vale	732	426	58.2	306	41.8

Source: U.S. Census Bureau, American Fact Finder, Table DP04, Selected Housing Statistics, 2013-2017, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml

[72] Museums in Malheur County, Oregon, https://en.wikipedia.org/wiki/Category:Museums_in_Malheur_County,_Oregon

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

Synthesis

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

Political Capacity

Political capacity is recognized as the government and planning structures established within the community. In terms of hazard resilience, it is essential for political capital to encompass diverse government and non-government entities in collaboration; as disaster losses stem from a predictable result of interactions between the physical environment, social and demographic characteristics and the built environment.[74] Communities with resilient political capital seeks to involve stakeholders in hazard planning and work towards integrating the Natural Hazard Mitigation Plan with other community plans, so that all planning approaches are consistent.

Government Structure

In Section 4 Plan Implementation and Maintenance, under "Implementing through Existing Program" there is a description noting that Malheur County and the participating Cities have plans, programs, policies, procedures and agencies that may be used to implement mitigation actions. This "Government Structure" section and the subsequent section "Existing Plans & Policies" provide more detail on that information.

The County Court is the elected body that governs Malheur County. It is comprised of the County Judge and two commissioners. The Judge is the Chair of the County Court. The County Court is responsible for quasi-judicial and legislative members and does not preside over trials or have jurisdiction in the legal community.[75] The County Counsel provides legal advice to the County Court, county employees, elected officials, and county boards.

All the departments within the Malheur County governance structure have some degree of responsibility in building overall community resilience. Each plays a role in ensuring that County functions and normal operations resume after an incident, and the needs of the population are met.

Malheur County government includes the following; see the website for additional departments.[76]

- **Administrative Office:** County budget, personnel, accounts payable, and carpool.
- **Ambulance Service District:** Emergency services and ambulance.
- **Assessor:** Property valuations, record searches, cartography, sales information, veteran's information, senior citizen's deferrals, etc.

---

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

[75] Malheur County, *County Court*, https://www.malheurco.org/county-court/, accessed March 13, 2019.

[76] Malheur County, *County Departments*, https://www.malheurco.org/county-departments/, accessed March 13, 2019.

- **Economic Development:** Supports business and industrial development, performs demographic and grant research, and is responsible for economic and community development in the county.
- **Emergency Management:** Includes emergency management and 911 dispatch.
- **Environmental Health**: Issues permits for septic systems and manages solid waste licensing and consultation programs.
- **Extension Service**: Educational programs in agriculture, lawn and garden, youth development, foods, nutrition and family living.
- **Health Department**: Offers preventative and community health services for county residents, such as immunizations, family planning, HIV testing and counseling, emergency preparedness, WIC, breast and cervical cancer programming, and maternal child health nurse home visiting programs.
- **GIS:** Supports County Government by creating, managing, and analyzing spatial county data. Makes maps.
- **Planning** Evaluates land use applications and submits staff report to planning commission, and responsible for zoning permits and facilitating comprehensive planning process.
- **Road Department:** Responsible for County road and bridge maintenance and construction, as well as shop and weed control.
- **Sheriff's Office**: Responsible for Sheriff's administration, civil, concealed handgun licenses, corrections and jail, dispatch, emergency services, patrol, and investigation.
- **State Water Master:** The State of Oregon Water Resources Department has a representative located in the first floor of the County's courthouse.
- **Surveyor:** Maintains a record of all surveys performed in the County by the County Surveyor or licensed land surveyor and makes them available to the public. Protects, maintains, and reestablishes public land survey corners.

The Cities of Ontario, Nyssa, and Vale also have governance structures that have responsibility for community resilience. See Table C-24 for more information about the Cities.

Table C-23 Participating City Government Structure

	Ontario	Nyssa	Vale
Government Form	Mayor/Council	Mayor/Council	Mayor/Council
City Manager/Administrator	Yes	Yes	Yes
Mayor	Yes	Yes	Yes
City Council	Yes	Yes	Yes
Building	Yes	No	No
Planning	Yes	Planning Commission	Planning Commission
Public Works	Yes	Yes	Yes and Public Works Committee
Parks and Recreation	Yes	Yes	Parks Committee
Police	Yes	Yes	No
Fire	Yes	Yes	Yes
Information Technology	No	No	No
Economic Development	Yes	Yes	No
Finance	Yes	Yes (person) and Budget Committee	Budget Committee

Source: City of Ontario, http://www.ontariooregon.org/CityServices.cfm; City of Nyssa, https://www.nyssacity.org/; City of Vale, https://www.cityofvale.com/, accessed March 13, 2019.

Existing Plan & Policies

In Section 4 Plan Implementation and Maintenance, under "Implementing through Existing Program" there is a description noting that Malheur County and the participating Cities have plans, programs, policies, procedures and agencies that may be used to implement mitigation actions. This section and the previous section "Government Structure" provide more detail on that information.

Communities often have existing plans and policies that guide and influence land use, land development, and population growth. Existing plans and policies can include comprehensive plans, zoning ordinances, and technical reports or studies. Plans and policies already in existence have support from local residents, businesses and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can adapt easily to changing conditions and needs.[77]

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

The *2019 Malheur County NHMP* includes mitigation action items that, when implemented, will reduce the County's and Cities' vulnerability to natural hazards. These mitigation actions are consistent with the goals and objectives of the County's existing plans and policies.

Linking existing plans and policies to the *2019 Malheur County NHMP* helps identify what resources already exist that can be used to implement the mitigation actions in the NHMP. Implementing the natural hazards mitigation plan's action items through existing plans and policies increases their likelihood of being supported and getting updated, and maximizes the County's resources as well as the Cities. In addition to the plans listed in Table C-25, the County and Cities also have zoning ordinances (including floodplain development regulations) and building regulations.

Table C-24 Existing Plans

Jurisdiction	Document	Year
Malheur County	Community Wildfire Protection Plan	2009
Malheur County	Comprehensive	1982
Malheur County	Emergency Operations Plan	2017
Malheur County	Natural Hazards Mitigation Plan	2014
Malheur County	Transportation Systems Plan	1998
City of Ontario	Comprehensive Plan	1992
City of Ontario	Public Safety Master Plan	2002
City of Ontario	Stormwater Master Plan	2003
City of Ontario	Transportation Systems Plan	2006
City of Nyssa	Comprehensive Plan	1982
City of Nyssa	Development Code	2006
City of Nyssa	Main Street Revitalization Plan	1987
City of Nyssa	Transportation System Plan	1998
City of Nyssa	Snow Removal Plan	2018
City of Nyssa	Flood Control Ordinance	1962
City of Nyssa	Water Management and Conservation Plan	2009
City of Nyssa	Water System Master Plan	2010
City of Vale	Comprehensive Plan	2003
City of Vale	Development Code	2003
City of Vale	Downtown Plan	2001
City of Vale	Transportation System Plan	1998
City of Vale	Snow Removal Plan	2003

Jurisdiction	Document	Year
City of Vale	Water Management and Conservation Plan	2015
Natural Resource Conservation Service	Natural Resources Long Range Strategy in Malheur County, Oregon	2010
Greater Eastern Oregon Development Corporation	Comprehensive Economic Development Strategy	2014
City of Adrian	Comprehensive Plan	1978
City of Adrian	Transportation Systems Plan	2001
City of Jordan Valley	Comprehensive Plan	1981
City of Jordan Valley	Zoning Ordinance	1981
City of Jordan Valley	Flood Damage Prevention Ordinance	1980

Source: *2014 Malheur County NHMP*; City of Ontario, http://www.ontariooregon.org/CityServices.cfm; City of Nyssa, https://www.nyssacity.org/; City of Vale, https://www.cityofvale.com/, accessed March 13, 2019.

Existing Mitigation Activities

Existing mitigation activities include current programs and activities that are being implemented by the community in an effort to reduce the community's overall risk to natural hazards. Documenting these efforts can assist the community in better understanding its risk and can assist in recognizing successes. The list below consists of countywide efforts and city-specific mitigation activities. According to the *2014 Malheur County NHMP*, OEM has not documented any state- or federally-funded mitigation projects in Malheur County (neither pre-disaster nor recovery mitigation).

Malheur County Planning Department

There are flood hazard building regulations which regulate development on floodplain areas within the County. See the Flood Hazard Annex for details about flood-related provisions in Malheur County and the Cities.

Malheur County Emergency Services

The Emergency Management Team (EMT) was created to foster cooperation and communication between the County, Cities, and local organizations involved in disaster response, recovery, preparedness, and mitigation. The EMT meets monthly. It encourage teamwork and strategizing about response and recovery tactics in various situations. As described in Volume I Introduction, The Malheur County NHMP Steering Committee also serves as the Emergency Management Team (EMT) and the Local Emergency Planning Committee (LEPC).

Bureau of Land Management (BLM Vale Branch)

BLM is also described in the Wildfire Hazard Annex. Because 71% of Malheur County is managed by the BLM, its mitigation projects have the potential to positively impact both the natural and human environment. This is a summary of some of the BLM's mitigation projects Malheur County.

- Fuels Reduction: Treatments have occurred in various parts of the County for cheatgrass and juniper.
- Native grass restoration: Several projects in the county are underway to re-seed native grasses, which lengthens the natural fire cycle.
- Fire Breaks: BLM has created fire breaks along the Wildland-Urban Interface in Rome and Arock.
- Community Assessment Reports (2002): Comprehensively assessed fire risk and outlined mitigation activities for each community in the County.

Malheur, Owyhee, and Vale Irrigation Districts

According to the Malheur County NHMP Steering Committee, there is an ongoing conversion of earthen irrigation canals to sealed pipeline, reducing evaporation and contamination, and mitigating drought. The Malheur and Owyhee Watershed Councils will also be engaged in this discussion. Drought (DR) #2 mitigation action relates to this effort. The irrigation districts and watershed councils are also engaged in DR #1 regarding the Malheur County Soil and Water Conservation District's water assessment project. See Table 3-3 and Appendix A Action Item Forms for details.

Four Rivers Healthy Community (4RHC)

4RHC empowers community partners focused on strengthening health, education, livability and leadership in the Western Treasure Valley. 4HRC was established in 2003 and the task was to build a local Healthy Community Coalition and hold a stakeholder summit to create a shared vision of community health. This would set the stage for asset mapping, priority setting and action planning.[78]

Synthesis

As described above, many governmental entities are responsible for work relevant to hazards planning. There is more information to be located as not all plans, policies, and programs are available on the jurisdictional websites. Also, not all of them have been discussed at the NHMP Steering Committee meetings. It is challenging to ascertain whether these existing plans, policies, and programs work collaboratively in practice towards improving mitigation of hazards.

Based on the NHMP/EMT/LEPC meetings, there is a great desire for collaboration and effective implementation. Additional integration is desired and can certainly be obtained as continued dialogue and collaboration occurs. Further analysis is needed to evaluate the effectiveness of political capital in terms of community resilience.

[78] Four Rivers Healthy Community, *About Us*, https://www.4rhc.org/about

Appendix D: Economic Analysis of Natural Hazard Mitigation Projects

This appendix was originally developed by the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center (now the Institute for Policy Research and Engagement or IPRE) and included in the *2014 Malheur County NHMP*. It has been reviewed and accepted by the Federal Emergency Management Agency (FEMA) as a means of documenting how the prioritization of mitigation actions includes a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and associated costs.

The appendix outlines three approaches for conducting economic analyses of natural hazard mitigation projects:

- the benefit/cost analysis,
- the cost-effectiveness analysis, and
- the STAPLE/E Approach.

The appendix describes the importance of implementing mitigation activities, different approaches to economic analysis of mitigation strategies, and methods to calculate costs and benefits associated with mitigation strategies.

Information in this section is derived in part from: The Interagency Hazards Mitigation Team, *State Hazard Mitigation Plan*, (Oregon's Office of Emergency Management, 2000), and FEMA Publication 331, *Report on Costs and Benefits of Natural Hazard Mitigation*. This section is not intended to provide a comprehensive description of benefit/cost analysis, nor is it intended to evaluate local projects. It is intended to (1) raise benefit/cost analysis as an important issue, and (2) provide some background on how economic analysis can be used to evaluate mitigation projects.

Why Evaluate Mitigation Strategies?

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

Evaluating mitigation projects is a complex and difficult undertaking, which is influenced by many variables such as these three:

- Natural disasters affect all segments of the communities they strike, including individuals, businesses, and public services such as fire, police, utilities, and schools.
- While some of the direct and indirect costs of disaster damages are measurable, some of the costs are non-financial and difficult to quantify in dollars.
- Many of the impacts of such events produce "ripple-effects" throughout the community, greatly increasing the disaster's social and economic consequences.

While not easily accomplished, there is value in assessing the positive and negative impacts from mitigation activities, and obtaining an instructive benefit/cost comparison.

What are some Economic Analysis Approaches for Evaluating Mitigation Strategies?

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

Benefit/Cost Analysis

Benefit/cost analysis is a key mechanism used by OEM, FEMA, and other state and federal agencies in evaluating hazard mitigation projects, and is required by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended.

Benefit/cost analysis is used in natural hazards mitigation to show if the benefits to life and property protected through the mitigation action exceed the cost of the mitigation action. A benefit/cost analysis for a mitigation action can assist communities in determining whether a project is worth undertaking now to avoid disaster-related damages later.

Benefit/cost analysis is based on calculating the frequency and severity of a hazard, avoiding future damages, and risk. In benefit/cost analysis, all costs and benefits are evaluated in terms of dollars, and a net benefit/cost ratio is computed to determine whether a project should be implemented. A project must have a benefit/cost ratio greater than 1 (the net benefits will exceed the net costs) to be eligible for FEMA funding.

Cost-Effectiveness Analysis

Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. This type of analysis, however, does not necessarily measure costs and benefits in terms of dollars. Determining the economic feasibility of mitigating natural hazards can also be organized according to the perspective of those with an economic interest in the outcome. Hence, economic analysis approaches are covered for both public and private sectors as follows.

Investing in Public Sector Mitigation Activities

Evaluating mitigation strategies in the public sector is complicated because it involves estimating all of the economic benefits and costs regardless of who realizes them, and potentially to a large number of people and economic entities. Some benefits cannot be evaluated monetarily, but still affect the public in profound ways. Economists have developed methods to evaluate the economic feasibility of public decisions which involve a diverse set of beneficiaries and non-market benefits.

Investing in Private Sector Mitigation Activities

Private sector mitigation projects may occur on the basis of one or two approaches: it may be mandated by a regulation or standard, or it may be economically justified on its own merits. A building or landowner, whether a private entity or a public agency, required to conform to a mandated standard may consider the following options:

1. Request cost sharing from public agencies;
2. Dispose of the building or land either by sale or demolition;
3. Change the designated use of the building or land and change the hazard mitigation compliance requirement; or
4. Evaluate the most feasible alternatives and initiate the most cost effective hazard mitigation alternative.

The sale of a building or land triggers another set of concerns. For example, real estate disclosure laws can be developed which require sellers of real property to disclose known defects and deficiencies in the property, including earthquake weaknesses and hazards to prospective purchases. Correcting deficiencies can be expensive and time consuming, but their existence can prevent the sale of the building. Conditions of a sale regarding the deficiencies and the price of the building can be negotiated between a buyer and seller.

STAPLE/E Approach

Considering detailed benefit/cost or cost-effectiveness analysis for every possible mitigation action could be time consuming and impractical. There are approaches for conducting a quick evaluation of the proposed mitigation actions which could be used to identify those that merit more detailed assessment. One of those methods is the STAPLE/E approach.

Using STAPLE/E criteria, mitigation actions can be evaluated quickly. This set of criteria requires the assessment of the mitigation actions based on the Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLE/E) constraints and opportunities of implementing the particular mitigation action in your community.

The second chapter in FEMA's *How-To Guide Developing the Mitigation Plan – Identifying Mitigation Actions and Implementation Strategies* as well as the State of Oregon's *Local Natural Hazard Mitigation Plan: An Evaluation Process* outline some specific considerations in analyzing each aspect. The following are suggestions for how to examine each aspect of the STAPLE/E approach from the *State of Oregon's Local Natural Hazard Mitigation Plan: An Evaluation Process*.

Social: Community development staff, local non-profit organizations, or a local planning board can help answer these questions.

- Is the proposed action socially acceptable to the community?
- Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- Will the action cause social disruption?

Technical: The city or county public works staff, and building department staff can help answer these questions.

- Will the proposed action work?
- Will it create more problems than it solves?
- Does it solve a problem or only a symptom?
- Is it the most useful action in light of other community goals?

Administrative: Elected officials or the city or county administrator, can help answer these questions.

- Can the community implement the action?
- Is there someone to coordinate and lead the effort?
- Is there sufficient funding, staff, and technical support available?
- Are there ongoing administrative requirements that need to be met?

Political: Consult the mayor, city council or city board of commissioners, city or county administrator, and local planning commissions to help answer these questions.

- Is the action politically acceptable?
- Is there public support both to implement and to maintain the project?

Legal: Include legal counsel, land use planners, risk managers, and city council or county planning commission members, among others, in this discussion.

- Is the community authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity?
- Are there legal side effects? Could the activity be construed as a taking?
- Is the proposed action allowed by the comprehensive plan, or must the comprehensive plan be amended to allow the proposed action?
- Will the community be liable for action or lack of action?
- Will the activity be challenged?

Economic: Community economic development staff, civil engineers, building department staff, and the assessor's office can help answer these questions.

- What are the costs and benefits of this action?
- Do the benefits exceed the costs?
- Are initial, maintenance, and administrative costs taken into account?
- Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private?)
- How will this action affect the fiscal capability of the community?
- What burden will this action place on the tax base or local economy?
- What are the budget and revenue effects of this activity?
- Does the action contribute to other community goals, such as capital improvements or economic development?
- What benefits will the action provide? (This can include dollar amount of damages prevented, number of homes protected, credit under the CRS, potential for funding under the HMGP or the FMA program, etc.)

Environmental: Watershed councils, environmental groups, land use planners and natural resource managers can help answer these questions.

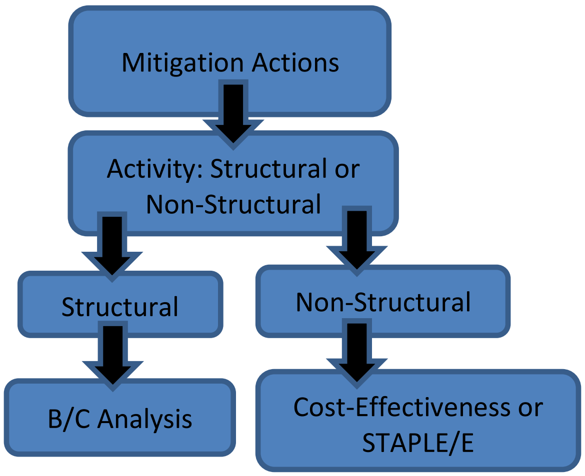
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

The STAPLE/E approach is helpful for doing a quick analysis of mitigation projects. Most projects that seek federal funding and others often require more detailed benefit/cost analyses.

When to use the Various Approaches

It is important to realize that various funding sources require different types of economic analyses. The following figure is to serve as a guideline for when to use the various approaches.

Figure D-1 Economic Analysis Flowchart



Source: Tricia Sears, DLCD, November 2018, based on OPDR 2005.

Implementing the Approaches

Below is a framework that could be used in further analyzing the feasibility of implementing prioritized mitigation actions after determining – through the use of one of the economic analysis approached described above – whether or not to implement the mitigation action.

1. Identify the Activities

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

2. Calculate the Costs and Benefits

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

- ***Determine the project cost***. This may include initial project development costs, and repair and operating costs of maintaining projects over time.

- ***Estimate the benefits***. Projecting the benefits, or cash flow resulting from a project can be difficult. Expected future returns from the mitigation effort depend on the correct specification of the risk and the effectiveness of the project, which may not be well known. Expected future costs depend on the physical durability and potential economic obsolescence of the investment. This is difficult to project. These considerations will also provide guidance in selecting an appropriate salvage value. Future tax structures and rates must be projected. Financing alternatives must be researched, and they may include retained earnings, bond and stock issues, and commercial loans.

- ***Consider costs and benefits to society and the environment***. These are not easily measured, but can be assessed through a variety of economic tools including existence value or contingent value theories. These theories provide quantitative data on the value people attribute to physical or social environments. Even without hard data, however, impacts of structural projects to the physical environment or to society should be considered when implementing mitigation projects.

- ***Determine the correct discount rate***. Determination of the discount rate can just be the risk-free cost of capital, but it may include the decision-maker's time preference and also a risk premium. Including inflation should also be considered.

3. Analyze and Rank the Activities

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

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

- ***Internal rate of return***. Using the internal rate of return method to evaluate mitigation projects provides the interest rate equivalent to the dollar returns expected from the project. Once the rate has been calculated, it can be compared to rates earned by investing in alternative projects. Projects may be feasible to implement when the internal rate of return is greater than the total costs of the project. Once the mitigation projects are ranked on the basis of economic criteria, decision-makers can consider other factors, such as risk, project effectiveness, and economic, environmental, and social returns in choosing the appropriate project for implementation.

Economic Returns of Natural Hazard Mitigation

The estimation of economic returns, which accrue to building or land owners as a result of natural hazard mitigation, is difficult. Owners evaluating the economic feasibility of mitigation should consider reductions in physical damages and financial losses. A partial list follows:

- Building damages avoided
- Content damages avoided

- Inventory damages avoided
- Rental income losses avoided
- Relocation and disruption expenses avoided
- Proprietor's income losses avoided

These parameters can be estimated using observed prices, costs, and engineering data. The difficult part is to correctly determine the effectiveness of the hazard mitigation project and the resulting reduction in damages and losses. Equally as difficult is assessing the probability that an event will occur. The damages and losses should only include those that will be borne by the owner. The salvage value of the investment can be important in determining economic feasibility. Salvage value becomes more important as the time horizon of the owner declines. This is important because most businesses depreciate assets over a period of time.

Additional Costs from Natural Hazards

Property owners should also assess changes in a broader set of factors that can change as a result of a large natural disaster. These are usually termed "indirect" effects, but they can have a very direct effect on the economic value of the owner's building or land. They can be positive or negative, and include changes in the following:

- Commodity and resource prices
- Availability of resource supplies
- Commodity and resource demand changes
- Building and land values
- Capital availability and interest rates
- Availability of labor
- Economic structure
- Infrastructure
- Regional exports and imports
- Local, state, and national regulations and policies
- Insurance availability and rates

Changes in the resources and industries listed above are more difficult to estimate and require models that are structured to estimate total economic impacts. Total economic impacts are the sum of direct and indirect economic impacts. Total economic impact models are usually not combined with economic feasibility models. Many models exist to estimate total economic impacts of changes in an economy. Decision-makers should understand the total economic impacts of natural disasters in order to calculate the benefits of a mitigation activity. This suggests that understanding the local economy is an important first step in being able to understand the potential impacts of a disaster, and the benefits of mitigation activities.

Additional Considerations

Conducting an economic analysis for potential mitigation activities can assist decision-makers in choosing the most appropriate strategy for their community to reduce risk and prevent loss from natural hazards. Economic analysis can also save time and resources from being spent on inappropriate or unfeasible projects. Several resources and models are listed on the following page that can assist in conducting an economic analysis for natural hazard mitigation activities.

Benefit/cost analysis is complicated, and the numbers may divert attention from other important issues. It is important to consider the qualitative factors of a project associated with mitigation that cannot be evaluated economically. There are alternative approaches to implementing mitigation projects. With this in mind, opportunity rises to develop strategies that integrate natural hazard mitigation with projects related to watersheds, environmental planning, community economic development, and small business development, among others. Incorporating natural hazard mitigation with other community projects can increase the viability of project implementation.

Resources

These resources were identified in the *2014 Malheur County NHMP* and may not be widely available at this time.

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

Federal Emergency Management Agency, *Benefit/Cost Analysis of Hazard Mitigation* Projects, Riverine Flood, Version 1.05, Hazard Mitigation Economics, Inc., 1996

Federal Emergency Management Agency, *Report on the Costs and Benefits of Natural Hazard Mitigation*. Publication 331, 1996.

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

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

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

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

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

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

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

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

APPENDIX E:
GRANT PROGRAMS AND RESOURCES

Introduction

There are numerous local, state, and federal funding sources available to support natural hazard mitigation projects and planning. The following section includes an abbreviated list of the most common funding sources and resources utilized by local jurisdictions in Oregon. Because grant programs often change, it is important to periodically review available funding sources for current guidelines and program descriptions.

Note that FEMA administers three programs that provide funding for eligible mitigation planning and projects that reduces disaster losses and protect life and property from future disaster damages. The three programs are the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance (FMA) Program, and the Pre-Disaster Mitigation (PDM) Program. https://www.fema.gov/hazard-mitigation-assistance

Post-Disaster Federal Programs

Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (HMGP) provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP involves a paper application which is first offered to the counties with declared disasters within the past year, then becomes available statewide if funding is still available. http://www.fema.gov/hazard-mitigation-grant-program

Disaster Loan Assistance

There are four types of loans available from the U.S. Small Business Administration (SBA): home and personal property loans; business physical disaster loans; economic injury loans; and military reservist injury loans. When physical disaster loans are made to homeowners and businesses following disaster declarations by the SBA, up to 20% of the loan amount can go towards specific measures taken to protect against recurring damage in similar future disasters.

http://www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/disaster-loans

Pre-Disaster Federal Programs

Pre-Disaster Mitigation Grant Program

The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds. The PDM grant program is offered annually; applications are submitted online. Applicants need a user profile approved by the State Hazard Mitigation Officer, which should be garnered well before the application period opens. http://www.fema.gov/pre-disaster-mitigation-grant-program

Flood Mitigation Assistance Program

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

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

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

Detailed program and application information for federal post-disaster and pre-disaster programs can be found in the *FY15 Hazard Mitigation Assistance Unified Guidance*, available at: https://www.fema.gov/media-library/assets/documents/103279**.** Note that guidance regularly changes. Verify that you have the most recent edition. Flood mitigation assistance is usually offered annually; applications are submitted online. Applicants need a user profile approved by the State Hazard Mitigation Officer, which should be garnered well before the application period opens.

For Oregon Military Department, Office of Emergency Management (OEM) grant guidance on Federal Hazard Mitigation Assistance,
visit: http://www.oregon.gov/OMD/OEM/pages/all_grants.aspx - Hazard_Mitigation_Grantshttps://www.oregon.gov/OEM/emresources/Grants/Pages/HMA.aspx

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

State Programs

State Preparedness and Incident Response Equipment (SPIRE)

Oregon House Bill 2687 became effective in August 2017. It established a grant program to distribute emergency preparedness equipment to local governments and other recipients to be used to decrease risk of life and property resulting from an emergency. Items purchased must qualify as capital assets, meaning individual items must cost at least $5,000. A total of $5,000,000 is available to procure emergency preparedness equipment to help Oregon communities prepare, respond, and recover from emergencies. The upcoming deadline for this grant program is February 28, 2019. The contact for the SPIRE program is Jim Jungling, jim.jungling@state.or.us.

https://www.oregon.gov/oem/Documents/Notice%20of%20Proposed%20Rulemaking%20Hearing%2011-26-18%20-%20Chapter%20104%20Division%2045.pdf

Seismic Rehabilitation Grant Program

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

Community Development Block Grant Program

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

Oregon Watershed Enhancement Board

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

Federal Mitigation Programs, Activities & Initiatives

Basic & Applied Research/Development

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

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

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

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

Hazard ID and Mapping

National Flood Insurance Program: Flood Mapping; FEMA

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

Cooperating Technical Partners

The purpose of the CTP Program is to provide, through a Cooperative Agreement, funds to ensure that partners can perform program management and technical mapping-related activities. https://www.fema.gov/media-library/assets/documents/21123

National Map: Orthoimagery, DOI – USGS

Develops topographic quadrangles for use in mapping of flood and other hazards. https://nationalmap.gov/ortho.html

Mapping Standards Support, DOI-USGS

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

Soil Survey, USDA-NRCS

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

Oregon Coastal Atlas

The Oregon Coastal Atlas is a multi-group project that is a resource for the various audiences that make up the management constituency of the Oregon Coastal Zone. The project is a depot for traditional and digital information interactive mapping, online geospatial analysis tools, and direct download of various planning and natural resource data sets. http://www.coastalatlas.net/

Oregon Geospatial Data Clearinghouse

Hosted by the Oregon Geospatial Enterprise Office (GEO), this is an electronic library of Oregon geographic information including Geographic Information System (GIS) data, orthophotography, Digital Elevation Models, and more.

http://www.oregon.gov/DAS/CIO/GEO/Pages/sdlibrary.aspx

Oregon Explorer

The Oregon-Explorer – maintained by the Institute for Natural Resources at Oregon State – provides several portals developed to provide background information about many topics relevant to Oregon natural hazards. Tools include the Hazards Reporter, an interactive map viewer created to provide current detailed information for hazards such as flood, tsunami, earthquake, volcano, and landslides for a variety of users including planners.

http://oregonexplorer.info/hazards/OregonsNaturalHazards

Oregon HazVu: Statewide Geohazards Viewer

HazVu provides a way to view many different geohazards in Oregon. You can enter the address for your home, school, business, or public buildings in your area to see what hazards might affect you. You can print the map you create. Geohazards include 100-year flooding; Cascadia Subduction Zone earthquake shaking and tsunami; coastal erosion; volcano; landslide; active faults; earthquake soft soil; and more. Assets include state-owned/leased facilities and public buildings such as schools, police and fire stations, and hospitals. There are links to seismic assessment reports for these public buildings. http://www.oregongeology.org/sub/hazvu/index.htm

Oregon Risk MAP

FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program represents a flood hazard mapping and risk analysis process with planning and mitigation considerations woven throughout. Risk MAP involves: (1) discovering local needs, (2) mapping with better base data, and (3) working with community representatives in assessing risk and vulnerability. Risk MAP concerns the community, making maps and information available in a way that that makes sense, is understandable, and is usable.

http://www.oregonriskmap.com/

RAPTOR - Real Time Assessment and Planning Tool for Oregon

RAPTOR is used within Oregon's emergency management community to view and interact with critical geospatial base maps, aerial imagery, preparedness, hazards, weather and event related data via the internet. http://www.oregon.gov/oem/emops/Pages/RAPTOR.aspx

Project Support

Coastal Zone Management Program, NOAA.

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

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

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

National Fire Plan (DOI – USDA)

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

Assistance to Firefighters Grant Program, FEMA

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

Emergency Watershed Protection Program, USDA-NRCS

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

Rural Development Assistance – Utilities, USDA

Direct and guaranteed rural economic loans and business enterprise grants to address utility issues and development needs.
https://www.rd.usda.gov/about-rd/agencies/rural-utilities-service

Rural Development Assistance – Housing, USDA.

The RDA program provides grants, loans, and technical assistance in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster necessary. https://www.rd.usda.gov/programs-services

Public Assistance Grant Program, FEMA.

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

National Flood Insurance Program, FEMA

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

HOME Investments Partnerships Program, HUD

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

Disaster Recovery Initiative, HUD

The DRI provides grants to fund gaps in available recovery assistance after disasters (including mitigation). http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs/dri

Emergency Management Performance Grants, FEMA

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

Partners for Fish and Wildlife, DOI – FWS

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

North American Wetland Conservation Fund, DOI-FWS

NAWC fund provides cost-share grants to stimulate public/private partnerships for the protection, restoration, and management of wetland habitats. http://www.fws.gov/birdhabitat/Grants/index.shtm and https://www.grants-gov.net/cfda.php?CFDANumber=15.623

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

Identifies, assesses, and transfers available federal real property for acquisition for State and local parks and recreation, such as open space. http://www.nps.gov/ncrc/programs/flp/index.htm

Wetlands Reserve program, USDA-NCRS

The WR program provides financial and technical assistance to protect and restore wetlands through easements and restoration agreements. http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/wetlands

Secure Rural Schools and Community Self-Determination Act of 2000, US Forest Service.

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

The Oregon Climate Change Adaptation Framework

This 2010 report provides a framework for the continued development of strategies and plans to address future climate conditions in the state. It is the result of a collaborative effort between Oregon's state agencies, and with support from the Oregon Climate Change Research Institute.

http://www.oregon.gov/LCD/docs/ClimateChange/Framework_Final.pdf

Oregon Climate Assessment Report

The Oregon State Legislature established the Oregon Climate Change Research Institute (OCCRI) within the Department of Higher Education in 2007. OCCRI is a network of over 150 researchers at Oregon State University (OSU), the University of Oregon, Portland State University, Southern Oregon University, and affiliated federal and state labs. OCCRI is administered by OSU. The *Fourth Oregon Climate Assessment Report (2019)* was released in January 2019.

http://www.occri.net/publications-and-reports/third-oregon-climate-assessment-report-2017/

Oregon Health Authority (OHA)

Environmental public health works to identify, assess and report on threats to human health from exposure to environmental and occupational hazards, and advise Oregon communities on potential risks where they live, work and play in order to remain healthy and safe. OHA’s Climate and Health Program is working with partners to study, prevent, and plan for the health effects of climate change. The *Climate and Health Resilience Plan* offers a selection of strategies and policy priorities for state, local, and tribal public health practitioners and partners.

http://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/CLIMATECHANGE/Pages/resilience-plan.aspx

Oregon's *Public Health Hazard Vulnerability Assessment* summarizes public health consequences of Oregon's likely hazards based on the input from local health jurisdictions, tribal health agencies, and emergency management partners.

http://www.oregon.gov/oha/PH/Preparedness/Partners/Documents/OHA%208584%20PH%20Hazard%20Vulnerability.pdf

Special Edition of Silver Jackets newsletter

This is prepared to provide a reference of federal agency programs, resources, and training opportunities that interagency Silver Jackets teams can leverage to achieve their flood risk management goals, is also useful to local government seeking funds to advance their flood mitigation efforts.

http://silverjackets.nfrmp.us/Resources/Silver-Jackets-Newsletter/The-Buzz-August-2014

USGS Natural Hazards

The USGS Natural Hazards Mission Area includes six science programs: Coastal & Marine Geology, Earthquake Hazards, Geomagnetism, Global Seismographic Network, Landslide Hazards, and Volcano Hazards. Through these programs, the USGS provides alerts and warnings of geologic hazards and provides interactive maps and data.

http://www.usgs.gov/natural_hazards/

State Interagency Hazard Mitigation Team (IHMT) website

The State IHMT is comprised of about 18 state agencies involved with natural hazards. The State IHMT meets quarterly to understand losses arising from natural hazards, coordinate recommended strategies to mitigate loss of life, property, and natural resources, and maintain the *Oregon Natural Hazards Mitigation Plan* (*Oregon NHMP*).

http://www.oregon.gov/oem/Councils-and-Committees/Pages/IHMT.aspx

Oregon Natural Hazards Mitigation Plan (NHMP)

The *Oregon NHMP* identifies and prioritizes mitigation actions throughout Oregon that would reduce our vulnerability to natural hazards. In addition, the plan satisfies the requirements of the Federal Emergency Management Agency (FEMA) to ensure that Oregon is eligible to receive hazard mitigation and disaster assistance funds from the federal government. The current version of the plan was approved on September 24, 2015 as an Enhanced State Plan and is effective through September 23, 2020.

https://www.oregon.gov/lcd/NH/Pages/Mitigation-Planning.aspx

Subscribe to the Oregon NHMP list serve and receive an email when the site is updated (approximately quarterly).

http://listsmart.osl.state.or.us/mailman/listinfo/2015-or-nhmp

APPENDIX F:
FUTURE CLIMATE PROJECTIONS REPORTS

Introduction

As part of the PDM 16 grants, the Department of Land Conservation and Development (DLCD) contracted with the Oregon Climate Change Research Institute (OCCRI) to provide an analysis of climate change influences on natural hazards. The collaboration resulted in multiple products which provide important information regarding the influence and impacts of climate change on existing natural hazards events such as heavy rains, river flooding, droughts, heat waves, cold waves, wildfire, and air quality.

The products include:

- *Future Climate Projections: Malheur County;*
- *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports;*
- *Climate Change One-Pager;* and
- *Future Climate Change Projections to Support County Natural hazard Mitigation Planning in Oregon* (webinar).

Two of the products are included within this Appendix, the *Future Climate Projections: Malheur County* and the *Climate Change Influence on Natural Hazards in Eight Oregon Counties: Overview of County Reports.*

All of the products are available on the DLCD website: https://www.oregon.gov/lcd/CL/Pages/Climate-Change-Resources.aspx.

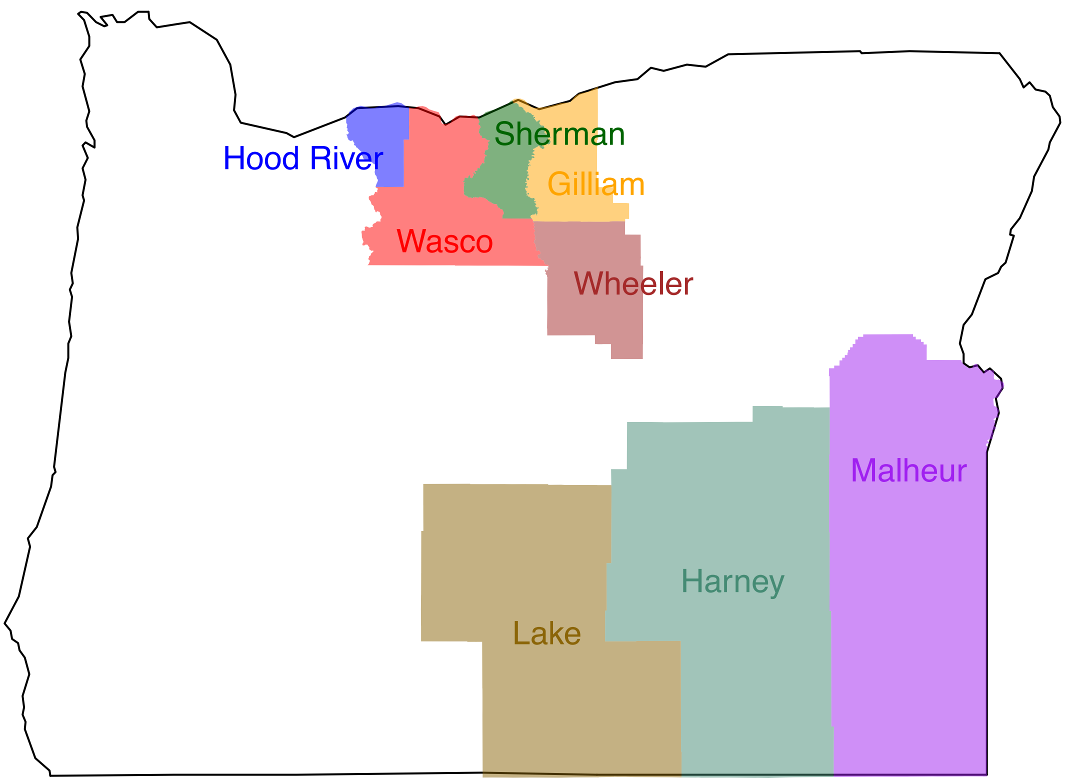
In addition to this Appendix, see also Volume I Section 2 Risk Assessment and Volume II Hazard Annexes for more climate change information.

Climate Change Influence on Natural Hazards in Eight Oregon Counties

Overview of County Reports

August 2018

Prepared by
Oregon Climate Change Research Institute
www.occri.net



Oregon Department of Land Conservation and Development

Introduction. The Earth's climate is warming largely due to increasing amounts of greenhouse gas emissions worldwide. Climate change is expected to influence the likelihood of occurrence of existing natural hazard events such as heavy rains, river flooding, drought, heat waves, cold waves, wildfire, and air quality. Supported by the Oregon Department of Land Conservation and Development's Pre-Disaster Mitigation grants, the Oregon Climate Change Research Institute provided analyses and summaries of how climate change is expected to influence natural hazards for eight counties in Oregon.

Hood River, Wasco, Sherman, Gilliam, Wheeler, Malheur, Harney, and Lake Counties each received a report, *Future Climate Projections*, describing county-specific projected changes in climate metrics related to selected natural hazards. The reports present future climate projections for the 2020s (2010–2039 average) and 2050s (2040–2069 average) compared to the 1971–2000 average historical baseline. This overview presents a summary of projected direction of changes in climate change-related risk of natural hazard occurrence based on projections only for the 2050s compared to the historical baseline (Table 1). Projections for the 2020s are similar to those for the 2050s, but of smaller magnitude, and can be found in the county reports.

Heat Waves. Across all eight counties, extreme heat events are expected to increase in frequency, duration, and intensity due to continued warming temperatures. Under the higher emissions scenario, projected increases in the number of days with temperature at or above 90°F range on average from 12 additional days in Hood River County to 38 additional days in Malheur County (Figure 1) by the 2050s compared to the historical baseline.

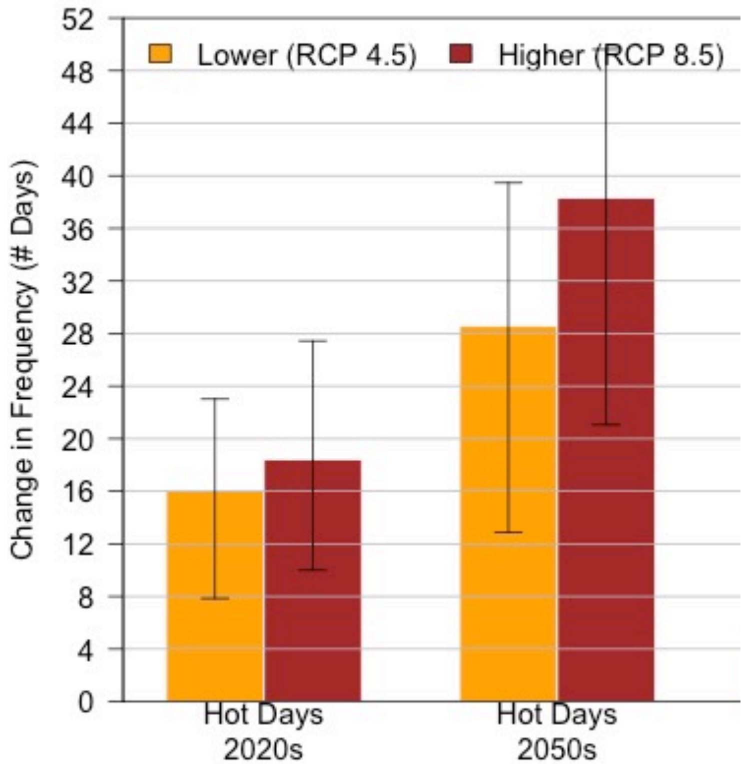


Figure 1 Projected future change in the number of hot days for Malheur County from the historical baseline for the 2020s and 2050s under a lower and higher emissions scenario. The bars and whiskers display the mean and range, respectively, of changes across 20 global climate models. Hot days are defined as days with maximum temperature of at least 90°F.

Cold Waves. Across all eight counties, cold extremes are still expected to occur from time to time, but with much less frequency and intensity as the climate warms. Under the higher emissions scenario, projected decreases in the number of days with temperature at or below freezing range on average from 7 fewer days in Sherman and Gilliam Counties to 14 fewer days in Hood River County by the 2050s compared to the historical baseline.

Heavy Rains. As the atmosphere warms and is able to hold more water vapor, the frequency and intensity of extreme precipitation events is expected to increase. Across all eight counties, the amount of precipitation on the wettest day of the year is expected to increase in the future. Under the higher emissions scenario, projected increases range on average from 14% more precipitation on the wettest day in Wheeler County to 20% more precipitation in Sherman County by the 2050s compared to the historical baseline.

River Flooding. Mid- to low-elevation tributaries, such as Hood River and John Day River, that are near freezing level in winter, receiving a mix of rain and snow, may experience an increase in winter flood risk due to warmer winter temperatures causing precipitation to fall more as rain and less as snow, as well as more intense precipitation events. The flood magnitude of the 10-year (10% exceedance probability) single-day food event is projected to increase on the Snake, John Day, and

Owyhee Rivers, but shows little change on the Columbia main stem by the 2050s compared to the historical baseline.

Drought. Counties reliant on spring and summer snowpack to supply summer water demands are projected to experience greater frequency of low spring snowpack years. Drought conditions represented by low summer soil moisture and low summer runoff are projected to become more frequent in Hood River (Figure 2), Wasco, and Wheeler Counties, but may become less frequent in the other five counties by the 2050s compared to the historical baseline.

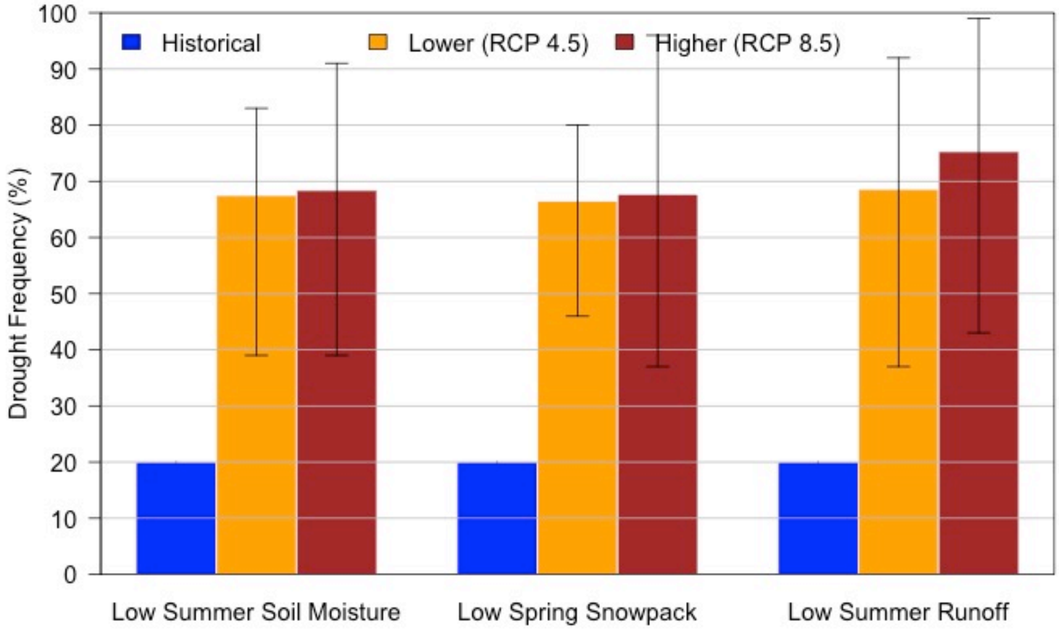


Figure 2 Frequency of the historical baseline 1-in-5 year event (by definition 20% frequency) of low summer soil moisture, low spring snowpack, and low summer runoff projected for the 2050s for Hood River County under lower and higher emissions scenarios. The bar and whiskers depict the mean and range across ten global climate models.

Wildfire. Across all eight counties, wildfire risk, as expressed through the frequency of very high fire danger days, is projected to increase under future climate change. Under the higher emissions scenario, projected increases in the frequency of very high fire danger days range on average from 38% greater frequency in Lake and Wasco Counties to 41% greater frequency in Gilliam County by the 2050s compared to the historical baseline.

Poor Air Quality. Under future climate change, the risk of wildfire smoke exposure is projected to increase across nearly all eight counties. Under a medium emissions scenario, projected increases in the frequency of days with high concentrations of wildfire-specific particulate matter between 2004–2009 and 2046–2051 range on average from 0% greater frequency in Sherman County to 122% greater frequency in Malheur County.

Windstorms. Limited research suggests very little, if any, change in the frequency and intensity of windstorms in the Pacific Northwest as a result of climate change.

Dust Storms. Limited research suggests that the risk of dust storms in summer would decrease under climate change in parts of eastern Oregon that experience an increase in vegetation cover from the carbon dioxide fertilization effect.

Increased Invasive Species. Warming temperatures, altered precipitation patterns, and increasing atmospheric carbon dioxide levels increase the risk for invasive species, insect and plant pests for forest and rangeland vegetation, and cropping systems.

Loss of Wetland Ecosystems. Freshwater wetland ecosystems are sensitive to warming temperatures and altered hydrological patterns, such as changes in precipitation seasonality and snowpack reduction.

Table 1 Summary of projected direction of changes in climate change-related risk of natural hazard occurrence across eight Oregon counties. Within each box, symbols denote the direction of expected change in risk: increasing, decreasing, or unchanging; and shading denotes the level of confidence in the projected direction of change. High confidence means nearly all models agree on the direction of change and there is strong evidence in the published literature. Medium confidence means a majority of models agree on the direction of change and there is strong to medium evidence in the published literature. Low confidence means the direction of change is small compared to the range of model responses or there is limited evidence in the published literature.

	Hood River	Wasco	Sherman	Gilliam	Wheeler	Malheur	Harney	Lake
Heat Waves	↑	↑	↑	↑	↑	↑	↑	↑
Cold Waves	↓	↓	↓	↓	↓	↓	↓	↓
Heavy Rains	↑	↑	↑	↑	↑	↑	↑	↑
River Flooding	↑	↑	↑	↑	↑	↑	↑	↑
Drought	↑	↑	=	=	↑	↑	↑	↑
Wildfire	↑	↑	↑	↑	↑	↑	↑	↑
Poor Air Quality	↑	↑	=	↑	↑	↑	↑	↑
Windstorms	=	=	=	=	=	=	=	=
Dust Storms	↓	↓	↓	↓	↓	↓	↓	↓
Increased Invasive Species	↑	↑	↑	↑	↑	↑	↑	↑
Loss of Wetland Ecosystems	↑	↑	↑	↑	↑	↑	↑	↑

Level of Confidence in Direction of Change	
	High Confidence
	Medium Confidence
	Low Confidence

Expected Direction of Change	
↑	**Risk Increasing**
↓	**Risk Decreasing**
=	**Risk Unchanging**

Future Climate Projections
Malheur County

August 2018

A Report to the Oregon Department of Landscape Conservation and Development

Prepared by
The Oregon Climate Change Research Institute

Photo credit: Oregon Canyon WSA from Jackson Summit, Malheur County by Bureau of Land Management, https://flic.kr/p/X2gJH3, Creative Commons License (CC BY 2.0)

OCCRI

Oregon Department of Land Conservation and Development

Future Climate Projections: Malheur County

A report to the Oregon Department of Landscape Conservation and Development

Prepared by:
Meghan Dalton, David Rupp, Linnia Hawkins
Oregon Climate Change Research Institute
College of Earth, Ocean, and Atmospheric Sciences
104 CEOAS Admin Building
Oregon State University
Corvallis, OR 97331

Guidance and review provided by:
Tricia Sears, Oregon Department of Land Conservation and Development

August 2018

Table of Contents

Executive Summary

This report presents future climate projections for Malheur County relevant to specific natural hazards for the 2020s (2010–2039 average) and 2050s (2040–2069 average) compared to the 1971–2000 average historical baseline. The projections were analyzed for a lower greenhouse gas emissions scenario as well as a higher greenhouse gas emissions scenario, using multiple global climate models. This summary lists only the projections for the 2050s under the higher emissions scenario. Projections for both time periods and both emissions scenarios can be found within relevant sections of the main report.

Heat Waves

Extreme heat events are expected to increase in frequency, duration, and intensity due to continued warming temperatures.

In Malheur County, the frequency of hot days with temperatures at or above 90°F is projected to increase on average by 38 days (with a range of 21 to 50 days) by the 2050s under the higher emissions scenario compared to the historical baseline.

In Malheur County, the temperature of the hottest day of the year is projected to increase by 8°F (with a range of 3 to 11°F) by the 2050s under the higher emissions scenario compared to the historical baseline.

Cold Waves

Cold extremes are still expected to occur from time to time, but with much less frequency and intensity as the climate warms.

In Malheur County, the frequency of days at or below freezing is projected to decline on average by 13 days (with a range of 6 to 18 days) by the 2050s under the higher emissions scenario compared to the historical baseline.

In Malheur County, the temperature of the coldest night of the year is projected to increase by 10°F (with a range of 2 to 16°F) by the 2050s under the higher emissions scenario compared to the historical baseline.

Heavy Rains

The intensity of extreme precipitation events is expected to increase slightly in the future as the atmosphere warms and is able to hold more water vapor.

In Malheur County, the magnitude of precipitation on the wettest day and wettest consecutive five days per year is projected to increase on average by about 19% (with a range of 2% to 35%) and 13% (with a range of -7% to 28%), respectively, by the 2050s under the higher emissions scenario compared to the historical baseline.

In Malheur County, the frequency of days with at least ¾” of precipitation and the frequency of days exceeding a threshold for landslide risk is not projected to change substantially.

River Flooding

Flood risk to Malheur County is expected to increase based on projected increases in non-regulated peak flow magnitudes on the Snake River at Nyssa and the Owyhee River.

Because basins in Malheur County are mixed rain-snow basins, they are sensitive to warming temperatures and resulting hydrologic changes including increasing and earlier seasonal peak flows.

Drought

Drought conditions, as represented by low spring snowpack, is projected to become more frequent whereas drought conditions represented by low summer soil moisture and low summer runoff may become less frequent in Malheur County by the 2050s compared to the historical baseline.

Wildfire

Wildfire risk, as expressed through the frequency of very high fire danger days, is projected to increase under future climate change. In Malheur County, the frequency of very high fire danger days per year is projected to increase on average by about 40% (with a range of -1 to +83%) by the 2050s under the higher emissions scenario compared to the historical baseline.

Air Quality

Under future climate change, the risk of wildfire smoke exposure is projected to increase in Malheur County. The number days with high concentrations of wildfire- specific particulate matter is projected to increase by 122% by 2046–2051 under a medium emissions scenario compared with 2004–2009.

Windstorms

Limited research suggests very little, if any, change in the frequency and intensity of windstorms in the Pacific Northwest as a result of climate change.

Dust Storms

Limited research suggests that the risk of dust storms in summer would decrease in eastern Oregon under climate change in areas that experience an increase in vegetation cover from the carbon dioxide fertilization effect.

Increased Invasive Species & Pests

Warming temperatures, altered precipitation patterns, and increasing atmospheric carbon dioxide levels increase the risk for invasive species, insect and plant pests for forest and rangeland vegetation, and cropping systems.

Loss of Wetland Ecosystems

Freshwater wetland ecosystems are sensitive to warming temperatures and altered hydrological patterns, such as changes in precipitation seasonality and reduction of snowpack.

Introduction

Industrialization has given rise to increasing amounts of greenhouse gas emissions worldwide, which is causing the Earth's climate to warm (IPCC, 2013). The effects of which are already apparent here in Oregon (Dalton *et al.*, 2017). Climate change is expected to influence the likelihood of occurrence of existing natural hazard events such as heavy rains, river flooding, drought, heat waves, cold waves, wildfire, and air quality.

Oregon's Department of Land Conservation and Development (DLCD) contracted with the Oregon Climate Change Research Institute (OCCRI) to perform and provide analysis of the influence of climate change on natural hazards. The scope of this report is limited to the geographic area encompassed by the eight Oregon counties (thus including the counties, the cities within them and the Burns Paiute Tribe) that are part of the two Pre-Disaster Mitigation (PDM) 16 grants DLCD received. Those counties include: Wasco, Hood River, Harney, Lake, Malheur, Wheeler, Sherman, and Gilliam Counties. Outcomes of this analysis include county-specific data, graphics, and text summarizing climate change projections for climate metrics related to each of the natural hazards lists in Table 1. This information will be integrated into the Natural Hazards Mitigation Plan (NHMP) updates for the eight counties, and can be used in other county plans, policies, and programs. In addition to this report, sharing of data, and other technical assistance will be provided to the counties.

Table 1 Natural hazards and related climate metrics evaluated in this project.

Heavy Rains Wettest Day ◆ Wettest Five Days Landslide Threshold Exceedance	**Heat Waves** Hottest Day ◆ Warmest Night "Hot" Days ◆ "Warm" Nights
River Flooding Annual maximum daily flows	**Cold Waves** Coldest Day ◆ Coldest Night "Cold" Days ◆ "Cold" Nights
Drought Summer Flow ◆ Spring Snow Summer Soil Moisture	**Air Quality** Unhealthy Smoke Days
Wildfire Fire Danger Days	**Windstorms ◆ Dust Storms** **Increased Invasive Species & Pests** **Loss of Wetland Ecosystems**

Future Climate Projections Background

Introduction

The county-specific future climate projections prepared by OCCRI are derived from 10–20 global climate models (GCM) and two scenarios of future global greenhouse gas emissions. Future climate projections have been "downscaled"—that is, made locally relevant—and summaries of projected changes in the climate metrics in Table 1 are presented for an early 21st century period and a mid 21st century period compared to a historical baseline. (Read more about the data sources in the Appendix.)

Global Climate Models

Global climate models are sophisticated computer models of the Earth's atmosphere, water, and land and how these components interact over time and space according to the fundamental laws of physics (Figure 1). GCMs are the most sophisticated tools for understanding the climate system, but while highly complex and built on solid physical principles, they are still simplifications of the actual climate system. There are several ways to implement such simplifications into a GCM, which results in each one giving a slightly different answer. As such, it is best practice to use at least ten GCMs and look at the average and range of projections across all of them. (Read more about GCMs & Uncertainty in the Appendix.)

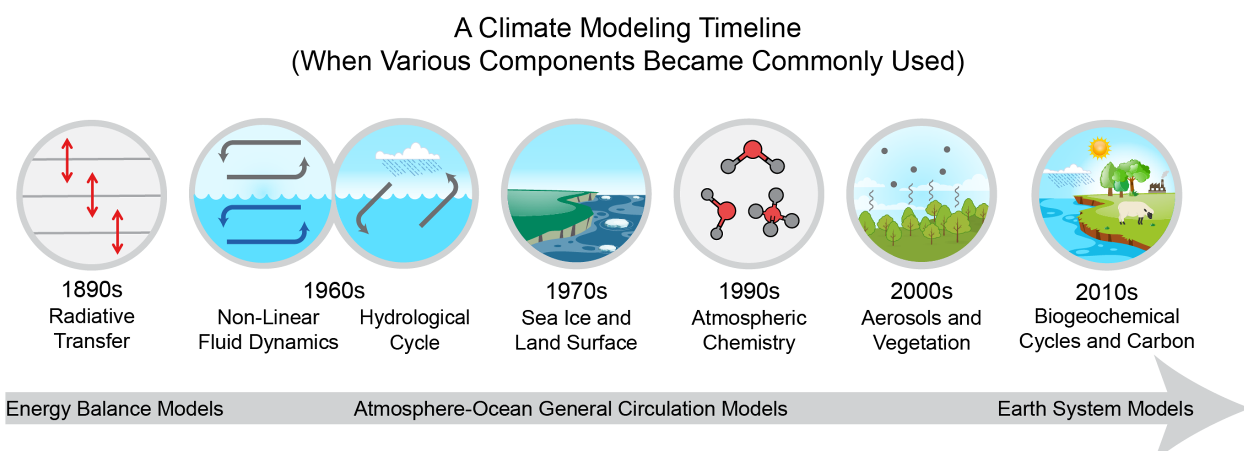


Figure 1 As scientific understanding of climate has evolved over the last 120 years, increasing amounts of physics, chemistry, and biology have been incorporated into calculations and, eventually, models. This figure shows when various processes and components of the climate system became regularly included in scientific understanding of global climate calculations and, over the second half of the century as computing resources became available, formalized in global climate models. (Source: science2017.globalchange.gov)

Greenhouse Gas Emissions

When used to project future climate, scientist give the GCMs information about the quantity of greenhouse gases that the world would emit, then the GCMs run simulations of what would happen to the air, water, and land over the next century. Since the precise amount of greenhouse gases the world will emit over the next century is unknown, scientists use several scenarios of different amounts of greenhouse gas emissions based on plausible societal trajectories. The future climate projections prepared by OCCRI uses emissions pathways called Representative Concentration Pathways (RCPs). There are several RCPs and the higher global emissions are, the greater the increase in global temperature is expected (Figure 2). OCCRI considers a lower emissions scenario (RCP 4.5) and a higher emissions scenario (RCP 8.5) because they are the most commonly used scenarios in published literature and the downscaled data is available for these scenarios. (Read more about Emissions Scenarios in the Appendix.)

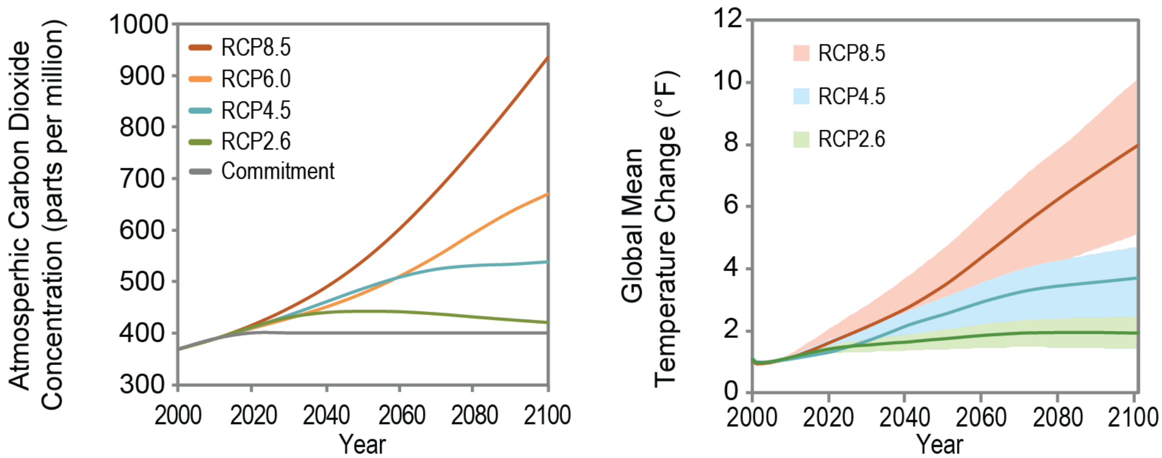


Figure 2 Future scenarios of atmospheric carbon dioxide concentrations (left) and global temperature change (right) resulting from several different emissions pathways, called Representative Concentration Pathways (RCPs), which are considered in the fourth and most recent National Climate Assessment. (Source: science2017.globalchange.gov)

Downscaling

Global climate models simulate the climate across adjacent grid boxes the size of about 60 by 60 miles. To make this coarse resolution information locally relevant, global climate model outputs have been combined with historical observations to translate large-scale patterns into high-resolution projections. This process is called statistical downscaling. The future climate projections produced by OCCRI were statistically downscaled to a resolution with grid boxes the size of about 2.5 by 2.5 miles (Abatzoglou and Brown, 2012). (Read more about Downscaling in the Appendix.)

Future Time Periods

When analyzing global climate model projections of future climate, it is best practice to compare the average across at least a 30-year period in the future to an average historical baseline across at least 30 years. For the future climate projections produced by OCCRI, two 30-year future periods are presented in comparison with a 30-year historical baseline (Table 2).

Table 2 Historical and future time periods for presentation of future climate projections

Historical Baseline	Early 21st Century "2020s"	Mid 21st Century "2050s"
1971–2000	2010–2039	2040–2069

How to Use the Information in this Report

Under a changing climate, past trends, while valuable, may no longer be, on their own, reliable predictors of future outcomes. Future projections from GCMs provide an opportunity to explore a range of plausible outcomes taking into consideration the climate system's complex response to increasing concentrations of greenhouse gases. It is important to be aware that GCM projections should not be thought of as predictions of what the weather will be like at some specified date in the future, but rather viewed as predictions of the long-term statistical aggregate of weather, in other words, "climate", if greenhouse gas concentrations follow some specified trajectory.[1]

The projections of climate variables in this report, both in the direction and magnitude of change, are best used in reference to the historical climate conditions under which a particular asset or system is designed to operate. For this reason, considering the projected changes between the historical and future periods allows one to envision how current systems of interest would respond to climate conditions that are different from what they have been. In some cases, the projected change may be small enough to be accommodated within the existing system. In other cases, the projected change may be large enough to require adjustments, or adaptations, to the existing system.

[1] Read more: https://nca2014.globalchange.gov/report/appendices/faqs#narrative-page-38784

Average Temperature

Oregon's average temperature warmed at a rate of 2.2°F per century during 1895–2015. Average temperature is expected to continue warming during the 21st century under scenarios of continued global greenhouse gas emissions; the rate of warming depends on the particular emissions scenario (Dalton *et al.*, 2017). By the "2050s" compared to the 1970–1999 historical baseline, Oregon's average temperature is projected to increase by 3.6 °F with a range of 1.8°–5.4°F under a lower emissions scenario (RCP 4.5) and by 5.0°F with a range of 2.9°F–6.9°F under a higher emissions scenario (RCP 8.5) (Dalton *et al.*, 2017). Furthermore, summers are projected to warm more than other seasons (Dalton *et al.*, 2017).

Average temperature in Malheur County is projected to warm during the 21st century at a similar rate to Oregon as a whole (Figure 3). Projected increases in average temperature in Malheur County compared to the 1971–2000 historical baseline range from 1.2–4.2°F by the 2020s and 2.1–8.3°F by the 2050s, depending on emissions scenario and climate model (Table 3).

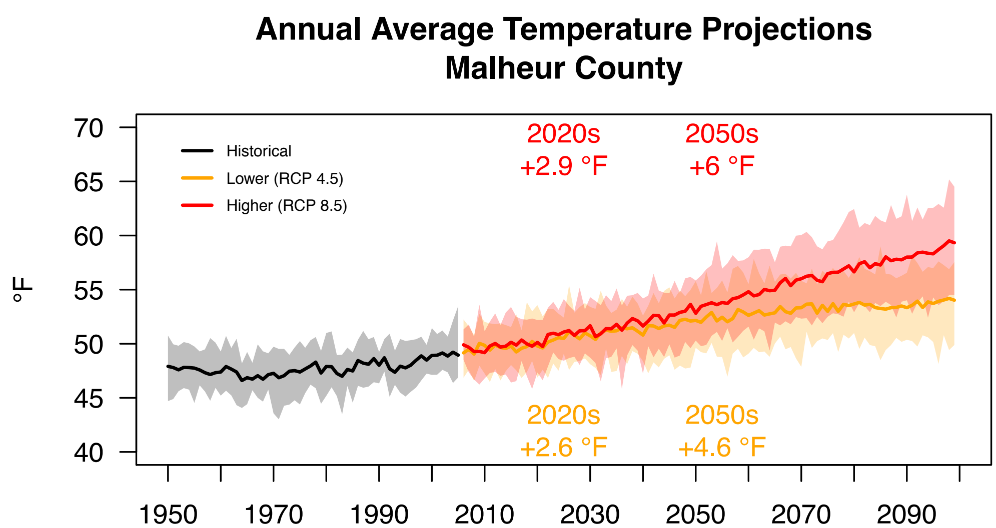


Figure 3 Annual average temperature projections for Malheur County as simulated by 20 downscaled global climate models under a lower (RCP 4.5) and a higher (RCP 8.5) greenhouse gas emissions scenario. Solid line and shading depicts the 20-model mean and range, respectively. The multi-model mean differences for the 2020s (2010–2039 average) and the 2050s (2040–2069 average) compared to the historical baseline (1971–2000 average) are shown.

Table 3 Average and range of projected future changes in Malheur County's average temperature from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models.

	Change by Early 21st Century "2020s"	Change by Mid 21st Century "2050s"
Higher (RCP 8.5)	+2.9°F (1.6 to 4.2)	+6.0°F (3.3 to 8.3)
Lower (RCP 4.5)	+2.6°F (1.2 to 4.1)	+4.6°F (2.1 to 6.6)

Heat Waves

Extreme heat events are expected to increase in frequency, duration, and intensity in Oregon due to continued warming temperatures. In fact, the hottest days in summer are projected to warm more than the change in mean temperature over the Pacific Northwest (Dalton *et al.*, 2017). This report presents projected changes for three metrics of heat extremes for both daytime (maximum temperature) and nighttime (minimum temperature) (Table 4).

Table 4 Heat extreme metrics and definitions

Metric	Definition
Hot Days	Number of days per year maximum temperature is greater than or equal to 90°F
Warm Nights	Number of days per year minimum temperature is greater than or equal to 65°F
Hottest Day	Annual maximum of maximum temperature
Warmest Night	Annual maximum of minimum temperature
Daytime Heat Waves	Number of events per year with at least 3 consecutive days with maximum temperature greater than or equal to 90°F
Nighttime Heat Waves	Number of events per year with at least 3 consecutive days with minimum temperature greater than or equal to 65°F

In Malheur County, all the extreme heat metrics in Table 4 are projected to increase by the 2020s and 2050s under both the lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios (Table 5). For example, compared to the 1971–2000 historical baseline, by the 2050s under the higher emissions scenario, the number of hot days greater than or equal to 90°F is projected to increase by 38 days on average with a range of about 21 to 50 days. Likewise, the temperature of the hottest day of the year is projected to increase by 7.6°F on average with a range of 3.1°F to 10.5°F and the frequency of daytime heat waves is projected to increase by 2.0 events per year.

Projected changes in the frequency extreme heat days (i.e., Hot Days and Warm Nights) are shown in Figure 4. Projected changes in the magnitude of heat records (i.e., Hottest Day and Warmest Night) are shown in Figure 5. Projected changes in the frequency of extreme heat events (i.e., Daytime Heat Waves and Nighttime Heat Waves) are shown in Figure 6.

Table 5 Mean and range of projected future changes in extreme heat metrics for Malheur County from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models.

	Change by Early 21st Century "2020s"		Change by Mid 21st Century "2050s"	
	Lower	**Higher**	**Lower**	**Higher**
Hot Days	+16.0 days (7.8–23.0)	+18.4 days (10.0–27.4)	+28.6 days (12.9–39.5)	+38.3 days (21.1–49.6)
Warm Nights	+3.5 days (0.7–6.0)	+4.2 days (1.8–7.0)	+8.8 days (2.2–17.2)	+15.5 days (4.3–25.1)
Hottest Day	+3.2°F (1.2–4.8)	+3.7°F (2.2–5.4)	+5.6°F (3.1–8.0)	+7.6°F (3.1–10.5)
Warmest Night	+2.5°F (0.9–4.1)	+2.8°F (1.2–3.8)	+4.6°F (1.9–7.2)	+6.4°F (3.7–8.4)
Daytime Heat Waves	+1.2 events (0.7–2.0)	+1.3 events (0.8–1.9)	+1.8 events (1.1–2.8)	+2.0 events (1.1–3.2)
Nighttime Heat Waves	+0.5 events (0.0–0.7)	+0.6 events (0.1–0.9)	+1.1 events (0.2–2.3)	+1.9 events (0.4–2.9)

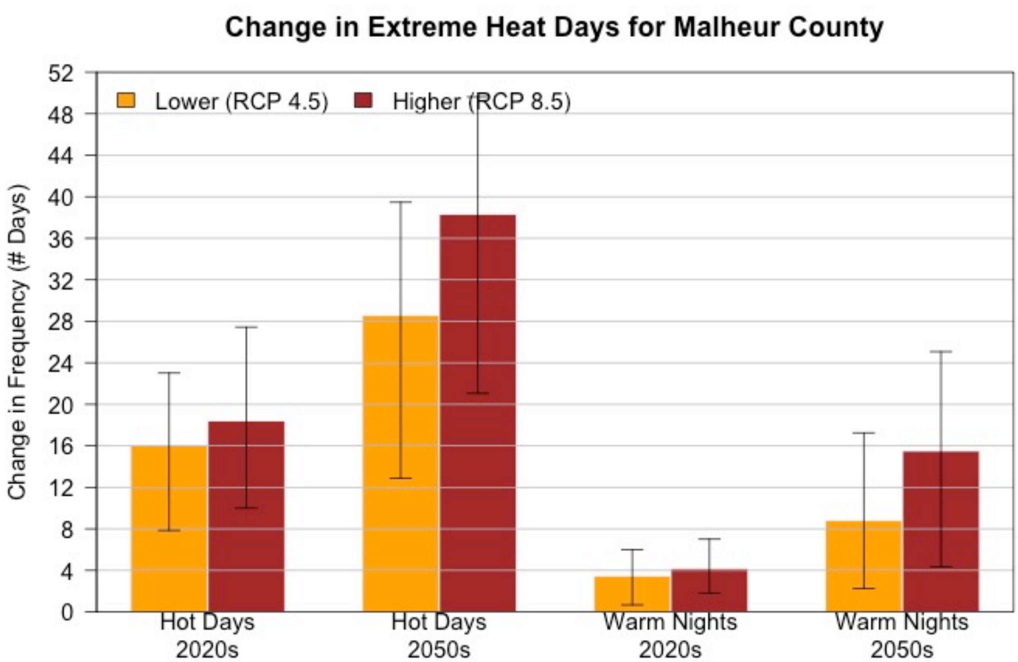


Figure 4 Projected future changes in the number of hot days (left two sets of bars) and number of warm nights (right two sets of bars) for Malheur County from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models. The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs. Hot days are defined as days with maximum temperature of at least 90°F; warm nights are defined as days with minimum temperature of at least 65°F.

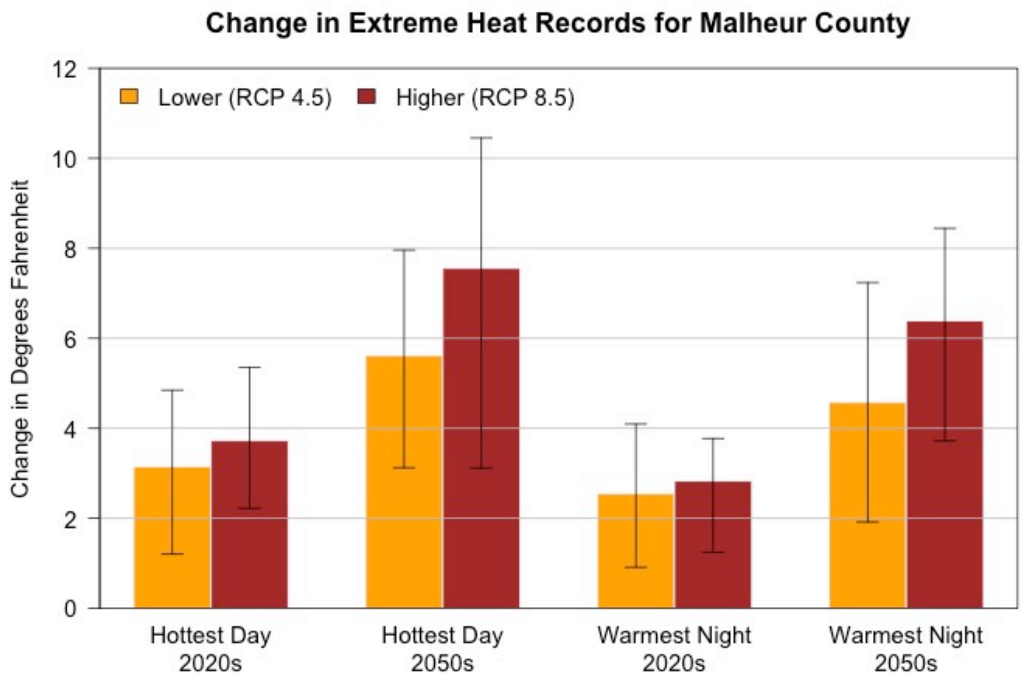


Figure 5 **Projected future changes in the hottest day of the year (left two sets of bars) and warmest night of the year (right two sets of bars) for Malheur County from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models. The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs.**

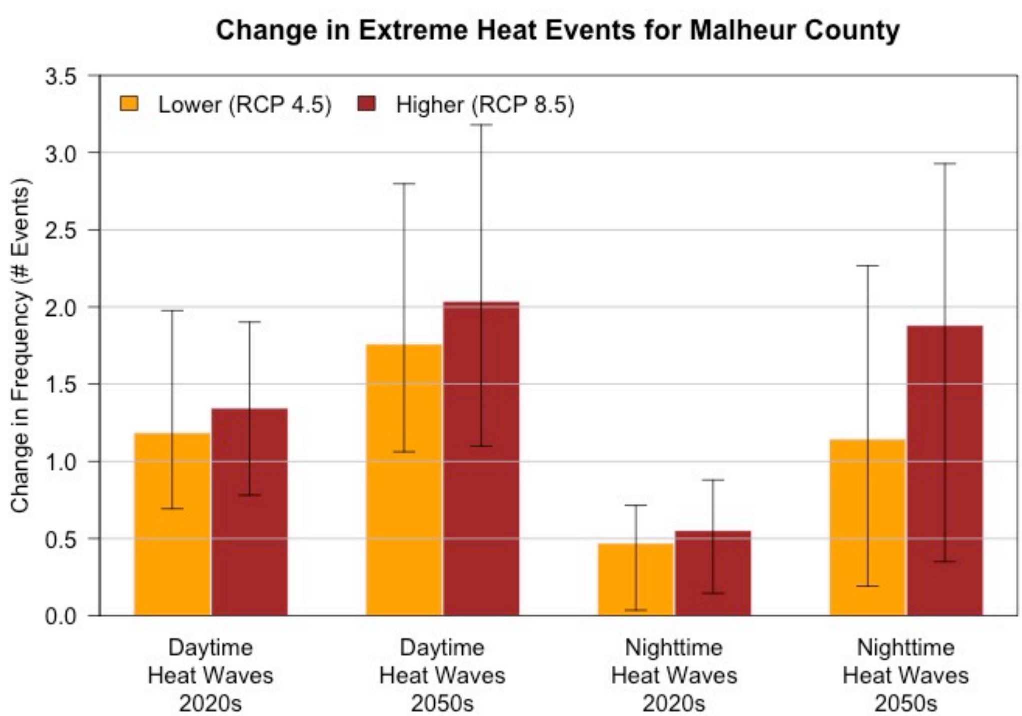


Figure 6 **Projected future changes in the number of daytime heat waves (left two sets of bars) and number of nighttime heat waves (right two sets of bars) for Malheur County from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models. The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs. Daytime heat waves are defined as events with three or more consecutive days with maximum temperature of at least 90°F; nighttime heat waves are defined as events with three or more consecutive days with minimum temperature of at least 65°F.**

Key Messages:

⇒ Extreme heat events are expected to increase in frequency, duration, and intensity due to continued warming temperatures.

⇒ In Malheur County, all the extreme heat metrics in Table 4 are projected to increase by the 2020s and 2050s under both the lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios (Table 5).

⇒ In Malheur County, the frequency of hot days with temperatures at or above 90°F is projected to increase on average by 38 days (with a range of 21 to 50 days) by the 2050s under the higher emissions scenario compared to the historical baseline.

⇒ In Malheur County, the temperature of the hottest day of the year is projected to increase by 8°F (with a range of 3 to 11°F) by the 2050s under the higher emissions scenario compared to the historical baseline.

Cold Waves

Over the past century, cold extremes have become less frequent and severe in the Northwest; this trend is expected to continue under future global warming of the climate system (Vose *et al.*, 2017). This report presents projected changes for three metrics of cold extremes for both daytime (maximum temperature) and nighttime (minimum temperature) (Table 6).

Table 6 Cold extreme metrics and definitions

Metric	Definition
Cold Days	Number of days per year maximum temperature is less than or equal to 32°F
Cold Nights	Number of days per year minimum temperature is less than or equal to 0°F
Coldest Day	Annual minimum of maximum temperature
Coldest Night	Annual minimum of minimum temperature
Daytime Cold Waves	Number of events per year with at least 3 consecutive days with maximum temperature less than or equal to 32°F
Nighttime Cold Waves	Number of events per year with at least 3 consecutive days with minimum temperature less than or equal to 0°F

In Malheur County, the extreme cold metrics in Table 6 are projected to become less frequent or less cold by the 2020s and 2050s under both the lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios (Table 7). For example, by the 2050s under the higher emissions scenario, the number of cold days less than or equal to 32°F is projected to decrease by 13 days on average with a range of about 6 to 18 days. Likewise, the temperature of the coldest night of the year is projected to increase by 9.7°F on average with a range of 2.3°F to 15.6°F and the frequency of daytime cold waves is projected to decrease by 1.7 events per year.

Projected changes in the frequency extreme cold days (i.e., Cold Days and Cold Nights) are shown in Figure 7. Projected changes in the magnitude of cold records (i.e., Coldest Day and Coldest Night) are shown in Figure 8. Projected changes in the frequency of extreme cold events (i.e., Daytime Cold Waves and Nighttime Cold Waves) are shown in Figure 9.

Table 7 **Mean and range of projected future changes in extreme cold metrics for Malheur County from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models.**

	Change by Early 21st Century "2020s"		Change by Mid 21st Century "2050s"	
	Lower	**Higher**	**Lower**	**Higher**
Cold Days	-6.9 days (-12.1 to -1.6)	-8.3 days (-12.6 to -1.9)	-11.1 days (-14.8 to -4.7)	-12.6 days (-18.1 to -6.2)
Cold Nights	-0.8 days (-1.9 to 0.7)	-1.0 days (-1.7 to -0.0)	-1.3 days (-2.2 to -0.2)	-1.4 days (-2.2 to -0.1)
Coldest Day	+2.0°F (-3.1 to 5.6)	+3.4°F (-0.2 to 6.4)	+5.0°F (0.2 to 7.8)	+6.5°F (1.8 to 11.6)
Coldest Night	+3.5°F (-2.4 to 9.7)	+4.9°F (0.3 to 9.9)	+7.5°F (1.3 to 12.0)	+9.7°F (2.3 to 15.6)
Daytime Cold Waves	-0.9 events (-1.8 to -0.2)	-1.1 events (-1.8 to -0.3)	-1.5 events (-2.0 to -0.5)	-1.7 events (-2.4 to -0.7)
Nighttime Cold Waves	-0.1 events (-0.2 to 0.2)	-0.1 events (-0.2 to 0.0)	-0.1 events (-0.3 to 0.0)	-0.2 events (-0.3 to -0.0)

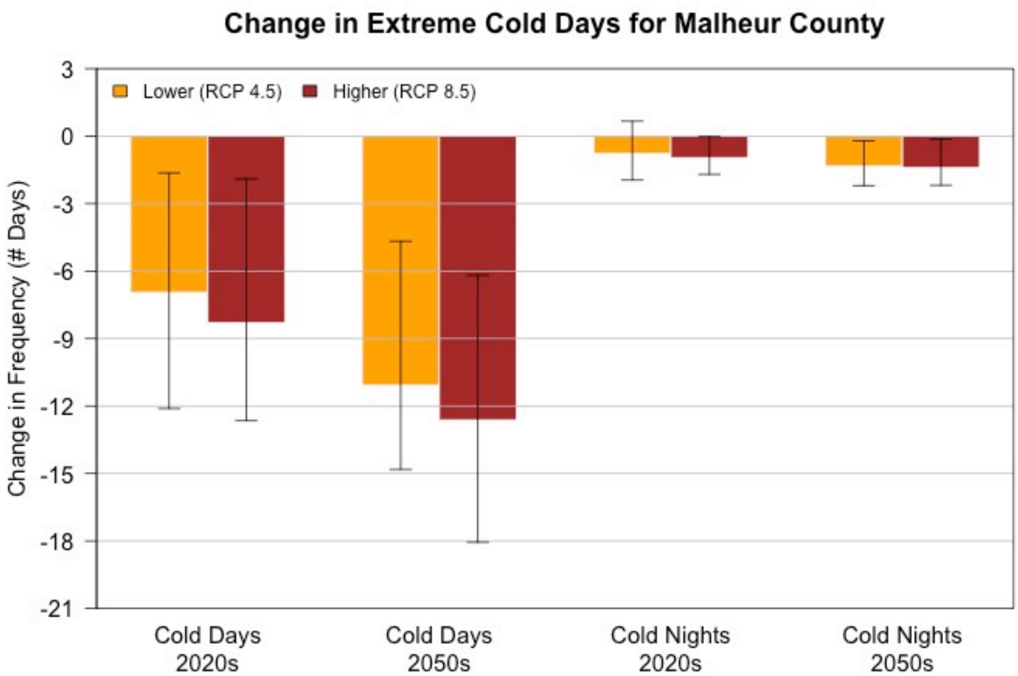


Figure 7 **Projected future changes in the number of cold days (left two sets of bars) and number of cold nights (right two sets of bars) for Malheur County from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models. The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs. Cold days are defined as days with maximum temperature at or below 32°F; cold nights are defined as days with minimum temperature at or below 0°F.**

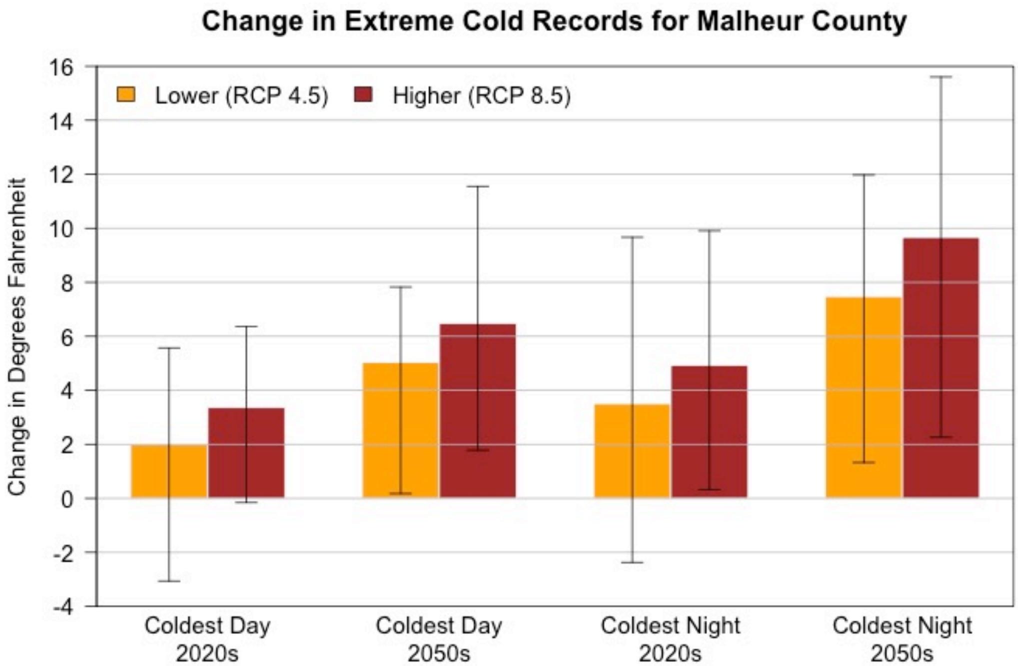


Figure 8 Projected future changes in the coldest day of the year (left two sets of bars) and coldest night of the year (right two sets of bars) for Malheur County from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models. The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs.

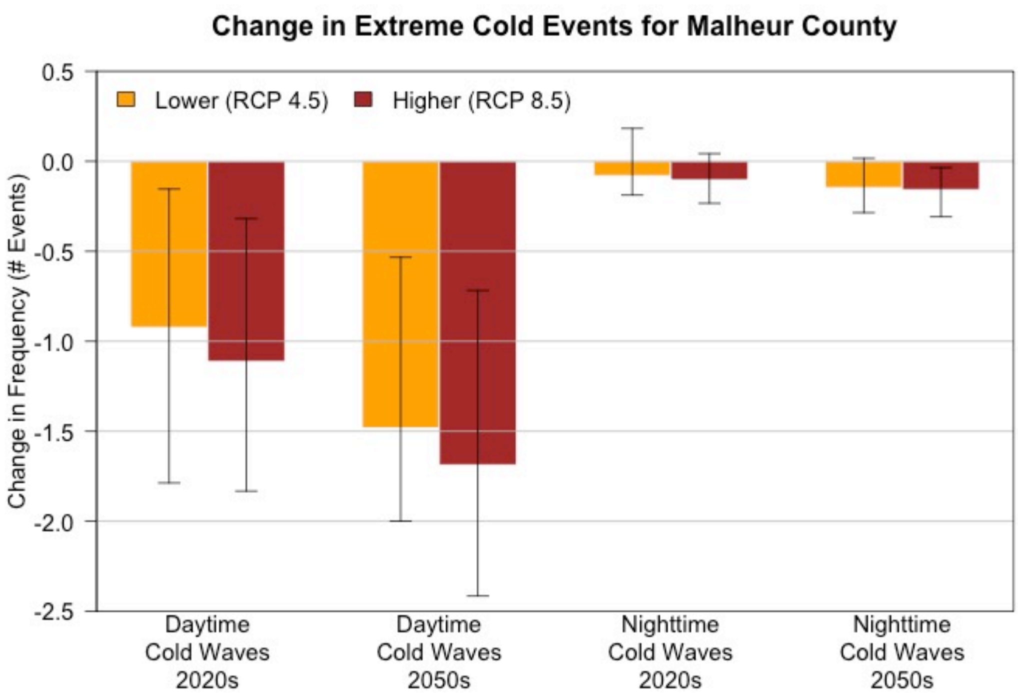


Figure 9 Projected future changes in the number of daytime cold waves (left two sets of bars) and number of nighttime cold waves (right two sets of bars) for Malheur County from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models. The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs. Daytime cold waves are defined as events with three or more consecutive days with maximum temperature at or below 32°F; nighttime cold waves are defined as events with three or more consecutive days with minimum temperature at or below 0°F.

Key Messages:

⇒ Cold extremes are still expected to occur from time to time, but with much less frequency and intensity as the climate warms.

⇒ In Malheur County, the extreme cold metrics in Table 6 are projected to become less frequent or less cold by the 2020s and 2050s under both the lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios (Table 7).

⇒ In Malheur County, the frequency of days at or below freezing is projected to decline on average by 13 days (with a range of 6 to 18 days) by the 2050s under the higher emissions scenario compared to the historical baseline.

⇒ In Malheur County, the temperature of the coldest night of the year is projected to increase by 10°F (with a range of 2 to 16°F) by the 2050s under the higher emissions scenario compared to the historical baseline.

Heavy Rains

There is greater uncertainty in future projections of precipitation-related metrics than temperature-related metrics. This is because of the large natural variability in precipitation patterns and the fact that the atmospheric patterns that influence precipitation are manifested differently across GCMs. From a global perspective, mean precipitation is likely to decrease in many dry regions in the sub-tropics and mid-latitudes and increase in many mid-latitude wet regions (IPCC, 2013). That boundary between mid-latitude increases and decreases in precipitation is positioned a little differently for each GCM, which results in some models projecting increases and others decreases in Oregon (Mote *et al.*, 2013).

In Oregon, observed precipitation is characterized by high year-to-year variability and future precipitation trends are expected to continue to be dominated by this large natural variability. On average, summers in Oregon are projected to become drier and other seasons to become wetter resulting in a slight increase in annual precipitation by the 2050s. However, some models project increases and others decreases in each season (Dalton *et al.*, 2017).

Extreme precipitation events in the Pacific Northwest are governed both by atmospheric circulation and by how it interacts with complex topography. Atmospheric rivers—long, narrow swaths of warm, moist air that carry large amounts of water vapor from the tropics to mid-latitudes—generally result in coherent extreme precipitation events west of the Cascade Range, while closed low pressure systems often lead to isolated precipitation extremes east of the Cascade Range (Parker and Abatzoglou, 2016).[2]

Observed trends in the frequency of extreme precipitation events across Oregon have depended on the location, time frame, and metric considered, but overall the frequency has not changed substantially. As the atmosphere warms, it is able to hold more water vapor that is available for precipitation. As a result, the frequency and intensity of extreme precipitation events are expected to increase slightly in the future (Dalton *et al.*, 2017). This report presents projected changes for four metrics of precipitation extremes (Table 8).

Table 8 Precipitation extreme metrics and definitions

Metric	Definition
Wettest Day	Annual maximum 1-day precipitation per water year
Wettest Five-Days	Annual maximum 5-day precipitation total per water year
Wet Days	Number of days with precipitation greater than 0.75 inches per year
Landslide Risk Days	Number of days per water year exceeding the USGS landslide threshold[3]: https://pubs.er.usgs.gov/publication/ofr20061064 ○ $P3/(3.5-.67*P15)>1$ where ○ P3 = Previous 3-day precipitation accumulation ○ P15 = 15-day precipitation accumulation prior to P3

[2] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)

[3] This threshold was developed for Seattle, Washington and may or may not have similar applicability to other locations.

In Malheur County, the magnitude of precipitation on the wettest day and wettest consecutive five days is projected to increase on average by the by the 2020s and 2050s under both the lower and higher emissions scenarios (Table 9). However, some models project decreases in these metrics for certain time periods and scenarios. For example, by the 2050s under the higher emissions scenario, the magnitude, or amount, of precipitation on the wettest day of the year is projected to increase by 19.1% on average with a range of 2.1 to 35.4%. Likewise, the magnitude of precipitation on the wettest consecutive five days of the year is projected to increase by 13.4% on average with a range of -6.9 to 27.9%. The average number of days per year with precipitation greater than ¾" isn't projected to change substantially.

Landslides are often triggered by rainfall when the soil becomes saturated. A cumulative rainfall threshold serves as a surrogate for landslide risk. For Malheur County, the average number of days per year exceeding the landslide risk threshold is projected to remain about the same. It is important to note that the landslide threshold used in this report was developed for Seattle, Washington and may or may not have similar applicability to other locations.

Projected changes in the magnitude of extreme precipitation events (i.e., Wettest Day and Wettest Five-Days) are shown in Figure 10. Projected changes in the frequency of extreme precipitation events (i.e., Wet Days and Landslide Risk Days) are shown in Figure 11.

Table 9 Mean and range of projected future changes in extreme precipitation metrics for Malheur County from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models.

	Change by Early 21st Century "2020s"		**Change by Mid 21st Century "2050s"**	
	Lower	**Higher**	**Lower**	**Higher**
Wettest Day	+14.4% (-1.7 to 42.7)	+10.7% (-0.6 to 25.9)	+16.6% (2.3 to 41.3)	+19.1% (2.1 to 35.4)
Wettest Five-Days	+10.0% (-4.1 to 30.1)	+8.4% (-11.1 to 19.9)	+11.5% (-1.5 to 31.0)	+13.4% (-6.9 to 27.9)
Wet Days	+0.2 days (-0.1 to 0.5)	+0.2 days (-0.0 to 0.5)	+0.3 days (0.0 to 0.6)	+0.3 days (0.0 to 0.8)
Landslide Risk Days	+0.1 days (-0.1 to 0.5)	+0.1 days (-0.1 to 0.3)	+0.1 days (-0.1 to 0.4)	+0.2 days (-0.1 to 0.5)

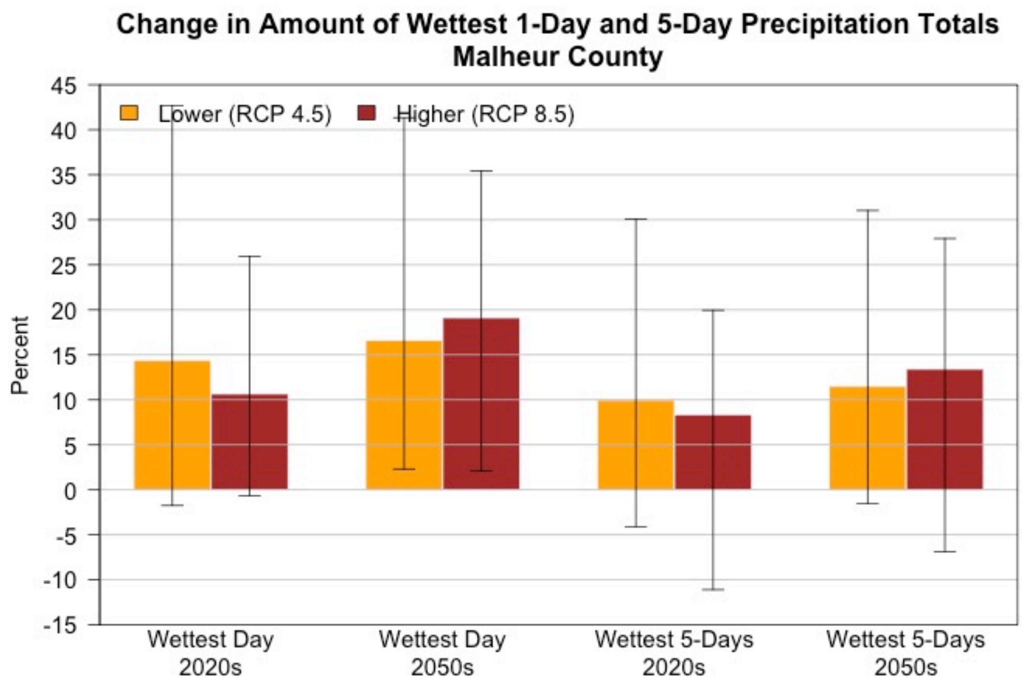


Figure 10 **Projected future changes in the wettest day of the year (left two sets of bars) and wettest consecutive five days of the year (right two sets of bars) for Malheur County from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models. The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs.**

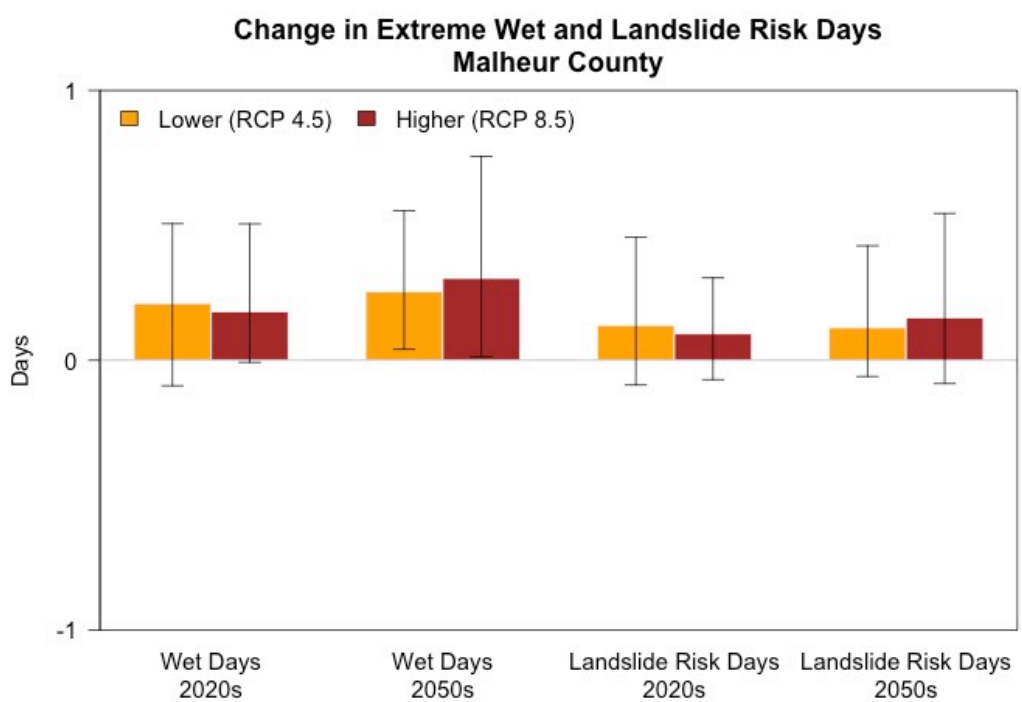


Figure 11 **Projected future changes in the frequency of wet days (left two sets of bars) and landslide risk days (right two sets of bars) for Malheur County from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 20 global climate models. The bars and whiskers display the mean and range, respectively, of changes across the 20 GCMs.**

Key Messages:

⇒ The intensity of extreme precipitation events is expected to increase slightly in the future as the atmosphere warms and is able to hold more water vapor.

⇒ In Malheur County, the magnitude of precipitation on the wettest day and wettest consecutive five days per year is projected to increase on average by about 19% (with a range of 2% to 35%) and 13% (with a range of -7% to 28%), respectively, by the 2050s under the higher emissions scenario compared to the historical baseline.

⇒ In Malheur County, the frequency of days with at least ¾" of precipitation and the frequency of days exceeding a threshold for landslide risk is not projected to change substantially.

Future streamflow magnitude and timing in the Pacific Northwest is projected to shift toward higher winter runoff, lower summer and fall runoff, and an earlier peak runoff, particularly in snow-dominated regions (Naz *et al.*, 2016; Raymondi *et al.*, 2013).[4] These changes are expected to result from warmer temperatures causing precipitation to fall more as rain and less as snow, in turn causing snow to melt earlier in the spring; and in combination with increasing winter precipitation and decreasing summer precipitation (Dalton *et al.*, 2017).

Warming temperatures and increased winter precipitation are expected to increase flood risk for many basins in the Pacific Northwest, particularly mid- to low-elevation mixed rain-snow basins with near freezing winter temperatures (Tohver *et al.*, 2014). The greatest changes in peak streamflow magnitudes are projected to occur at intermediate elevations in the Cascade Range and the Blue Mountains (Safeeq *et al.*, 2015). Recent advances in regional hydro-climate modeling support this expectation, projecting increases in extreme high flows for most of the Pacific Northwest, especially west of the Cascade Crest (Najafi and Moradkhani, 2015; Naz *et al.*, 2016; Salathé *et al.*, 2014). One study, using a single climate model, projects flood risk to increase in the fall due to earlier, more extreme storms, including atmospheric river events, and to a shift of precipitation from snow to rain (Salathé *et al.*, 2014).[5]

Some of the Pacific Northwest's largest floods occur when copious warm rainfall from atmospheric rivers combine with a strong snowpack, resulting in rain-on-snow flooding events (Safeeq *et al.*, 2015). During 1998–2014 in the California Sierra Nevada, atmospheric rivers were associated with half of all rain-on-snow events (Guan *et al.*, 2016). As a result of climate warming, rain-on-snow events are projected to decline at lower elevations, due to decreasing snow cover, and to increase at higher elevations as the number of rainy as opposed to snowy days increases (Safeeq *et al.*, 2015; Surfleet and Tullos, 2013).[6] How such changes in rain-on-snow frequency would affect high streamflow events is varied.

This report describes projected changes in the mean monthly "non-regulated" hydrograph of the Snake River at Nyssa. Mean monthly flows do not translate directly to flood risk because floods occur at shorter time scales. However, increases in higher monthly flow may imply increases in flood likelihood, particularly if increases are projected for months when flood occurrence has been historically high. This report also describes projected changes in the magnitude of flood events in terms of the water year maximum daily flows with 50%, 10%, and 4% exceedance probabilities at both the Snake River at Nyssa and the Owyhee River at the Owyhee Reservoir Inflow. In other words, these are the projected changes in the magnitude of the 2-year, 10-year, and 25-year return period single-day flood events, respectively. This flood analysis compares flood magnitudes between a historical baseline (1961–2010) and the 2050s (here, 2031–2080). These longer time periods (i.e., 50-year vs. 30-year), as required by the flood analysis, overlap with the time periods used throughout the rest of the report by adding a decade to either end. An analysis of flood risk projections

[4] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)

[5] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)

[6] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)

for the 2020s was not done because the required time period would have overlapped the historical baseline. These analyses are exploratory and should not be used for engineering or design, but rather to assess where climate change impacts may be significant.

On the Snake River at Nyssa, the monthly hydrograph is characteristic of a snow-dominated basin with peak flows during the late spring snowmelt season (Figure 12). By the 2050s, under both emissions scenarios, the peak streamflow is projected increase and shift earlier in the spring as warmer temperatures cause the snowpack to melt earlier. In addition, increased winter precipitation—and that precipitation falling more as rain than snow—contribute to the increased winter streamflow.

The Snake River Basin is managed largely for irrigation. Past streamflow trends in the Snake River basin below dams display a regulatory signal of declining flows in winter during 1950–2011 (Hatcher and Jones, 2013). The sub-basin draining to Snake River at Weiser also experienced a decline in peak runoff during April through June over the same period (Hatcher and Jones, 2013). The projected changes in the hydrograph of non-regulated flows (Figure 12) are opposite of the observed trends (not shown). The observed trends reflect regulatory practices where as the projected changes reflect the effects of climate change in the absence of regulation.

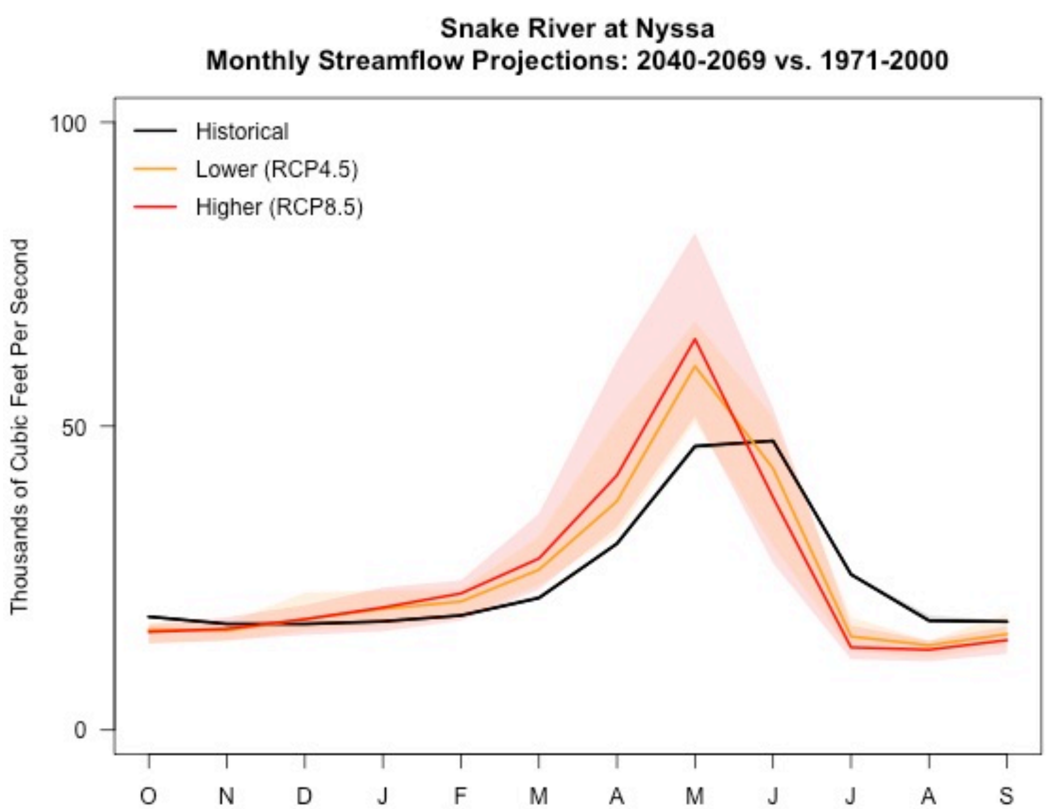


Figure 12 **Simulated historical and future bias-corrected mean monthly non-regulated streamflow at the Snake River at Nyssa for 2040–2069 compared to 1971–2000. Solid lines and shading depict the mean and range across ten global climate models. (Data source: Integrated Scenarios of the Future Northwest Environment, https://climatetoolbox.org/tool/Streamflow-Projections)**

On the Snake River at Nyssa, the magnitude of the 2-year (50% exceedance probability), 10-year (10% exceedance probability), and 25-year (4% exceedance probability) single-day flood events are projected to increase for the period 2031–2080 compared with 1961–2010 under both the lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios (Figure 13).

Likewise, on the Owyhee River at reservoir inflow, the magnitude of the 2-year (50% exceedance probability), 10-year (10% exceedance probability), and 25-year (4% exceedance probability) single-day flood events are also projected to increase for the period 2031–2080 compared with 1961–2010 under both the lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios (Figure 14). On the Malheur River below Nevada Dam near Vale, flood magnitudes are also projected to increase, however, potential biases in these projections could be quite large due to its small tributary size, and as such are not shown. Note that the hydrology model used to generate these projections does not perform well in southeast Oregon where groundwater is an important component of the hydrology, however, the flood analysis may not be largely affected by errors in the groundwater component.

These projected increases in flood risk for the Snake River at Nyssa and the Owyhee River at Reservoir Inflow are consistent with published literature on projected flood peak frequencies under climate change (Maurer *et al.*, 2018; Tohver *et al.*, 2014). Across the western US, the 100-year and 25-year peak flow magnitude is projected to increase at a majority of streamflow sites by the 2070–2099 period compared to the 1971–2000 historical baseline under the higher emissions scenario (RCP 8.5) (Maurer *et al.*, 2018).

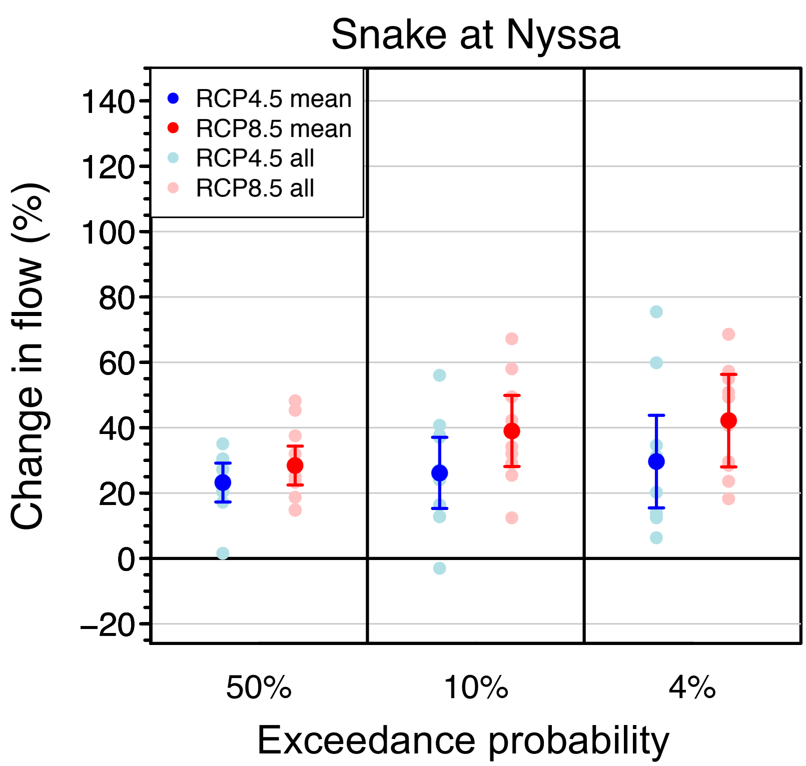


Figure 13 **Projected change in water year maximum daily non-regulated bias-corrected streamflows with 50%, 10%, and 4% probability of exceedance for the Snake River at Nyssa between 1961–2010 and 2031–2080 under lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios. Larger blue and red dots and bars depict the mean plus and minus two standard errors across all projections (ten global climate models). The smaller light blue and light red dots represent individual models. (Data source: Integrated Scenarios of the Future Northwest Environment, https://climate.northwestknowledge.net/IntegratedScenarios/; Figure source: David Rupp, OCCRI)**

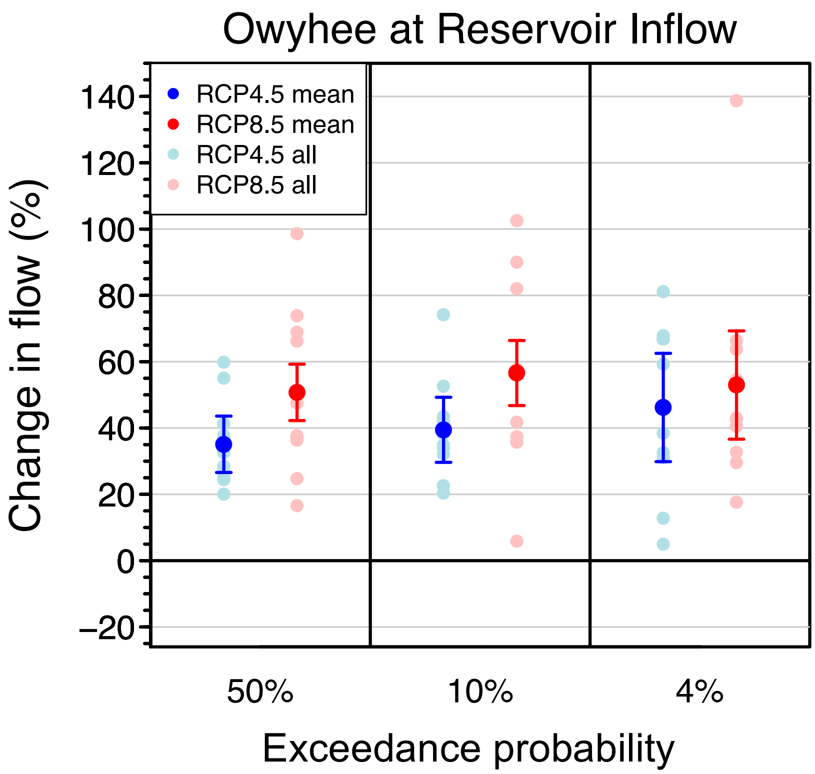


Figure 14 **Projected change in water year maximum daily non-regulated non-bias-corrected streamflows with 50%, 10%, and 4% probability of exceedance for the Owyhee River at Reservoir Inflow between 1961–2010 and 2031–2080 under lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios. Larger blue and red dots and bars depict the mean plus and minus two standard errors across all projections (ten global climate models). The smaller light blue and light red dots represent individual models. (Data source: Integrated Scenarios of the Future Northwest Environment, https://climate.northwestknowledge.net/IntegratedScenarios/; Figure source: David Rupp, OCCRI)**

Key Messages:

⇒ Flood risk to Malheur County is expected to increase based on projected increases in non-regulated peak flow magnitudes on the Snake River at Nyssa and the Owyhee River.

⇒ Because basins in Malheur County are mixed rain-snow basins, they are sensitive to warming temperatures and resulting hydrologic changes including increasing and earlier seasonal peak flows.

Drought

This report presents future changes in three variables indicative of drought conditions—spring snowpack, summer soil moisture[7], and summer runoff. Across the western US, mountain snowpack is projected to decline leading to reduced summer soil moisture in mountainous environments (Gergel *et al.*, 2017). In eastern Oregon, summer soil moisture is projected to increase on average, but the range of projected changes is large and depends on the models' projected change in precipitation, with some models projecting increases and others decreases (Gergel *et al.*, 2017).

Climate change is expected to result in lower summer streamflows in snow-dominated basins across the Pacific Northwest as snowpack melts off earlier due to warmer temperatures and summer precipitation decreases (Dalton *et al.*, 2017). See, for example, the decrease in summer flows expected for the Snake River at Nyssa (Figure 12) by the 2050s under both lower and higher emissions scenarios.

Changes in drought conditions for low spring snowpack, low summer soil moisture, and low summer runoff are presented in terms of a change in the frequency of the historical baseline 1-in-5 year event (that is, an event having a 20% chance of occurrence in any given year). The future projections, displayed in the orange and brown bars of Figure 15, are the frequency in the future period of the magnitude of the event that has a 20% frequency in the historical period.

In Malheur County, spring snowpack (that is, the snow water equivalent on April 1) is projected to decrease where as summer runoff and summer soil moisture are projected to increase under both lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios by the 2050s. This leads to the magnitude of low spring snow pack expected with a 20% chance in any given year of the historical period being projected to occur more frequently by the 2050s under both emissions scenarios (Figure 15). In contrast, the magnitude of low summer soil moisture and low summer runoff expected with a 20% chance historically is projected to occur less frequently on average. This is likely a consequence of projected increases in spring and summer precipitation in the southeast Oregon's Great Basin by the 2050s under both emissions scenarios. While soil moisture storage is projected to increase in the Northwest Interior, individual GCMs projections for the lowlands are varied since summer soil moisture depends on winter, spring, and summer precipitation (Gergel *et al.*, 2017). It is important to note that some models do project increased frequency of low summer runoff and low summer soil moisture even though the average across all models is a decrease in frequency (Figure 15). The 2020s were not evaluated in this drought analysis, but can be expected to be similar but of smaller magnitude to the changes for the 2050s.

[7] Soil moisture projections are for the total moisture in the soil column from the surface to 140 cm below the surface.

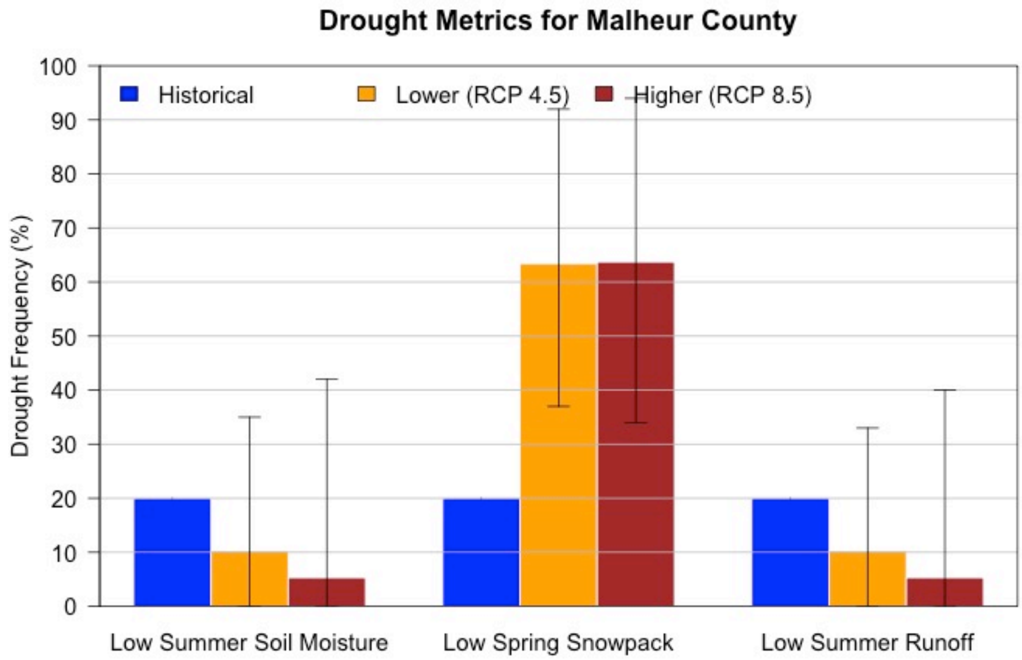


Figure 15 Frequency of the historical baseline (1971–2000) 1-in-5 year event (by definition 20% frequency) of low summer soil moisture (average of June-July-August), low spring snowpack (April 1 snow water equivalent), and low summer runoff (average of June-July-August) for the future period 2040–2069 for lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios. The bar and whiskers depict the mean and range across ten global climate models. (Data Source: Integrated Scenarios of the Future Northwest Environment, https://climate.northwestknowledge.net/IntegratedScenarios/)

Key Messages:

⇒ Drought conditions, as represented by low spring snowpack, is projected to become more frequent whereas drought conditions represented by low summer soil moisture and low summer runoff may become less frequent in Malheur County by the 2050s compared to the historical baseline under both emissions scenarios.

Wildfire

Over the last several decades, warmer and drier conditions during the summer months have contributed to an increase in fuel aridity and enabled more frequent large fires, an increase in the total area burned, and a longer fire season across the western United States, particularly in forested ecosystems (Dennison *et al.*, 2014; Jolly *et al.*, 2015; Westerling, 2016; Williams and Abatzoglou, 2016). The lengthening of the fire season is largely due to declining mountain snowpack and earlier spring snowmelt (Westerling, 2016). Recent wildfire activity in forested ecosystems is partially attributed to human-caused climate change: during the period 1984–2015, about half of the observed increase in fuel aridity and 4.2 million hectares (or more than 16,000 square miles) of burned area in the western United States were due to human-caused climate change (Abatzoglou and Williams, 2016). Under future climate change, wildfire frequency and area burned are expected to continue increasing in the Pacific Northwest (Barbero *et al.*, 2015; Sheehan *et al.*, 2015).[8]

As a proxy for wildfire risk, this report considers a fire danger index called 100-hour fuel moisture (FM100), which is a measure of the amount of moisture in dead vegetation in the 1–3 inch diameter class available to a fire. It is expressed as a percent of the dry weight of that specific fuel. FM100 is a common index used by the Northwest Interagency Coordination Center to predict fire danger. A majority of climate models project that FM100 would decline across Oregon by the 2050s under the higher (RCP 8.5) emissions scenario (Gergel *et al.*, 2017). This drying of vegetation would lead to greater wildfire risk, especially when coupled with projected decreases in summer soil moisture. This report defines a “very high” fire danger day to be a day in which FM100 is lower (i.e., drier) than the historical baseline 10th percentile value. By definition, the historical baseline has 36.5 very high fire danger days annually. The future change in wildfire risk is expressed as the average annual number of additional “very high” fire danger days for two future periods under two emissions scenarios compared with the historical baseline (Figure 16).

[8] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)

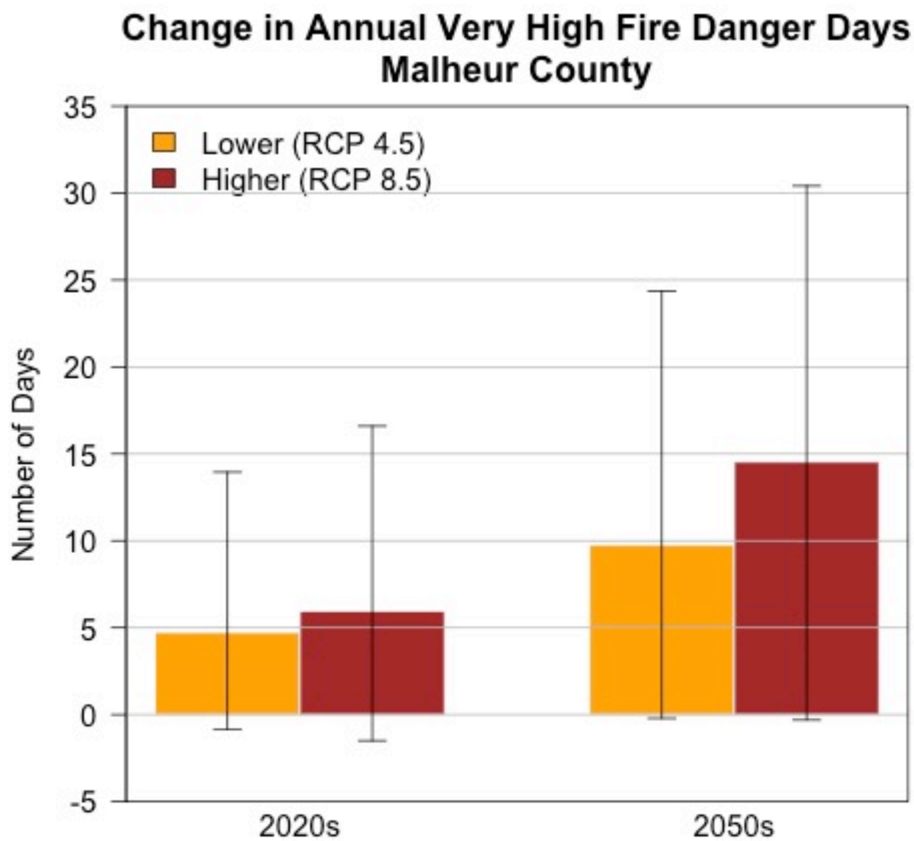


Figure 16 Projected future changes in the frequency of very high fire danger days for Malheur County from the historical baseline (1971–2000 average) for the 2020s (2010–2039 average) and 2050s (2040–2069 average) under a lower (RCP 4.5) and higher (RCP 8.5) emissions scenario based on 18 global climate models. The bars and whiskers display the mean and range, respectively, of changes across the 18 GCMs. (Data Source: Northwest Climate Toolbox, climatetoolbox.org/tool/Climate-Mapper)

Key Messages:

⇒ Wildfire risk, as expressed through the frequency of very high fire danger days, is projected to increase under future climate change in Malheur County.

⇒ In Malheur County, the frequency of very high fire danger days per year is projected to increase on average by nearly 15 days (with a range of 0 to 30 days) by the 2050s under the higher emissions scenario compared to the historical baseline.

⇒ In Malheur County, the frequency of very high fire danger days per year is projected to increase on average by about 40% (with a range of -1 to +83%) by the 2050s under the higher emissions scenario compared to the historical baseline.

Air Quality

Climate change is expected to worsen outdoor air quality. Warmer temperatures may increase ground level ozone pollution, more wildfires may increase smoke and particulate matter, and longer, more potent pollen seasons may increase aeroallergens. Such poor air quality is expected to exacerbate allergy and asthma conditions and increase respiratory and cardiovascular illnesses and death (Fann *et al.*, 2016).[9] This report presents quantitative projections of future air quality measures related to fine particulate matter (PM2.5) from wildfire smoke.

Climate change is expected to result in a longer wildfire season with more frequent wildfires and greater area burned (Sheehan *et al.*, 2015). Wildfires are primarily responsible for days when air quality standards for PM2.5 are exceeded in western Oregon and parts of eastern Oregon (Liu *et al.*, 2016), although woodstove smoke and diesel emissions are also main contributors (Oregon DEQ, 2016). Across the western United States, PM2.5 levels from wildfires are projected to increase 160% by mid-century under a medium emissions pathway[11] (SRES A1B) (Liu *et al.*, 2016). This translates to a greater risk of wildfire smoke exposure through increasing frequency, length, and intensity of "smoke waves"—that is, two or more consecutive days with high levels of PM2.5 from wildfires (Liu *et al.*, 2016).[10]

The change in risk of poor air quality due to wildfire-specific PM2.5 is expressed as the number of "smoke wave" days within a six-year period in the present (2004–2009) and mid-century (2046–2051) under a medium emissions pathway[11] (Figure 17). See Appendix for description of methodology and access to the Smoke Wave data.

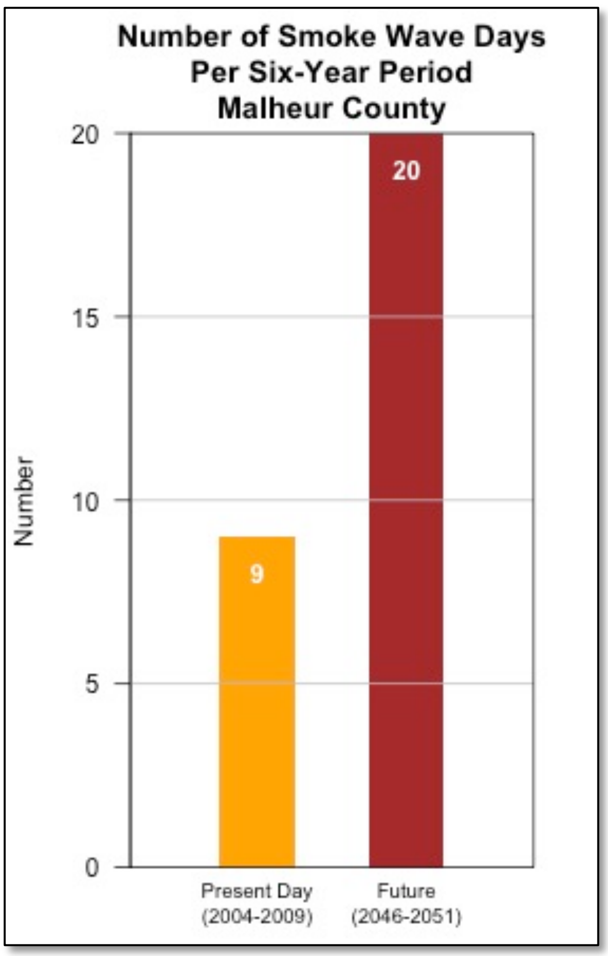


Figure 17 Simulated present day (2004–2009) and future (2046–2051) frequency of "smoke wave" days for Malheur County under a medium emissions scenario[11]. The bars display the mean across 15 GCMs. (Data source: Liu et al. 2016, https://khanotations.github.io/smoke-map/)

[9] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)
[10] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017)
[11] The medium emissions pathway used is from an earlier generation of emissions scenarios. Liu et al. (2016) used SRES-A1B, which is most similar to RCP 6.0 from Figure 2.

Key Messages:

⇒ Under future climate change, the risk of wildfire smoke exposure is projected to increase in Malheur County.

⇒ In Malheur County, there is projected to be 11 more “smoke wave” days during 2046–2051 under a medium emissions scenario compared with 2004–2009.

⇒ In Malheur County, the number of “smoke wave” days is projected to increase by 122% by 2046–2051 under a medium emissions scenario compared with 2004–2009.

Windstorms

Climate change has the potential to alter surface winds through changes in the large-scale free atmospheric circulation and storm systems, and through changes in the connection between the free atmosphere and the surface. West of the Cascade Mountains in the Pacific Northwest, changes in surface wind speeds tend to follow changes in upper atmosphere winds associated with extratropical cyclones (Salathé *et al.*, 2015). However, there is a high degree of uncertainty in future projections of extratropical cyclone frequency (IPCC, 2013). East of the Cascades, cool air pooling is common which can impede the transport of wind energy from the free atmosphere to the surface. Changes in this factor are likely important for understanding future changes in windstorms (Salathé *et al.*, 2015). However, this is not yet well studied. Therefore, no descriptions of future changing conditions are included in this report.

Key Messages:

⇒ Limited research suggests very little, if any, change in the frequency and intensity of windstorms in the Pacific Northwest as a result of climate change.

Dust Storms

Climate, through precipitation and winds, and vegetation coverage can influence the frequency and magnitude of dust events, or dust storms, which primarily concern parts of eastern Oregon. Periods of low precipitation can dry out the soils increasing the amount of soil particulate matter available to be entrained in high winds. In addition, the amount of vegetation cover can influence the amount of soil susceptible to high winds.

One study found that in eastern Oregon, precipitation is the dominant factor affecting dust event frequency in the spring whereas vegetation cover is the dominant factor in the summer (Pu and Ginoux, 2017). The same study projected that in the summertime in eastern Oregon, dust event frequency would decrease largely due to a decrease in bareness (or an increase in vegetation cover) (Pu and Ginoux, 2017). There were no clear projected changes in other seasons or locations in Oregon. These projections compare the 2051–2100 average under a higher emissions scenario (RCP 8.5) with the 1861–2005 average.

Another study found that wind erosion in Columbia Plateau agricultural areas is projected to decrease by mid-century under a lower emissions scenario (RCP 4.5) largely due to increases in biomass production, which retain the soil (Sharratt *et al.*, 2015). The increase in vegetation cover in both studies is likely due to the fertilization effect of increased amounts of carbon dioxide in the atmosphere and warmer temperatures. Tillage practices may also influence the amount of soil available to winds. Therefore, no descriptions of future changing conditions are included in this report.

Key Messages:

⇒ Limited research suggests that the risk of dust storms in summer would decrease in eastern Oregon under climate change in areas that experience an increase in vegetation cover from the carbon dioxide fertilization effect.

Increased Invasive Species & Pests

Warming temperatures, altered precipitation patterns, and increasing atmospheric carbon dioxide levels increase the risk for invasive species, insect and plant pests for forest and rangeland vegetation, and cropping systems.

Warming and more frequent drought will likely lead to a greater susceptibility among trees to insects and pathogens, a greater risk of exotic species establishment, more frequent and severe forest insect outbreaks (Halofsky and Peterson, 2016), and increased damage by a number of forest pathogens (Vose *et al.*, 2016). In Oregon and Washington, mountain pine beetle (*Dendroctonus ponderosae*) and western spruce budworm (*Choristoneura freemani*) are the most common native forest insect pests, and both have caused substantial tree mortality and defoliation over the past several decades (Meigs *et al.*, 2015).[12]

Climatic warming has facilitated the expansion and survival of mountain pine beetles, particularly in areas that have historically been too cold for the insect (Littell *et al.*, 2013). Across the western United States, the time between generations among different populations of mountain pine beetles is similar; however, the amount of thermal units required to complete a generation cycle was significantly less for beetles at cooler sites (Bentz *et al.*, 2014). Winter survival and faster generation cycles could be favored under future projections of decreases in the number of freeze days (Rawlins *et al.*, 2016).[13]

Western spruce budworm is a destructive defoliator that sporadically breaks out in interior Oregon Douglas-fir (*Pseudotsuga menziesii*) forests (Flower *et al.*, 2014). An analysis of three hundred years of tree ring data reveals that outbreaks tended to occur near the end of a drought, when trees' physiological thresholds had likely been reached. This analysis suggests that such outbreaks would likely intensify under the more frequent drought conditions that are projected for the future (Flower *et al.*, 2014), unless increasing atmospheric carbon dioxide, which may enhance water use efficiency, mitigates drought stress.[14]

More frequent rangeland droughts could facilitate invasion of non-native weeds as native vegetation succumbs to drought or wildfire cycles, leaving bare ground (Vose *et al.*, 2016). Cheatgrass (*Bromus tectorum L.*), a lower nutritional quality forage grass, facilitates more frequent fires, which reduces the capacity of shrub steppe ecosystem to provide livestock forage and critical wildlife habitat (Boyte *et al.*, 2016). Cheatgrass is a highly invasive species in the rangelands in the West that is projected to expand northward (Creighton *et al.*, 2015) and remain stable or increase in cover in most parts of the Great Basin (Boyte *et al.*, 2016) under climate change.[15]

Crop pests and pathogens may continue to migrate poleward under global warming as has been observed globally for several types since the 1960s (Bebber *et al.*, 2013). Much

---

[12] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017), p. 49

[13] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017), p. 49

[14] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017), p. 49–50

[15] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017), p. 70

remains to be learned about which pests and pathogens are most likely to affect certain crops as the climate changes, and about which management strategies will be most effective.[16]

Key Messages:

⇒ Warming temperatures, altered precipitation patterns, and increasing atmospheric carbon dioxide levels increase the risk for invasive species, insect and plant pests for forest and rangeland vegetation, and cropping systems.

Loss of Wetland Ecosystems

Wetlands play key roles in major ecological processes and provide a number of essential ecosystem services: flood reduction, groundwater recharge, pollution control, recreational opportunities, and fish and wildlife habitat, including for endangered species.[17] Climate change stands to affect freshwater wetlands Oregon through changes in the duration, frequency, and seasonality of precipitation and runoff; decreased groundwater recharge; and higher rates of evapotranspiration (Raymondi *et al.*, 2013).

Reduced snowpack and altered runoff timing may contribute to the drying of many ponds and wetland habitats across the Northwest.[18] The absence of water or declining water levels in permanent or ephemeral wetlands would affect resident and migratory birds, amphibians, and other animals that rely on the wetlands (Dello and Mote, 2010). However, potential future increases in winter precipitation may lead to the expansion of some wetland systems, such as wetland prairies.[19]

In Oregon's western Great Basin, changes in climate would alter the water chemistry of fresh and saline wetlands affecting the migratory water birds that depend on them. Hotter summer temperatures would cause freshwater sites to become more saline making them less useful to raise young birds that haven't yet developed the ability to process salt. At the same time, increased precipitation would cause saline sites to become fresher thereby decreasing the abundance of invertebrate food supply for adult water birds (Dello and Mote, 2010).

Key Messages:

⇒ Freshwater wetland ecosystems are sensitive to warming temperatures and altered hydrological patterns, such as changes in precipitation seasonality and reduction of snowpack.

[16] Verbatim from the Third Oregon Climate Assessment Report (Dalton *et al.*, 2017), p. 67
[17] Verbatim from the Oregon Climate Change Adaptation Framework, p. 62
[18] Verbatim from the Climate Change in the Northwest (Dalton *et al.*, 2013), p. 53
[19] Verbatim from the Climate Change in the Northwest (Dalton *et al.*, 2013), p. 53

Appendix

Future Climate Projections Background

Read more about emissions scenarios, global climate models, and uncertainty in the Climate Science Special Report, Volume 1 of the Fourth National Climate Assessment (https://science2017.globalchange.gov).

Emissions Scenarios: https://science2017.globalchange.gov/chapter/4#section-2

Global Climate Models & Downscaling:
https://science2017.globalchange.gov/chapter/4#section-3

Uncertainty: https://science2017.globalchange.gov/chapter/4#section-4

Climate & Hydrological Data

Statistically downscaled GCM output from the Fifth phase of the Coupled Model Intercomparison Project (CMIP5) served as the basis for future projections of temperature, precipitation, and hydrology variables. The coarse resolution of GCMs output (100-300 km) was downscaled to a resolution of about 6km using the Multivariate Adaptive Constructed Analogs (MACA) method, which has demonstrated skill in complex topographic terrain (Abatzoglou and Brown, 2012). The MACA approach utilizes a gridded training observation dataset to accomplish the downscaling by applying bias-corrections and spatial pattern matching of observed large- scale to small-scale statistical relationships. (For a detailed description of the MACA method see:
http://maca.northwestknowledge.net/MACAmethod.php.)

This downscaled gridded meteorological data (i.e., MACA data) is used as the climate inputs to an integrated climate-hydrology-vegetation modeling project called Integrated Scenarios of the Future Northwest Environment (https://climate.northwestknowledge.net/IntegratedScenarios/). Snow dynamics were simulated using the Variable- Infiltration Capacity hydrological model (VIC version 4.1.2.l; (Liang *et al.*, 1994) and updates) run on a 1/16th x 1/16th (6 km) grid.

Simulations of historical and future climate for the variables maximum temperature (*tasmax*), minimum temperature (*tasmin*), and precipitation (*pr*) are available at the daily time step from 1950 to 2099 for 20 GCMs and 2 RCPs (i.e., RCP4.5 and RCP8.5). Hydrological simulations of snow water equivalent (*SWE*) are only available for the 10 GCMs used as input to VIC. Table X lists all 20 CMIP5 GCMs and indicates the subset of 10 used for hydrological simulations. Data for all the models available was obtained for each variable from the Integrated Scenarios data archives in order to get the best uncertainty estimates.

All simulated climate data and the streamflow data have been bias-corrected using quantile mapping techniques. Only SWE is presented without bias correction. Quantile mapping adjusts simulated values by creating a one-to-one mapping between the cumulative probability distribution of simulated values and the cumulative probability distribution of observed values. In practice, both the simulated and observed values of a variable (e.g., daily streamflow) over the some historical time period are separately sorted and ranked and the values are assigned their respective probabilities of exceedence. The bias corrected value of a given simulated value is assigned the observed value that has the same probability of exceedence as the simulated value. The historical bias in the simulations is assumed to stay constant into the future; therefore the same mapping relationship developed from the historical period was applied to the future scenarios. For MACA, a separate quantile mapping relationship was made for each non-overlapping 15-day window in the calendar year. For streamflow, a separate quantile mapping relationship was made for each calendar month.

Hydrology was simulated using the Variable-Infiltration Capacity hydrological model (VIC; Liang et al. 1994) run on a $1/16^{th}$ x $1/16^{th}$ (6 km) grid. To generate daily streamflow estimates, runoff from VIC grid cells was then routed to selected locations along the stream network using a daily-time-step routing model. Where records of naturalized flow were available, the daily streamflow estimates were then bias-corrected so that their statistical distributions matched those of the naturalized streamflows.

The wildfire danger day metric was computed using the same MACA climate variables to compute the 100-hour fuel moisture content according to the equations in the National Fire Danger Rating System.

Smoke Wave Data

Abstract from Liu et al. (2016):
Wildfire can impose a direct impact on human health under climate change. While the potential impacts of climate change on wildfires and resulting air pollution have been studied, it is not known who will be most affected by the growing threat of wildfires. Identifying communities that will be most affected will inform development of fire management strategies and disaster preparedness programs. We estimate levels of fine particulate matter ($PM_{2.5}$) directly attributable to wildfires in 561 western US counties during fire seasons for the present-day (2004–2009) and future (2046–2051), using a fire prediction model and GEOS-Chem, a 3-D global chemical transport model. Future estimates are obtained under a scenario of moderately increasing greenhouse gases by mid-century. We create a new term “Smoke Wave,” defined as ≥2 consecutive days with high wildfire-specific $PM_{2.5}$, to describe episodes of high air pollution from wildfires. We develop an interactive map to demonstrate the counties likely to suffer from future high wildfire pollution events. For 2004–2009, on days exceeding regulatory $PM_{2.5}$ standards, wildfires contributed an average of 71.3 % of total $PM_{2.5}$. Under future climate change, we estimate that more than 82 million individuals will experience a 57 % and 31 % increase in the frequency and intensity, respectively, of Smoke Waves. Northern California, Western Oregon and the Great Plains are likely to suffer the highest exposure to wildfire smoke in the future. Results point to the potential health impacts of increasing wildfire activity on large numbers of people in a warming climate and the need to establish or modify US wildfire management and evacuation programs in high-risk regions. The study also adds to the growing literature arguing that extreme events in a changing climate could have significant consequences for human health.

Data can be accessed here: https://khanotations.github.io/smoke-map/

For the DLCD project, we looked at the variable "Total # of SW days in 6 yrs". This variable tallies all the days within each time period in which the fine particulate matter exceeded the threshold defined as the 98th quantile of the distribution of daily wildfire-specific $PM_{2.5}$ values in the modeled present-day years, on average across the study area. Liu et al. (2016) used 15 GCMs from the Third Phase of the Coupled Model Intercomparison Project (CMIP3) under a medium emissions scenario (SRES-A1B). The data site only offers the multi-model mean value (not the range), which should be understood as the aggregate direction of projected change rather than the actual number expected.

References

Abatzoglou JT, Brown TJ. 2012. A comparison of statistical downscaling methods suited for wildfire applications. *International Journal of Climatology* **32**(5): 772–780. DOI: 10.1002/joc.2312.

Abatzoglou JT, Williams AP. 2016. Impact of anthropogenic climate change on wildfire across western US forests. *Proceedings of the National Academy of Sciences* **113**(42): 11770–11775. DOI: 10.1073/pnas.1607171113.

Barbero R, Abatzoglou JT, Larkin NK, Kolden CA, Stocks B. 2015. Climate change presents increased potential for very large fires in the contiguous United States. *International Journal of Wildland Fire* **24**(7): 892–899.

Bebber DP, Ramotowski MAT, Gurr SJ. 2013. Crop pests and pathogens move polewards in a warming world. *Nature Climate Change* **3**(11): 985–988. DOI: 10.1038/nclimate1990.

Bentz B, Vandygriff J, Jensen C, Coleman T, Maloney P, Smith S, Grady A, Schen-Langenheim G. 2014. *Mountain Pine Beetle Voltinism and Life History Characteristics across Latitudinal and Elevational Gradients in the Western United States*. Text. .

Boyte SP, Wylie BK, Major DJ. 2016. Cheatgrass Percent Cover Change: Comparing Recent Estimates to Climate Change — Driven Predictions in the Northern Great Basin,. *Rangeland Ecology & Management* **69**(4): 265–279. DOI: 10.1016/j.rama.2016.03.002.

Creighton J, Strobel M, Hardegree S, Steele R, Van Horne B, Gravenmier B, Owen W, Peterson D, Hoang L, Little N, Bochicchio J, Hall W, Cole M, Hestvik S, Olson J. 2015. *Northwest Regional Climate Hub Assessment of Climate Change Vulnerability and Adaptation and Mitigation Strategies*. United States Department of Agriculture, 52.

Dalton MM, Dello KD, Hawkins L, Mote PW, Rupp DE. 2017. *The Third Oregon Climate Assessment Report*. Oregon Climate Change Research Institute, College of Earth, Ocean and Atmospheric Sciences, Oregon State University: Corvallis, OR, 99.

Dalton MM, Mote PW, Snover AK. 2013. *Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities*. Island Press: Washington, DC.

Dello KD, Mote PW. 2010. *Oregon Climate Assessment Report*. Oregon Climate Change Research Institute, College of Oceanic and Atmospheric Sciences, Oregon State University: Corvallis, OR.

Dennison PE, Brewer SC, Arnold JD, Moritz MA. 2014. Large wildfire trends in the western United States, 1984–2011. *Geophysical Research Letters* **41**(8): 2014GL059576. DOI: 10.1002/2014GL059576.

Fann N, Brennan T, Dolwick P, Gamble JL, Ilacqua V, Kolb L, Nolte CG, Spero TL, Ziska L. 2016. Ch. 3: Air Quality Impacts. *The Impacts of Climate Change on Human Health in the*

United States: A Scientific Assessment. US Global Change Research Program: Washington, DC, 69–98.

Flower A, Gavin DG, Heyerdahl EK, Parsons RA, Cohn GM; 2014. Drought-triggered western spruce budworm outbreaks in the Interior Pacific Northwest: A multi-century dendrochronological record. *Forest Ecology and Management* **324**: 16–27.

Gergel DR, Nijssen B, Abatzoglou JT, Lettenmaier DP, Stumbaugh MR. 2017. Effects of climate change on snowpack and fire potential in the western USA. *Climatic Change* **141**(2): 287–299. DOI: 10.1007/s10584-017-1899-y.

Guan B, Waliser DE, Ralph FM, Fetzer EJ, Neiman PJ. 2016. Hydrometeorological characteristics of rain-on-snow events associated with atmospheric rivers. *Geophysical Research Letters* **43**(6): 2016GL067978. DOI: 10.1002/2016GL067978.

Halofsky JE, Peterson DL. 2016. Climate Change Vulnerabilities and Adaptation Options for Forest Vegetation Management in the Northwestern USA. *Atmosphere* **7**(3): 46. DOI: 10.3390/atmos7030046.

Hatcher KL, Jones JA. 2013. Climate and Streamflow Trends in the Columbia River Basin: Evidence for Ecological and Engineering Resilience to Climate Change. *Atmosphere-Ocean* **51**(4). DOI: 10.1080/07055900.2013.808167.

IPCC. 2013. Summary for Policymakers. *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press: Cambridge, United Kingdom and New York, NY, USA.

Jolly WM, Cochrane MA, Freeborn PH, Holden ZA, Brown TJ, Williamson GJ, Bowman DMJS. 2015. Climate-induced variations in global wildfire danger from 1979 to 2013. *Nature Communications* **6**: 7537. DOI: 10.1038/ncomms8537.

Liang X, Lettenmaier DP, Wood EF, Burges SJ. 1994. A simple hydrologically based model of land surface water and energy fluxes for general circulation models. *Journal of Geophysical Research* **99**(D7): 14415–14428.

Littell JS, Hicke JA, Shafer SL, Capalbo SM, Houston LL, Glick P. 2013. Forest ecosystems: Vegetation, disturbance, and economics: Chapter 5. In: Dalton MM, Mote PW and Snover AK (eds) *Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities*. Island Press: Washington, DC, 110–148.

Liu JC, Mickley LJ, Sulprizio MP, Dominici F, Yue X, Ebisu K, Anderson GB, Khan RFA, Bravo MA, Bell ML. 2016. Particulate air pollution from wildfires in the Western US under climate change. *Climatic Change* **138**(3–4): 655–666. DOI: 10.1007/s10584-016-1762-6.

Maurer EP, Kayser G, Gabel L, Wood AW. 2018. Adjusting Flood Peak Frequency Changes to Account for Climate Change Impacts in the Western United States. *Journal of Water*

Resources Planning and Management **144**(3): 05017025. DOI: 10.1061/(ASCE)WR.1943-5452.0000903.

Meigs GW, Kennedy RE, Gray AN, Gregory MJ. 2015. Spatiotemporal dynamics of recent mountain pine beetle and western spruce budworm outbreaks across the Pacific Northwest Region, USA. *Forest Ecology and Management* **339**: 71–86. DOI: 10.1016/j.foreco.2014.11.030.

Mote PW, Abatzoglou JT, Kunkel KE. 2013. Climate: Variability and Change in the Past and the Future: Chapter 2. In: Dalton MM, Mote PW and Snover AK (eds) *Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities*. Island Press: Washington, DC, 25–40.

Najafi MR, Moradkhani H. 2015. Multi-model ensemble analysis of runoff extremes for climate change impact assessments. *Journal of Hydrology* **525**: 352–361. DOI: 10.1016/j.jhydrol.2015.03.045.

Naz BS, Kao S-C, Ashfaq M, Rastogi D, Mei R, Bowling LC. 2016. Regional hydrologic response to climate change in the conterminous United States using high-resolution hydroclimate simulations. *Global and Planetary Change* **143**: 100–117. DOI: 10.1016/j.gloplacha.2016.06.003.

Oregon DEQ. 2016. *2015 Oregon Air Quality Data Summaries*. Oregon Department of Environmental Quality: Portland, OR.

Parker LE, Abatzoglou JT. 2016. Spatial coherence of extreme precipitation events in the Northwestern United States. *International Journal of Climatology* **36**(6): 2451–2460. DOI: 10.1002/joc.4504.

Pu B, Ginoux P. 2017. Projection of American dustiness in the late 21 st century due to climate change. *Scientific Reports* **7**(1): 5553. DOI: 10.1038/s41598-017-05431-9.

Rawlins MA, Bradley RS, Diaz HF, Kimball JS, Robinson DA. 2016. Future Decreases in Freezing Days across North America. *Journal of Climate* **29**(19): 6923–6935. DOI: 10.1175/JCLI-D-15-0802.1.

Raymondi RR, Cuhaciyan JE, Glick P, Capalbo SM, Houston LL, Shafer SL, Grah O. 2013. Water Resources: Implications of Changes in Temperature and Precipiptation: Chapter 3. In: Dalton MM, Mote PW and Snover AK (eds) *Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities*. Island Press: Washington, DC, 41–66.

Safeeq M, Grant GE, Lewis SL, Kramer MG, Staab B. 2014. A hydrogeologic framework for characterizing summer streamflow sensitivity to climate warming in the Pacific Northwest, USA. *Hydrology and Earth System Sciences* **18**(9): 3693–3710. DOI: 10.5194/hess-18-3693-2014.

Safeeq M, Grant GE, Lewis SL, Staab B. 2015. Predicting landscape sensitivity to present and future floods in the Pacific Northwest, USA. *Hydrological Processes* **29**(26): 5337–5353. DOI: 10.1002/hyp.10553.

Salathé E, Mauger G, Steed R, Dotson B. 2015. *Final Project Report: Regional Modeling for Windstorms and Lightning. Prepared for Seattle City Light.* Climate Impacts Group, University of Washington: Seattle, WA.

Salathé EP, Hamlet AF, Mass CF, Lee S-Y, Stumbaugh M, Steed R. 2014. Estimates of Twenty-First-Century Flood Risk in the Pacific Northwest Based on Regional Climate Model Simulations. *Journal of Hydrometeorology* **15**(5): 1881–1899. DOI: 10.1175/JHM-D-13-0137.1.

Sharratt BS, Tatarko J, Abatzoglou JT, Fox FA, Huggins D. 2015. Implications of climate change on wind erosion of agricultural lands in the Columbia plateau. *Weather and Climate Extremes* **10**, **Part A**: 20–31. DOI: 10.1016/j.wace.2015.06.001.

Sheehan T, Bachelet D, Ferschweiler K. 2015. Projected major fire and vegetation changes in the Pacific Northwest of the conterminous United States under selected CMIP5 climate futures. *Ecological Modelling* **317**: 16–29. DOI: 10.1016/j.ecolmodel.2015.08.023.

Surfleet CG, Tullos D. 2013. Variability in effect of climate change on rain-on-snow peak flow events in a temperate climate. *Journal of Hydrology* **479**: 24–34. DOI: 10.1016/j.jhydrol.2012.11.021.

Tohver IM, Hamlet AF, Lee S-Y. 2014. Impacts of 21st-Century Climate Change on Hydrologic Extremes in the Pacific Northwest Region of North America. *JAWRA Journal of the American Water Resources Association* **50**(6): 1461–1476. DOI: 10.1111/jawr.12199.

Vose JM, Clark JS, Luce CH, Patel-Weynand T. 2016. Executive Summary. In: Vose JM, Clark JS, Luce CH and Patel-Weynand T (eds) *Effects of drought on forests and rangelands in the United States: a comprehensive science synthesis. Gen. Tech. Rep. WO-93b*. U.S. Department of Agriculture, Forest Service, Washington Office: Washington, D.C., 289.

Vose RS, Easterling DR, Kunkel KE, LeGrande AN, Wehner MF. 2017. Temperature changes in the United States. In: Wuebbles D., Fahey DW, Hibbard KA, Dokken DJ, Stewart BC and Maycock TK (eds) *Climate Science Special Report: Fourth National Climate Assessment, Volume 1*. U.S. Global Change Research Program: Washington, DC, USA, 185–206.

Westerling AL. 2016. Increasing western US forest wildfire activity: sensitivity to changes in the timing of spring. *Phil. Trans. R. Soc. B* **371**(1696): 20150178. DOI: 10.1098/rstb.2015.0178.

Williams AP, Abatzoglou JT. 2016. Recent Advances and Remaining Uncertainties in Resolving Past and Future Climate Effects on Global Fire Activity. *Current Climate Change Reports* **2**(1): 1–14. DOI: 10.1007/s40641-016-0031-0.

APPENDIX G: SUCCESS STORIES

Introduction

There are many times when a community ascertains a problem or an issue and then works to troubleshoot or problem solve. That takes recognition and commitment.

One illustration of this commitment to increase resilience is that mitigation actions identified in the NHMPs can become integrated into the regular activities that a community does. For example, these activities may be something like a yearly trimming of roadside vegetation to reduce fuel load for wildfires or a public outreach campaign each winter to alert and remind people of winter hazards. In the mitigation actions tables, communities often mark these activities or actions as "on-going." These on-going activities have become well accepted activities the community continues to prioritize each year. This is a very good accomplishment to have mitigation integrated as a priority.

Mitigation actions can also be achieved through specific projects.

Below, there are examples from the Malheur County NHMP Steering Committee of success stories.

City of Nyssa

The City of Nyssa has a bridge that crosses the Snake River and connects to Idaho. The City's water source is connected via a pipe on the bridge. One of the biggest concerns to the community was that if this bridge went down, the water source would go with it. If the water source were to go down, say in an earthquake or other disaster situation, the City's water source would be unavailable. To have a back-up supply of water was key for the community.

In addition, in the *2014 Malheur County NHMP*, the multi-hazard action (MH) #7 was "Install arsenic removal equipment on municipal wells #7 and #9 to provide backup drinking water supply out of the floodplain."

The Public Works lead, Duane Petty, talked with Jim Maret, the City Manager, about making the well water in South Park available in case of an emergency. This would necessitate getting approvals from the Oregon Department of Environmental Quality (DEQ) to use the well water for human consumption; the City would need to demonstrate that the water was potable. The City did the necessary tests and received approval to use the well water in time of an emergency. The water system now has a tie in valve to connect the well to the water system so "now if something happens we are ready" says Jim Maret. In addition, Maret says "I think this is a great step in emergency preparedness and Mr. Petty needs to be commended on his thought and efforts, for our City."[1]

The City of Nyssa built a new water treatment facility to serve the people of Nyssa; it opened in 2018.

---

[1] Jim Maret, City Manager of Nyssa, personal communication, May 21, 2018.

Figure G-1 View of South Park in Nyssa, OR

Source: Tricia Sears, DLCD, personal communication, August 8, 2018

Figure G-2 View of the Water Treatment Facility

Source: Tricia Sears, DLCD, personal communication, August 8, 2018

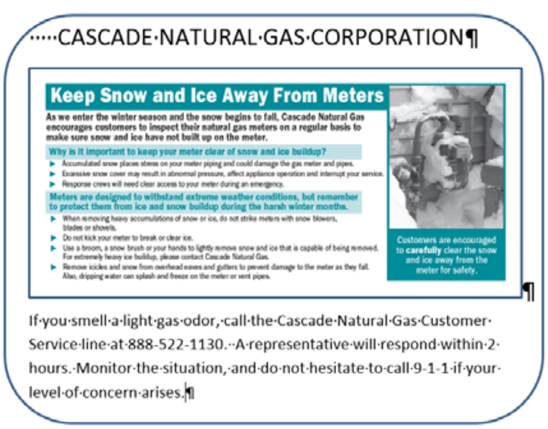
Figure G-3 View from the Nyssa Water Treatment Plant to the Bridge that Crosses the Snake River into Idaho

Source: Tricia Sears, DLCD, personal communication, August 8, 2018

Cascade Natural Gas

Cascade Natural Gas staff noticed that during severe snowstorms the snow would pile up around their natural gas meters. They put an announcement in the local newspapers and in the January bills for Cascade Natural Gas customers to alert people to this situation and identified the need for people to take action to not put snow by the natural gas meters. The announcement was published in the Argus Observer in Ontario and the Baker City Herald. They also sent the information to the City Managers of Ontario, Nyssa, Vale, and Baker City so that the managers could distribute the information. A noticeable increase in accessibility to gas meters during snowstorms has occurred.

Figure G-4 Cascade Natural Gas Announcement



CASCADE NATURAL GAS CORPORATION

Keep Snow and Ice Away From Meters

As we enter the winter season and the snow begins to fall, Cascade Natural Gas encourages customers to inspect their natural gas meters on a regular basis to make sure snow and ice have not built up on the meter.

Why is it important to keep your meter clear of snow and ice buildup?

- Accumulated snow places stress on your meter piping and could damage the gas meter and pipes.
- Excessive snow cover may result in abnormal pressure, affect appliance operation and interrupt your service.
- Response crews will need clear access to your meter during an emergency.

Meters are designed to withstand extreme weather conditions, but remember to protect them from ice and snow buildup during the harsh winter months.

- When removing heavy accumulations of snow or ice, do not strike meters with snow blowers, blades or shovels.
- Do not kick your meter to break or clear ice.
- Use a broom, a snow brush or your hands to lightly remove snow and ice that is capable of being removed. For extremely heavy ice buildup, please contact Cascade Natural Gas.
- Remove icicles and snow from overhead eaves and gutters to prevent damage to the meter as they fall. Also, dripping water can splash and freeze on the meter or vent pipes.

Customers are encouraged to **carefully** clear the snow and ice away from the meter for safety.

If you smell a light gas odor, call the Cascade Natural Gas Customer Service line at 888-522-1130. A representative will respond within 2 hours. Monitor the situation, and do not hesitate to call 9-1-1 if your level of concern arises.

Source: Kyle McCauley, Cascade Natural Gas, personal communication, April 2018

APPENDIX H: MALHEUR COUNTY HAZUS GLOBAL REPORTS FOR CRUSTAL AND PROBABILISTIC SCENARIOS

Introduction

This appendix contains the *Malheur County HAZUS Global Reports for Crustal and Probabilistic Scenarios* which includes details about simulated earthquake scenarios and the results. The report includes two HAZUS-MH scenarios: the Malheur Arbitrary Crustal M6.9 and the 2500 Year Probable Scenario M6.5 Driving. The report includes inventories of: buildings; critical facilities; and transportation and utilities. The damage assessment is listed in the categories of direct damage, induced damage, social impact, and economic loss.

The report was prepared by DOGAMI in 2007 but was not formally published. Some of the information in this report has been excerpted and included in the Earthquake Annex of this *2019 Malheur County NHMP*. A copy of the report was provided to DLCD by Bill Burns of DOGAMI.

Malheur County

Crustal Earthquake Scenario Details and Ground Motion Map

Probabilistic Earthquake Scenario Details and Ground Motion Map

Relative Ground Shaking Amplification Susceptibility Map

Relative Liquefaction Hazard Susceptibility Map

Relative Earthquake Induced Landslide Susceptibility Map

Identified Landslide Areas Map

HAZUS Global Reports for Crustal and Probabilistic Scenarios

Crustal Earthquake Scenario Details

Crustal Earthquake Scenario: A magnitude 6.5 earthquake on an Arbitrary Crustal Fault.

For the magnitude 6.5 earthquake on the Arbitrary Fault scenario, we defined the fault source using the “Arbitrary Seismic Source” option within HAZUS (Figure ?-1) (FEMA, 2005). The fault and earthquake event was chosen by examination of USGS data and data in the Geomatrix report (1995) titled *S eismic Design Mapping State of Oregon* prepared for the Oregon Department of Transportation (USGS, 2004). In general, a likely worst-case scenario was selected. Figure ?-1 has the location of the fault, shown as the maroon line. Figure ?-2 displays the PGA for the crustal scenario.

Scenario Name	Malheur Arbitrary Crustal M6.9
Type of Earthquake	Source
Fault Name	Malheur_Arbitrary
Historical Epicenter ID #	-
Probabilistic Return Period	NA
Longitude of Epicenter	-117.0750
Latitude of Epicenter	51.0505
Earthquake Magnitude	6.9
Depth (km)	0.00
Rupture Length (km)	51
Rupture Orientation (degrees)	0.00
Attenuation Function	WUS Shallow Crustal Event Extensional

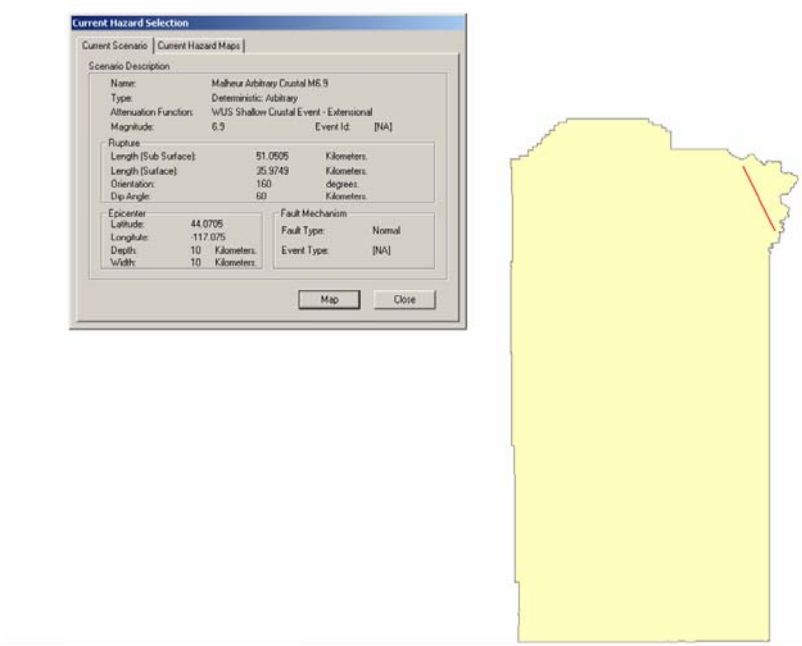


Figure ?-1. Arbitrary Fault details from HAZUS-MH (FEMA, 2005)

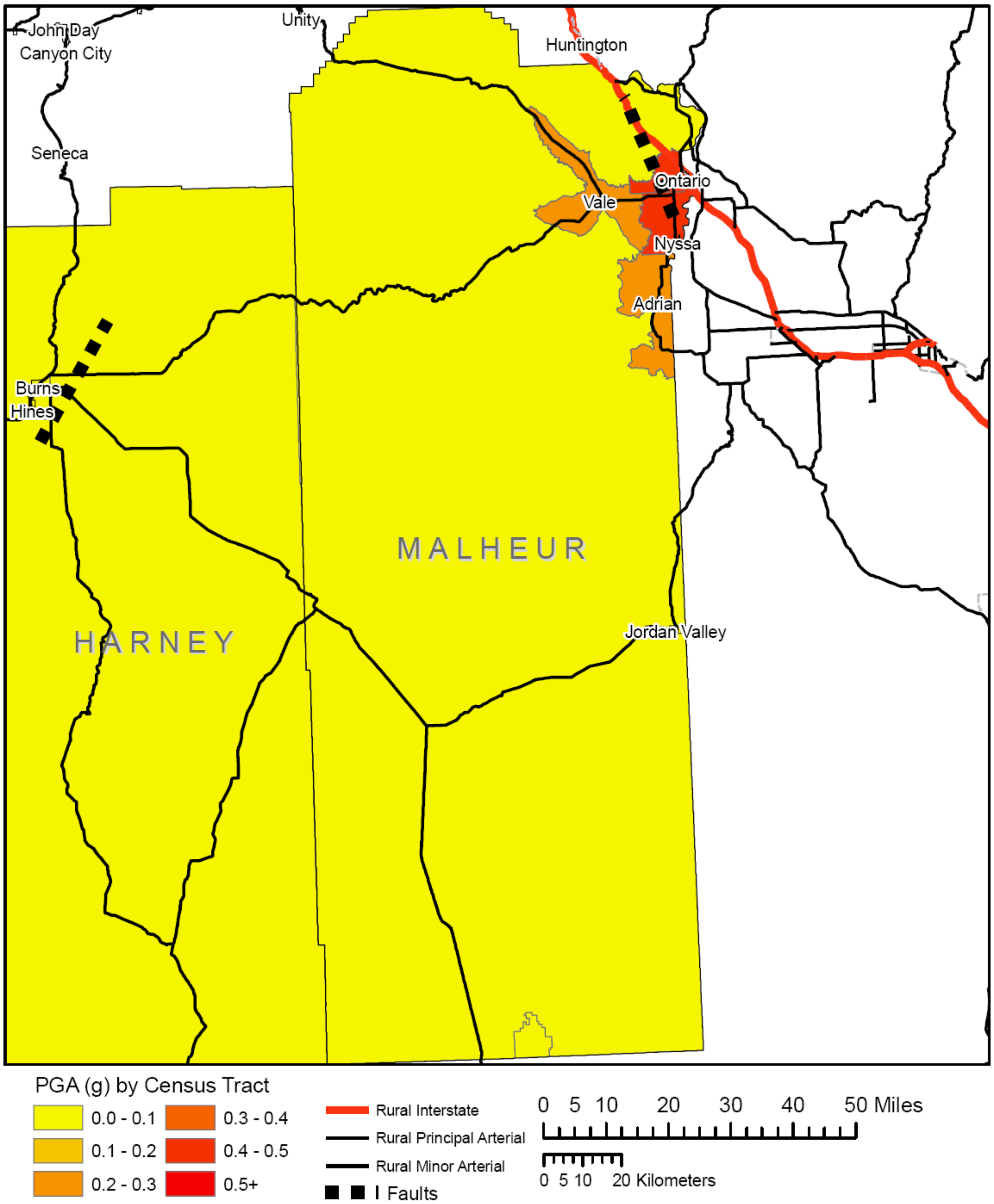


Figure ?-2. Peak ground acceleration (PGA) by census tracts map for crustal scenario, Malheur County, Oregon (FEMA, 2005).

Probabilistic Earthquake Scenario Details

Probabilistic Earthquake Scenario: A 2500 year mean return period probabilistic earthquake scenario was selected.

For the probabilistic earthquake scenario, we used the “Pre-defined event” option within HAZUS to incorporate ground motion maps developed by USGS to model damage and loss from a magnitude 6.5 driving probabilistic earthquake scenario (Figure ?-3). The maps were developed based on ground motion data provided by the U.S. Geological Survey. The Methodology includes probabilistic seismic hazard contour maps developed by the USGS for the 2002 update of the National Seismic Hazard Maps (Frankel et al., 2002). The USGS maps provide estimates of PGA and spectral acceleration at periods of 0.3 second and 1.0 second, respectively.

Ground shaking with a 2500 year mean return period or 2% probability of being exceeded in 50 years was used. Figure ?-4 displays the PGA for the probabilistic scenario.

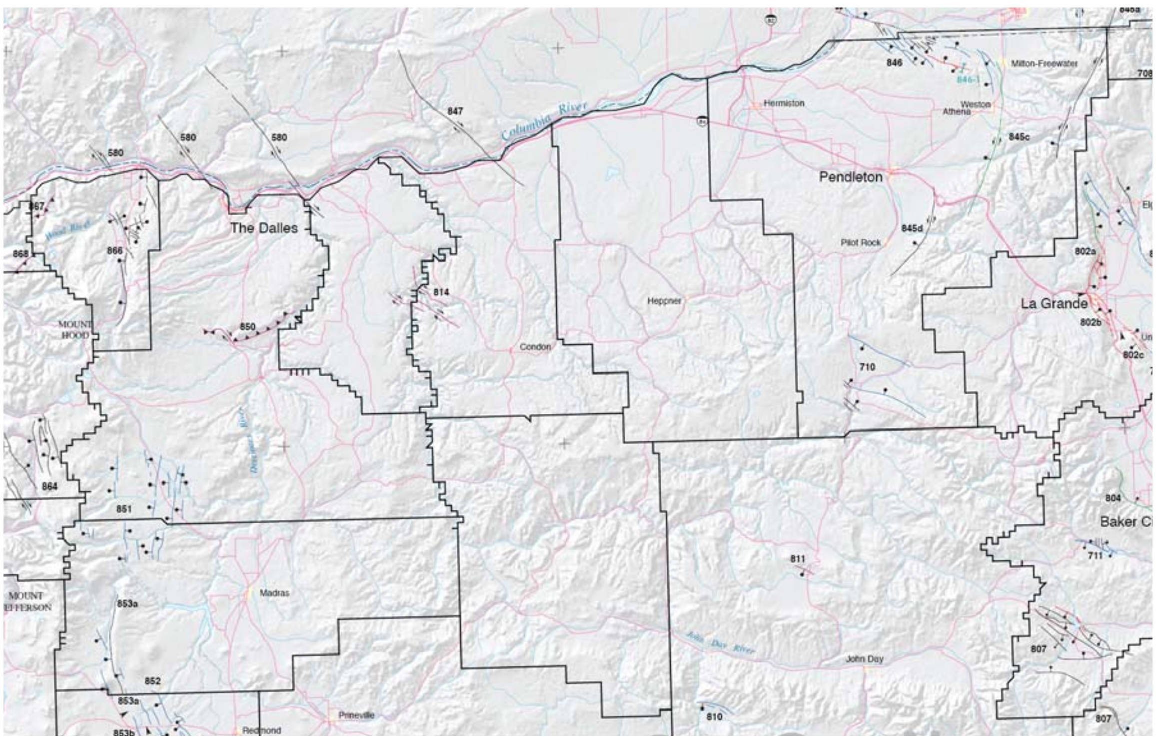


Figure ?-3. Location of the primary faults used to develop the 2500 year return ground motion maps (USGS, 2002).

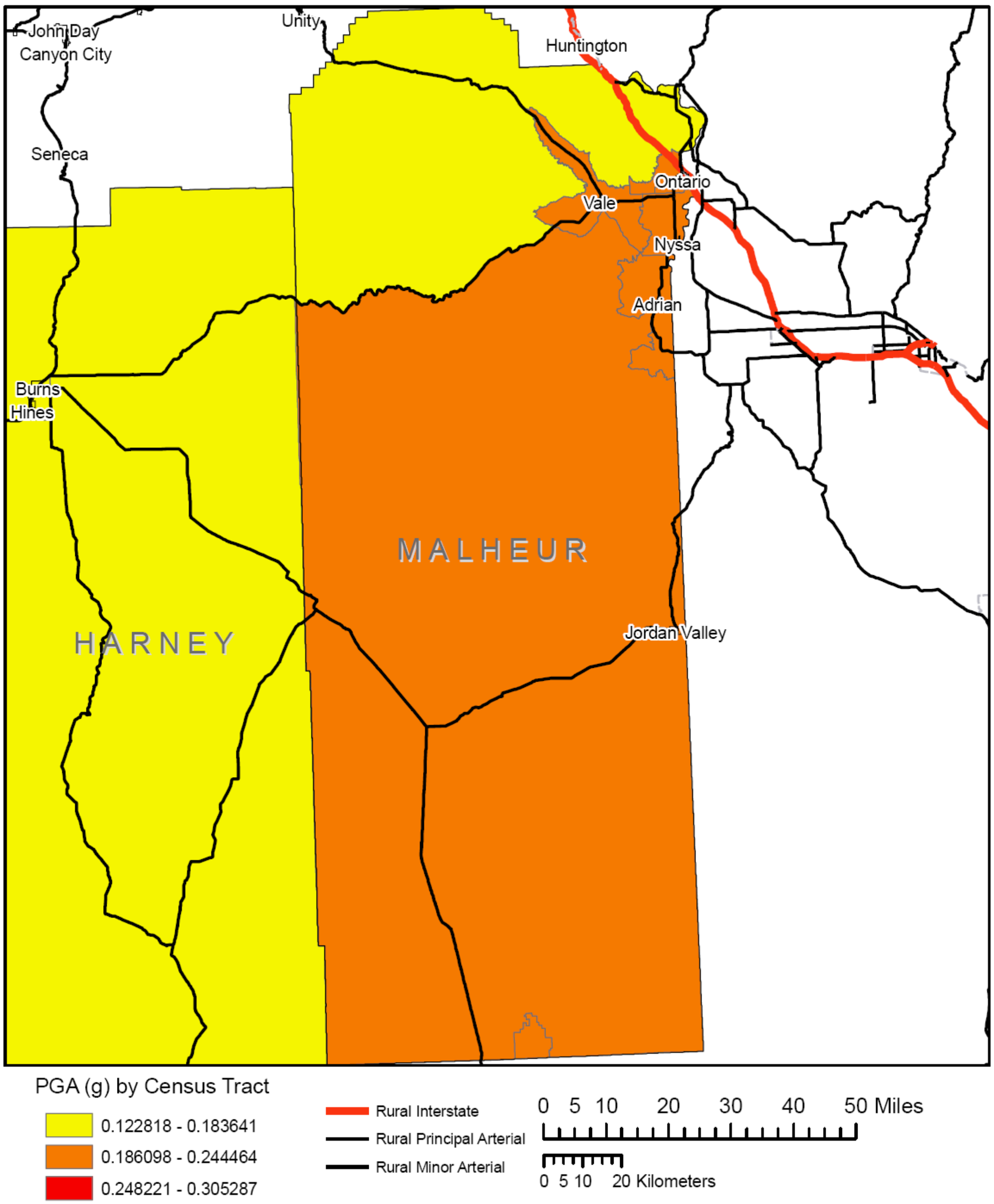


Figure ?-4. Peak ground acceleration (PGA) by census tracts map for probabilistic scenario, Malheur County, Oregon (FEMA, 2005).

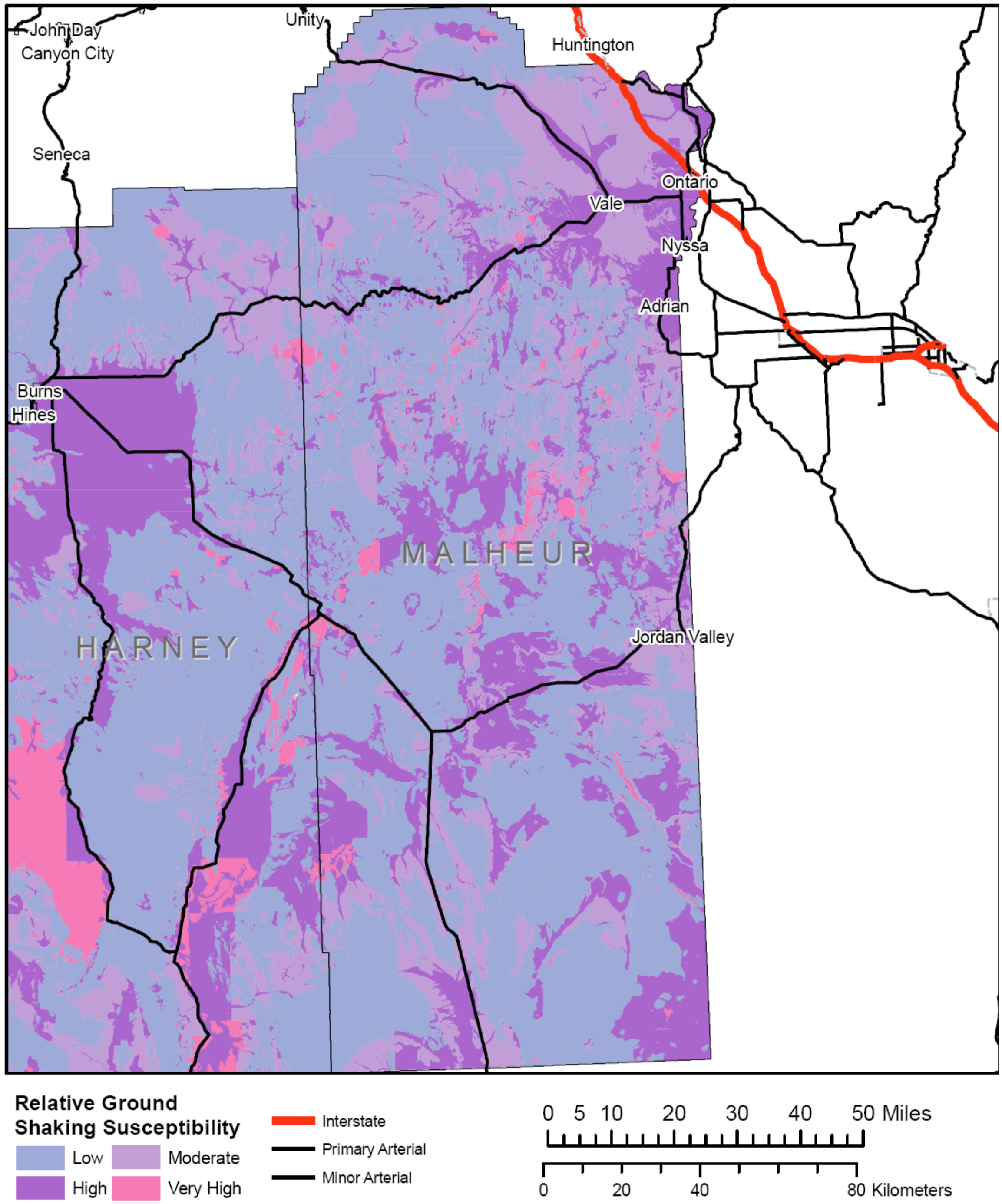


Figure ?-5. Relative ground shaking amplification susceptibility map for Malheur County, Oregon.

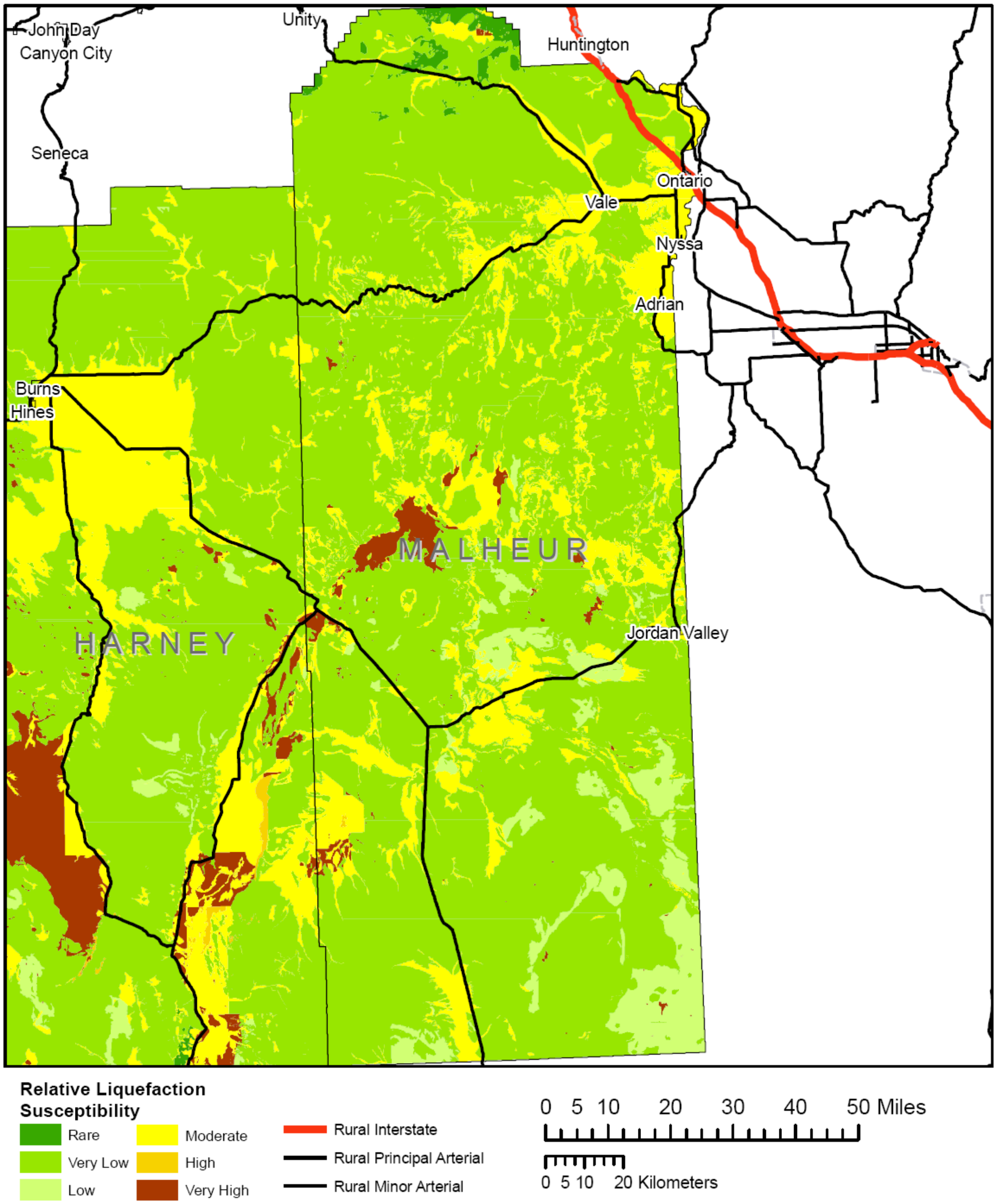


Figure ?-6. Relative liquefaction susceptibility map for Malheur County, Oregon.

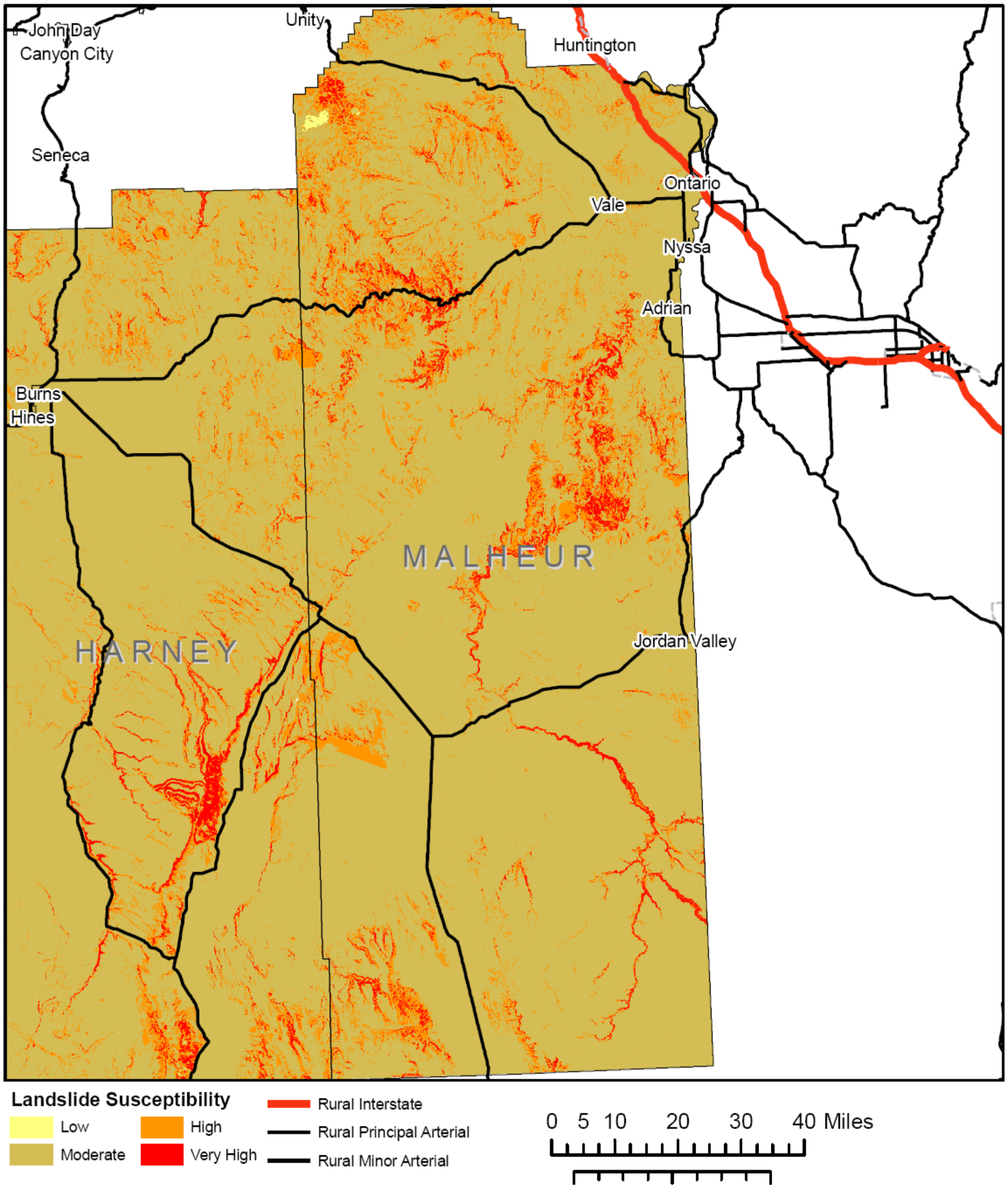


Figure ?-7. Relative earthquake induced landslide susceptibility map for Malheur County, Oregon.

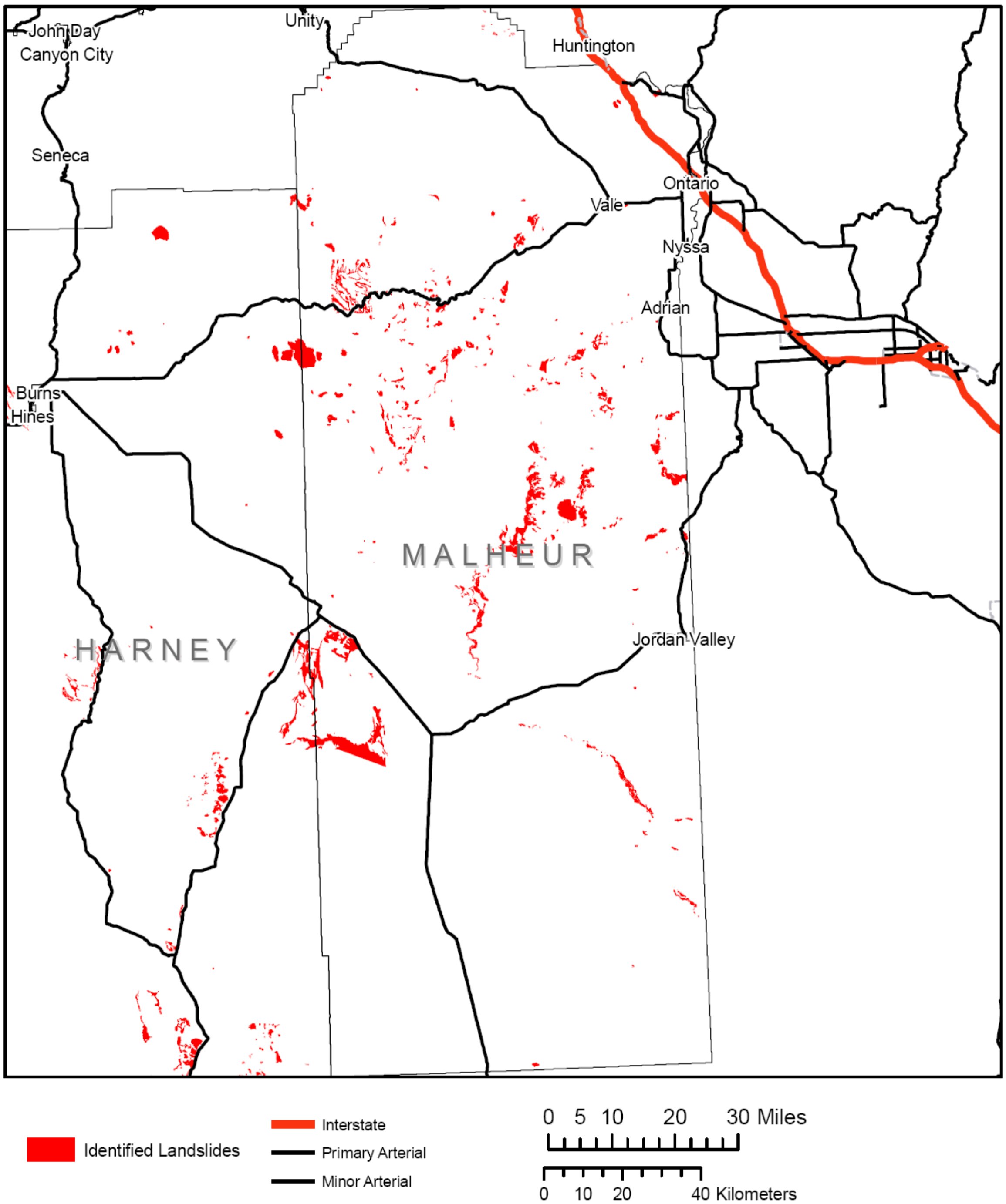


Figure ?-8. Identified landslide map for Malheur County, Oregon.

HAZUS Global Reports for Crustal and Probabilistic Scenarios

HAZUS-MH: Earthquake Event Report

Region Name: *Malheur County*

Earthquake Scenario: *Malheur Arbitrary Crustal M6.9*

Print Date: *May 30, 2007*

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Oregon

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 9,909.33 square miles and contains 9 census tracts. There are over 10 thousand households in the region and has a total population of 31,615 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 9 thousand buildings in the region with a total building replacement value (excluding contents) of 1,441 (millions of dollars). Approximately 99.00 % of the buildings (and 86.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 4,396 and 188 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

HAZUS estimates that there are 9 thousand buildings in the region which have an aggregate total replacement value of 1,441 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 77% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 74 beds. There are 25 schools, 4 fire stations, 4 police stations and 0 emergency operation facilities. With respect to HPL facilities, there are 49 dams identified within the region. Of these, 7 of the dams are classified as 'high hazard'. The inventory also includes 3 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 2 and 3.

The total value of the lifeline inventory is over 4,584.00 (millions of dollars). This inventory includes over 611 kilometers of highways, 149 bridges, 31,103 kilometers of pipes.

Table 2: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	149	1,014.80
	Segments	55	2,812.30
	Tunnels	0	0.00
		Subtotal	**3,827.20**
Railways	Bridges	0	0.00
	Facilities	2	4.90
	Segments	38	68.20
	Tunnels	0	0.00
		Subtotal	**73.10**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	1	1.20
		Subtotal	**1.20**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	12	73.90
	Runways	12	421.40
		Subtotal	**495.30**
		Total	**4,396.90**

Table 3: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	311.00
	Facilities	1	37.60
	Pipelines	0	0.00
		Subtotal	**348.70**
Waste Water	Distribution Lines	NA	186.60
	Facilities	2	150.50
	Pipelines	0	0.00
		Subtotal	**337.10**
Natural Gas	Distribution Lines	NA	124.40
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**124.40**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	0	0.00
		Subtotal	**0.00**
Communication	Facilities	1	0.10
		Subtotal	**0.10**
		Total	**810.30**

Earthquake Scenario

HAZUS uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Malheur Arbitrary Crustal M6.9
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-117.07
Latitude of Epicenter	44.07
Earthquake Magnitude	6.90
Depth (Km)	10.00
Rupture Length (Km)	35.97
Rupture Orientation (degrees)	160.00
Attenuation Function	WUS Shallow Crustal Event - Extensional

Building Damage

Building Damage

HAZUS estimates that about 4,290 buildings will be at least moderately damaged. This is over 45.00 % of the total number of buildings in the region. There are an estimated 1,187 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS technical manual. Table 4 below summaries the expected damage by general occupancy for the buildings in the region. Table 5 summaries the expected damage by general building type.

Table 4: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	3	0.09	4	0.17	12	0.56	16	1.55	23	1.97
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.01	0	0.03	0	0.04
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	490	15.31	223	10.82	448	21.48	501	49.30	533	44.91
Religion	0	0.00	0	0.00	0	0.01	0	0.02	0	0.03
Single Family	2,708	84.60	1,837	89.00	1,627	77.95	499	49.09	630	53.05
Total	**3,201**		**2,064**		**2,087**		**1,016**		**1,187**	

Table 5: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	2,718	84.93	1866	90.43	1,652	79.15	498	49.03	623	52.45
Steel	2	0.06	1	0.04	3	0.16	7	0.70	11	0.96
Concrete	4	0.13	2	0.08	5	0.24	7	0.68	9	0.74
Precast	0	0.01	0	0.01	1	0.05	2	0.21	4	0.33
RM	0	0.01	0	0.01	0	0.02	1	0.07	1	0.08
URM	20	0.61	11	0.52	20	0.97	22	2.14	37	3.12
MH	456	14.25	184	8.92	405	19.40	479	47.16	502	42.32
Total	**3,201**		**2,064**		**2,087**		**1,016**		**1,187**	

*Note:
- RM Reinforced Masonry
- URM Unreinforced Masonry
- MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 74 hospital beds available for use. On the day of the earthquake, the model estimates that only 1 hospital beds (3.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 12.00% of the beds will be back in service. By 30 days, 48.00% will be operational.

Table 6: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	1	1	0	0
Schools	25	11	0	12
EOCs	0	0	0	0
PoliceStations	4	2	0	2
FireStations	4	3	0	1

Transportation and Utility Lifeline Damage

Table 7 provides damage estimates for the transportation system.

Table 7: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	55	0	0	55	55
	Bridges	149	12	0	138	142
	Tunnels	0	0	0	0	0
Railways	Segments	38	0	0	38	38
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	2	1	0	2	2
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	12	1	0	12	12
	Runways	12	0	0	12	12

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 8-10 provide information on the damage to the utility lifeline systems. Table 8 provides damage to the utility system facilities. Table 9 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, HAZUS performs a simplified system performance analysis. Table 10 provides a summary of the system performance information.

Table 8 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	1	1	0	0	1
Waste Water	2	1	0	1	2
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	1	1	0	1	1

Table 9 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	15,552	336	234
Waste Water	9,331	266	185
Natural Gas	6,221	284	198
Oil	0	0	0

Table 10: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	10,221	94	38	2	0	0
Electric Power		2,923	1,682	649	139	4

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 2 ignitions that will burn about 0.05 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 38 people and burn about 1 (millions of dollars) of building value.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 42.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates (1,224 households to be displaced due to the earthquake. Of these, 347 people (out of a total population of 31,615 will seek temporary shelter in public shelters.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 11 provides a summary of the casualties estimated for this earthquake

Table 11: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	4	1	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	3	1	0	0
	Industrial	2	1	0	0
	Other-Residential	135	35	3	6
	Single Family	142	33	2	4
	Total	**286**	**71**	**6**	**11**
2 PM	Commercial	246	78	13	26
	Commuting	0	0	1	0
	Educational	68	22	4	7
	Hotels	1	0	0	0
	Industrial	14	4	1	1
	Other-Residential	32	8	1	2
	Single Family	36	8	1	1
	Total	**398**	**121**	**20**	**37**
5 PM	Commercial	192	61	10	20
	Commuting	5	7	12	2
	Educational	6	2	0	1
	Hotels	1	0	0	0
	Industrial	9	3	0	1
	Other-Residential	50	13	1	2
	Single Family	57	13	1	2
	Total	**320**	**99**	**25**	**28**

Economic Loss

The total economic loss estimated for the earthquake is 604.42 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 453.47 (millions of dollars); 12 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 64 % of the total loss. Table 12 below provides a summary of the losses associated with the building damage.

Table 12: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses							
	Wage	0.00	1.07	15.50	0.15	0.42	17.13
	Capital-Related	0.00	0.46	12.95	0.09	0.18	13.68
	Rental	6.67	6.75	6.39	0.04	0.20	20.05
	Relocation	0.75	0.20	0.36	0.00	0.08	1.39
	Subtotal	**7.42**	**8.48**	**35.19**	**0.28**	**0.88**	**52.25**
Capital Stock Loses							
	Structural	33.67	14.31	20.54	0.91	2.38	71.80
	Non_Structural	124.39	60.83	56.45	3.56	7.10	252.33
	Content	30.58	12.70	26.10	2.21	3.45	75.04
	Inventory	0.00	0.00	1.43	0.52	0.10	2.04
	Subtotal	**188.64**	**87.83**	**104.52**	**7.19**	**13.03**	**401.21**
	Total	**196.06**	**96.31**	**139.71**	**7.47**	**13.91**	**453.47**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages. Tables 13 & 14 provide a detailed breakdown in the expected lifeline losses.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 15 presents the results of the region for the given earthquake.

Table 13: Transportation System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	2,812.32	$15.22	0.54
	Bridges	1,014.85	$91.90	9.06
	Tunnels	0.00	$0.00	0.00
	Subtotal	**3827.20**	**107.10**	
Railways	Segments	68.21	$0.52	0.76
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	4.93	$1.31	26.58
	Subtotal	**73.10**	**1.80**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Bus	Facilities	1.23	$0.42	33.92
	Subtotal	**1.20**	**0.40**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Airport	Facilities	73.90	$4.07	5.51
	Runways	421.44	$0.70	0.17
	Subtotal	**495.30**	**4.80**	
	Total	**4396.90**	**114.10**	

Table 14: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	37.60	$8.33	22.14
	Distribution Line	311.00	$3.01	0.97
	Subtotal	**348.67**	**$11.34**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	150.50	$20.52	13.63
	Distribution Line	186.60	$2.38	1.28
	Subtotal	**337.14**	**$22.90**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Line	124.40	$2.55	2.05
	Subtotal	**124.41**	**$2.55**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Communication	Facilities	0.10	$0.03	25.66
	Subtotal	**0.11**	**$0.03**	
	Total	**810.33**	**$36.82**	

Table 15. Indirect Economic Impact with outside aid
(Employment as # of people and Income in millions of $)

	LOSS	Total	%
First Year			
	Employment Impact	0	0.00
	Income Impact	(4)	-1.99
Second Year			
	Employment Impact	0	0.00
	Income Impact	(12)	-6.06
Third Year			
	Employment Impact	0	0.00
	Income Impact	(15)	-7.80
Fourth Year			
	Employment Impact	0	0.00
	Income Impact	(15)	-7.80
Fifth Year			
	Employment Impact	0	0.00
	Income Impact	(15)	-7.80
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	(15)	-7.80

Appendix A: County Listing for the Region

Malheur,OR

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Oregon					
	Malheur	31,615	1,234	206	1,441
Total State		**31,615**	**1,234**	**206**	**1,441**
Total Region		**31,615**	**1,234**	**206**	**1,441**

HAZUS-MH: Earthquake Event Report

Region Name: *Malheur County*

Earthquake Scenario: *2500yr Probable Scenario M6.5 Driving*

Print Date: *May 30, 2007*

Table of Contents

General Description of the Region

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Oregon

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 9,909.33 square miles and contains 9 census tracts. There are over 10 thousand households in the region and has a total population of 31,615 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 9 thousand buildings in the region with a total building replacement value (excluding contents) of 1,441 (millions of dollars). Approximately 99.00 % of the buildings (and 86.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 4,396 and 188 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

HAZUS estimates that there are 9 thousand buildings in the region which have an aggregate total replacement value of 1,441 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 77% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 74 beds. There are 25 schools, 4 fire stations, 4 police stations and 0 emergency operation facilities. With respect to HPL facilities, there are 49 dams identified within the region. Of these, 7 of the dams are classified as 'high hazard'. The inventory also includes 3 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 2 and 3.

The total value of the lifeline inventory is over 4,584.00 (millions of dollars). This inventory includes over 611 kilometers of highways, 149 bridges, 31,103 kilometers of pipes.

Table 2: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	149	1,014.80
	Segments	55	2,812.30
	Tunnels	0	0.00
		Subtotal	**3,827.20**
Railways	Bridges	0	0.00
	Facilities	2	4.90
	Segments	38	68.20
	Tunnels	0	0.00
		Subtotal	**73.10**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	1	1.20
		Subtotal	**1.20**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	12	73.90
	Runways	12	421.40
		Subtotal	**495.30**
		Total	**4,396.90**

Table 3: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	311.00
	Facilities	1	37.60
	Pipelines	0	0.00
		Subtotal	**348.70**
Waste Water	Distribution Lines	NA	186.60
	Facilities	2	150.50
	Pipelines	0	0.00
		Subtotal	**337.10**
Natural Gas	Distribution Lines	NA	124.40
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**124.40**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	0	0.00
		Subtotal	**0.00**
Communication	Facilities	1	0.10
		Subtotal	**0.10**
		Total	**810.30**

Earthquake Scenario

HAZUS uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	2500yr Probable Scenario M6.5 Driving
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	2,500.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	6.50
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

HAZUS estimates that about 2,151 buildings will be at least moderately damaged. This is over 23.00 % of the total number of buildings in the region. There are an estimated 297 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS technical manual. Table 4 below summaries the expected damage by general occupancy for the buildings in the region. Table 5 summaries the expected damage by general building type.

Table 4: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	16	0.32	12	0.54	17	1.18	8	1.78	4	1.27
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.01	0	0.01	0	0.02	0	0.03	0	0.02
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	535	10.54	480	20.61	734	52.43	341	75.28	106	35.59
Religion	0	0.01	0	0.01	0	0.02	0	0.03	0	0.02
Single Family	4,525	89.13	1,835	78.84	649	46.35	104	22.88	188	63.09
Total	**5,077**		**2,327**		**1,400**		**454**		**298**	

Table 5: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	4,576	90.14	1852	79.58	645	46.07	98	21.50	187	62.79
Steel	7	0.13	4	0.17	8	0.55	4	0.95	2	0.60
Concrete	9	0.17	5	0.23	8	0.54	4	0.81	1	0.42
Precast	2	0.03	1	0.05	2	0.17	2	0.43	1	0.21
RM	1	0.02	0	0.01	1	0.05	1	0.12	0	0.05
URM	37	0.74	26	1.10	26	1.88	13	2.81	7	2.45
MH	445	8.77	439	18.85	710	50.74	333	73.38	100	33.49
Total	**5,077**		**2,327**		**1,400**		**454**		**298**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 74 hospital beds available for use. On the day of the earthquake, the model estimates that only 19 hospital beds (27.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 59.00% of the beds will be back in service. By 30 days, 91.00% will be operational.

Table 6: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	1	0	0	0
Schools	25	0	0	25
EOCs	0	0	0	0
PoliceStations	4	0	0	4
FireStations	4	0	0	4

Transportation and Utility Lifeline Damage

Table 7 provides damage estimates for the transportation system.

Table 7: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	55	0	0	55	55
	Bridges	149	0	0	149	149
	Tunnels	0	0	0	0	0
Railways	Segments	38	0	0	38	38
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	2	0	0	2	2
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	12	0	0	12	12
	Runways	12	0	0	12	12

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 8-10 provide information on the damage to the utility lifeline systems. Table 8 provides damage to the utility system facilities. Table 9 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, HAZUS performs a simplified system performance analysis. Table 10 provides a summary of the system performance information.

Table 8 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	1	0	0	1	1
Waste Water	2	0	0	1	2
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	1	0	0	1	1

Table 9 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	15,552	631	190
Waste Water	9,331	499	150
Natural Gas	6,221	533	160
Oil	0	0	0

Table 10: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	10,221	43	12	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 1 ignitions that will burn about 0.03 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 33 people and burn about 1 (millions of dollars) of building value.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 46.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates (357 households to be displaced due to the earthquake. Of these, 99 people (out of a total population of 31,615 will seek temporary shelter in public shelters.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 11 provides a summary of the casualties estimated for this earthquake

Table 11: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	1	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	1	0	0	0
	Industrial	0	0	0	0
	Other-Residential	39	8	1	1
	Single Family	44	10	1	1
	Total	**85**	**18**	**1**	**2**
2 PM	Commercial	55	15	2	4
	Commuting	0	0	0	0
	Educational	17	4	1	1
	Hotels	0	0	0	0
	Industrial	3	1	0	0
	Other-Residential	9	2	0	0
	Single Family	11	2	0	0
	Total	**95**	**25**	**4**	**7**
5 PM	Commercial	45	12	2	4
	Commuting	1	1	2	0
	Educational	1	0	0	0
	Hotels	0	0	0	0
	Industrial	2	1	0	0
	Other-Residential	14	3	0	0
	Single Family	18	4	0	0
	Total	**81**	**21**	**4**	**5**

Economic Loss

The total economic loss estimated for the earthquake is 210.09 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 143.37 (millions of dollars); 12 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 68 % of the total loss. Table 12 below provides a summary of the losses associated with the building damage.

Table 12: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses							
	Wage	0.00	0.34	5.29	0.05	0.13	5.82
	Capital-Related	0.00	0.15	4.49	0.03	0.06	4.73
	Rental	2.06	2.18	2.47	0.01	0.06	6.78
	Relocation	0.23	0.08	0.14	0.00	0.03	0.47
	Subtotal	**2.28**	**2.75**	**12.39**	**0.09**	**0.27**	**17.79**
Capital Stock Loses							
	Structural	10.65	5.17	6.54	0.29	0.84	23.49
	Non_Structural	42.25	18.64	14.22	0.83	1.80	77.75
	Content	12.29	3.76	6.41	0.51	0.88	23.84
	Inventory	0.00	0.00	0.35	0.12	0.04	0.51
	Subtotal	**65.19**	**27.57**	**27.52**	**1.74**	**3.56**	**125.58**
	Total	**67.47**	**30.31**	**39.91**	**1.84**	**3.83**	**143.37**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages. Tables 13 & 14 provide a detailed breakdown in the expected lifeline losses.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 15 presents the results of the region for the given earthquake.

Table 13: Transportation System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	2,812.32	$3.67	0.13
	Bridges	1,014.85	$30.68	3.02
	Tunnels	0.00	$0.00	0.00
	Subtotal	**3827.20**	**34.30**	
Railways	Segments	68.21	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	4.93	$0.75	15.16
	Subtotal	**73.10**	**0.70**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Bus	Facilities	1.23	$0.19	15.39
	Subtotal	**1.20**	**0.20**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Airport	Facilities	73.90	$10.99	14.87
	Runways	421.44	$0.77	0.18
	Subtotal	**495.30**	**11.80**	
	Total	**4396.90**	**47.00**	

Table 14: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	37.60	$3.00	7.98
	Distribution Line	311.00	$3.16	1.02
	Subtotal	**348.67**	**$6.16**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	150.50	$8.34	5.54
	Distribution Line	186.60	$2.50	1.34
	Subtotal	**337.14**	**$10.84**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Line	124.40	$2.67	2.15
	Subtotal	**124.41**	**$2.67**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Communication	Facilities	0.10	$0.01	7.96
	Subtotal	**0.11**	**$0.01**	
	Total	**810.33**	**$19.68**	

Table 15. Indirect Economic Impact with outside aid
(Employment as # of people and Income in millions of $)

	LOSS	Total	%
First Year			
	Employment Impact	0	0.00
	Income Impact	(1)	-0.62
Second Year			
	Employment Impact	0	0.00
	Income Impact	(4)	-1.89
Third Year			
	Employment Impact	0	0.00
	Income Impact	(5)	-2.43
Fourth Year			
	Employment Impact	0	0.00
	Income Impact	(5)	-2.43
Fifth Year			
	Employment Impact	0	0.00
	Income Impact	(5)	-2.43
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	(5)	-2.43

Appendix A: County Listing for the Region

Malheur,OR

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Oregon					
	Malheur	31,615	1,234	206	1,441
Total State		**31,615**	**1,234**	**206**	**1,441**
Total Region		**31,615**	**1,234**	**206**	**1,441**

Approval Summary

Malheur County's Multi-Jurisdictional Natural Hazards Mitigation Plan (NHMP) went through the OEM and FEMA review and approval processes as required.

The FEMA Approval Pending Adoption (APA) letter is dated June 19, 2019.

The Malheur Board of County Commissioners approved the NHMP on June 26, 2019.

The City of Ontario City Council approved the NHMP on July 3, 2019.

The City of Nyssa City Council approved the NHMP on July 9, 2019.

The City of Vale City Council approved the NHMP on July 9, 2019.

The FEMA approval letter is dated July 24, 2019. The approval letter includes the FEMA Region 10 Local Mitigation Plan Review Tool.

With the approval of this *2019 Malheur County NHMP*, the entities listed above are now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM) grant, and Flood Mitigation Assistance (FMA) grant funds, through July 23, 2024.

Copies of each of the resolutions and approval letters follow.

U.S. Department of Homeland Security
FEMA Region 10
130 – 228th Street, SW
Bothell, Washington 98021-8627

FEMA

July 24, 2019

The Honorable Dan Joyce
Judge, Malheur County Commissioners
251 B ST. West, Suite 5
Vale, Oregon 97918

Dear Judge Joyce:

On July 24, 2019, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the *Malheur County Multi-Jurisdictional Natural Hazards Mitigation Plan* as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance (HMA) grants through July 23, 2024, through your state.

Malheur County	City of Ontario	City of Nyssa
City of Vale		

The updated list of approved jurisdictions includes Malheur County and the cities of Vale, Nyssa, and Ontario which recently adopted the *Malheur County Multi-Jurisdictional Natural Hazards Mitigation Plan*. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

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

Sincerely,

Mark Carey, Director
Mitigation Division

Enclosure

JG:vl

FEMA REGION 10 LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to participating jurisdictions.

1. The Multi-Jurisdiction Summary Sheet is used to document how each jurisdiction met the requirements in the Plan.
2. The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
3. The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.

The FEMA Mitigation Planner must reference the *Local Mitigation Plan Review Guide* when completing this *Local Mitigation Plan Review Tool*.

Jurisdiction: Malheur County with the Cities of Ontario, Nyssa, and Vale	**Title of Plan:** Malheur County Multi-Jurisdiction Natural Hazards Mitigation Plan	**Date of Plan:** April 2019

Local Point of Contact: Rich Harriman, Lt.	**Address:** Malheur County Sheriff's Office 151 "B" Street Vale, Oregon 97918
Title: Emergency Services Manager	
Agency: Malheur County Sheriff's Office	
Phone Number: 541-473-5120 (desk) 541-709-7726 (cell)	**E-Mail:** rharriman@malheurco.org

State Reviewer: Joseph Murray	**Title:** Planner	**Date:** May 16, 2019

FEMA Reviewer: **Jake Grabowsky**	**Title:** Hazard Mitigation Planner	**Date:** 06/19/2019
Date Received in FEMA Region 10	05/16/2019	
Plan Not Approved		
Plan Approvable Pending Adoption	06/19/2019	
Plan Approved	07/24/2019	

SECTION 1: MULTI-JURISDICTION SUMMARY SHEET (used only for multi-jurisdictional plans)

INSTRUCTIONS: The Multi-Jurisdiction Summary Spreadsheet is completed by listing each participating jurisdiction and which required Elements for each jurisdiction were 'Met' or 'Not Met,' and when the adoption resolutions were received. This Summary Sheet does not imply that a mini-plan be developed for each jurisdiction; it is used to ensure that each jurisdiction participating in the Plan has been documented and has met the requirements for those Elements (A through E).

MULTI-JURISDICTION SUMMARY SHEET (Add additional pages if necessary)

#	Jurisdiction Name	Jurisdiction Type (city, district, etc.)	POC	Required Revisions / Comments	Requirements Met (Y/N)					
					A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption	F. State Require-ments
1	Malheur County	county	Tricia Sears, DLCD, 503-934-0031 and tricia.sears@state.or.us; Rich Harriman, Malheur County		Y	Y	Y	Y	Y	n/a
2	City of Ontario	city	Adam Brown, City Manager 541-881-3223 and adam.brown@ontariooregon.org		Y	Y	Y	Y	Y	n/a
3	City of Nyssa	city	Jim Maret, City Manager 541-212-2863 (cell) and jmaret@nyssacity.org		Y	Y	Y	Y	Y	n/a
4	City of Vale	city	Katy Lamb, City Manager 541-473-3133 and klamb@cityofvale.com & Mike McLaughlin, Mayor 503-319-1097 and valemayor@fmtc.com		Y	Y	Y	Y	Y	n/a
7										
8										
9										

SECTION 2: REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist is completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element is completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions are explained for each plan sub-element that is 'Not Met.' Sub-elements are referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable.

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Executive Summary, see 1-6 Introduction, see I to iii Appendix B, see pages B-1 to B-12	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Introduction, see 1-3, 1-4, 1-6 Appendix B, see B-13 to B-69	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Introduction, see 1-3, 1-4 Appendix B, see B-13 to B-69	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Executive Summary, see ii-iii Mitigation Strategy, see page 3-3 Implementation and Maintenance, see 4-3 to 4-4 and Table 4-1 Appendix C, see page C-46 to C-50 and Table C-24	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Executive Summary, see vi Implementation and Maintenance, see 4-1, 4-2, 4-5 to 4-8 Appendix B, see B-5	X	

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Executive Summary, see ii, iii, vi Implementation and Maintenance, see 4-5 to 4-8 Appendix B, see B-5	X	
ELEMENT A: REQUIRED REVISIONS			
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Risk Assessment includes a summary of each hazard, see 2-1 to 2-35 Hazard Annexes contain a more detailed analysis of each natural hazard, see each annex.	X	
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Risk Assessment includes a summary of each hazard, see 2-1 to 2-35 Hazard Annexes contain a more detailed analysis of each natural hazard, see each annex.	X	

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Risk Assessment includes a summary of each hazard, see 2-1 to 2-35 Hazard Annexes contain a more detailed analysis of each natural hazard, see each annex.	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Risk Assessment, see 2-28 Flood Annex, see FL-11 to FL-12 and Table FL-2	X	
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Implementation and Maintenance, see 4-3 to 4-4 and Table 4-1 Appendix C, see C-46 to C-50 and Table C-24	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Risk Assessment, see 2-28 Flood Annex, see FL-11 to FL-12 and Table FL-2	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Executive Summary, see v Mitigation Strategy, see 3-1 to 3-2	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Mitigation Strategy, see 3-9 to 3-26 status of prior mitigation actions, Table 3-2 and 3-27 to 3-36 Table 3 3-2 mitigation actions for 2019	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Mitigation Strategy, see 3-3 to 3-8 Appendix D, see D1-to D8	X	

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	**Mitigation Strategy, see 3-3 to 3-8**	X	
<u>ELEMENT C: REQUIRED REVISIONS</u>			
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Risk Assessment, see each brief description of the natural hazard. Hazard Annexes, see each hazard for a detailed description of the hazard including changes in development. The Risk Assessment, Hazard Annexes, and Appendix F all have climate change information.	X	
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Mitigation Strategy, see 3-9 to 3-26 status of prior mitigation actions,	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Mitigation Strategy, see Table 3-2 and 3-27 to 3-36 Table 3 3-2 mitigation actions for 2019 Appendix A, see all pages for the details on the mitigation actions Appendix B, see B-2 to B-6 for a summary of changes to the NHMP Appendix G includes success stories	X	

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))		Y	
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))		Y	
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			

SECTION 3: PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Plan Strengths

- Regional and state officials from Idaho were included.

Opportunities for Improvement

- Several of the hazards that affect Malheur County cross county lines. For the next update, please consider inviting the surrounding counties to comment and be involved in the planning process.

Element B: Hazard Identification and Risk Assessment

Plan Strengths

- Climate change is effectively included throughout the plan for each hazard.
- Included the incorporation of specific comments made at a public meeting.

Opportunities for Improvement

- Using maps more often throughout the Risk Assessment would help provide context for location.
- The extent and location of some hazards could have been better, particularly the hazards lumped together under severe weather.
-

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

Plan Strengths

- Success stories were a great addition to the plan!
- Table 3-2 detailing the status of the 2014 plan mitigation actions was very well done.

RESOLUTION

BEFORE THE COUNTY COURT

FOR MALHEUR COUNTY

Recognizing and adopting)
the updated Natural Hazards) **R19-17**
Mitigation Plan)

RESOLUTION

NOW ON THIS DAY, the 26th day of June, 2019 the above-entitled matter having come to the County Court on a regularly scheduled session for consideration; and

WHEREAS, the County of Malheur 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, for the last year and a half, the Malheur County Local Emergency Planning Committee (formerly the Emergency Management Team) has worked with the Oregon Department of Land Conservation and Development (DLCD) in updating the *Malheur County Multi-Jurisdictional Natural Hazards Mitigation Plan.* This plan, last updated in 2014, has established a comprehensive, coordinated planning process to eliminate or minimize these vulnerabilities; and

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

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

WHEREAS, the Oregon Military Department's Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *Malheur County, Multi-Jurisdictional Natural Hazards Mitigation Plan* and pre-approved it (dated: June 19, 2019) contingent upon this official adoption of the participating governments and entities;

WHEREAS, the NHMP is comprised of four volumes: Volume I - Basic Mitigation Plan, Volume II – Hazard Annexes, Volume III – City/Special District Addendums, and Volume IV – Mitigation Resources, collectively referred to herein as the NHMP; and

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

WHEREAS, Malheur County adopts the NHMP and directs the Staff to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.

NOW, THEREFORE, BE IT RESOLVED, that Malheur County adopts *the Malheur County Multi-Jurisdictional Natural Hazards Mitigation Plan* as an official plan; and

BE IT FURTHER RESOLVED, that Malheur County will submit this Adoption Resolution to the Oregon Military Department's Office of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the *Malheur County Multi-Jurisdictional Natural Hazards Mitigation Plan*.

DATED this 26Th day of June, 2019.

MALHEUR COUNTY COURT

Dan P. Joyce

County Judge Dan Joyce

Commissioner Don Hodge

Larry Wilson

Commissioner Larry Wilson

RESOLUTION # 2019-125

A RESOLUTION ADOPTING THE CITY OF ONTARIO'S REPRESENTATION IN THE UPDATES TO THE MALHEUR COUNTY MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN

Whereas, The City of Ontario 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 Ontario has fully participated in the FEMA prescribed mitigation planning process to prepare the *Malheur 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 Ontario has identified natural hazard risks and prioritized several proposed actions and programs needed to mitigate the vulnerabilities of the City of Ontario to the impacts of future disasters within the *Malheur County Multi-Jurisdictional Natural Hazard Mitigation Plan*; and

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

Whereas, The Oregon Military Department's Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *Malheur County, Multi-Jurisdictional Natural Hazards Mitigation Plan* and pre-approved it (dated: March 20, 2019) contingent upon this official adoption of the participating governments and entities;

Whereas, The NHMP is comprised of four volumes: Volume I - Basic Mitigation Plan, Volume II – Hazard Annexes, Volume III – City/Special District Addendums, and Volume IV – Mitigation Resources, collectively referred to herein as the NHMP; and

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

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

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

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

EFFECTIVE DATE: Immediately upon passage.

PASSED AND ADOPTED by the Ontario City Council this 3rd day of July, 2019, by the following vote:

AYES: CAPRON, RODRIGUEZ, HILL, JUSTUS, BRADEN

NAYS: NONE

EXCUSED: CRUME, PALOMO

ABSENT: NONE

APPROVED by the Mayor this 3rd day of July, 2019.

ATTEST:

Riley J. Hill, Mayor

Tori Barnett, MMC, City Recorder

RESOLUTION

NATURAL HAZARD MITIGATION 1320-19

A RESOLUTION OF THE CITY OF NYSSA, MALHEUR COUNTY, OREGON, IN THE MATTER OF ADOPTING THE CITY OF NYSSA'S REPRESENTATION IN THE UPDATES TO THE MALHEUR COUNTY MULTI-JURISDICTIONAL NATURAL HAZARD'S MITIGATION PLAN

WHEREAS, the City of Nyssa recognizes the threat that natural hazards pose to people, property and infrastructure within our City; 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 Nyssa has fully participated in the FEMA prescribed mitigation planning process to prepare the Malheur County Natural Hazards Mitigation Plan, which has established a comprehensive, coordinated planning process to eliminate or minimize these vulnerabilities; and

WHEREAS, Malheur County has identified natural hazard risks and prioritized several proposed actions and programs need to mitigate the vulnerabilities of Malheur County to the impacts of future disasters within the Malheur County Multi-Jurisdictional Natural Hazard Mitigation Plan; and

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

WHEREAS, the Oregon Military Department's Office of Emergency Management and Federal Emergency Management Agency, Region 10 officials have reviewed the Malheur County, Multi-Jurisdictional Natural Hazards Mitigation Plan and pre-approved it (dated March 20, 2019) contingent upon this official adoption of the participating governments and entities; and

WHEREAS, the NHMP is comprised of four volumes: Volume I- Basic Mitigation Plan; Volume II – Hazard Annexes, Volume III – City/Special District Addendums, and Volume IV – Mitigation Resources, collectively referred to herein as the NHMP; and

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

NOW, THEREFORE, BE IT RESOLVED, that the City of Nyssa adopts the Malheur County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan; and directs staff to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.

BE IT FURTHER RESOLVED, that the City of Nyssa will submit this Adoption Resolution to the Oregon Military Department's Office of Emergency Management and Federal Emergency Management Agency, Region 10 officials to enable final approval of the Malheur County Multijurisdictional Natural Hazards Mitigation.

Passed and approved this 9th Day of July, 2019

AYES: 5 Sue Walker, Betty Holcomb, Robert DeLeon, Patricia Esplin, Morganne DeLeon
NAYS: 0
ABSENT: Mayor Pat Oliver, Dennis Savage

Sue Walker

Sue Walker, Council President

Attest:

Marla Roberts

Marla Roberts, City Recorder

I hereby certify that the foregoing resolution was passed and approved by the City Council of the City of Nyssa at a regular or special meeting of said Council held on the 9th Day of July, 2019, and the above copy is a true and correct copy of the original and of the whole thereof.

DATED this 9th Day of July, 2019.

Marla Roberts

Marla Roberts, City Recorder

Resolution # 19-08

A Resolution Adopting the City of Vale's Representation in the Updates to the Malheur County Multi-Jurisdictional Natural Hazards Mitigation Plan

Whereas, the City of Vale 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 Vale has fully participated in the FEMA prescribed mitigation planning process to prepare the *Malheur 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 Vale has identified natural hazard risks and prioritized several proposed actions and programs needed to mitigate the vulnerabilities of the City of Vale to the impacts of future disasters within the *Malheur County Multi-Jurisdictional Natural Hazard Mitigation Plan*; and

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

Whereas, the Oregon Military Department's Office of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the *Malheur County, Multi-Jurisdictional Natural Hazards Mitigation Plan* and pre-approved it (dated: June 19, 2019) contingent upon this official adoption of the participating governments and entities;

Whereas, the NHMP is comprised of four volumes: Volume I - Basic Mitigation Plan, Volume II – Hazard Annexes, Volume III – City/Special District Addendums, and Volume IV – Mitigation Resources, collectively referred to herein as the NHMP; and

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

Whereas, City of Vale adopts the NHMP and directs the [City Manager,] to develop, approve, and implement the mitigation strategies and any administrative changes to the NHMP.

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

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

Adopted this 9th day of July, 2019

Mike McLaughlin – City Mayor

U.S. Department of Homeland Security
FEMA Region 10
130 – 228th Street, SW
Bothell, Washington 98021

FEMA

June 19, 2019

Mr. Joseph Murray
State Hazard Mitigation Planner
Oregon Military Department
Office of Emergency Management
P.O. Box 14370
Salem, Oregon 97309

Dear Mr. Murray:

The Federal Emergency Management Agency (FEMA) Region 10 completed a pre-adoption review of the draft *Malheur County Hazard Mitigation Plan*. The attached Mitigation Plan Review Tool documents the Region's review and compliance with all required elements of 44 CFR Part 201.6, as well as identifies the jurisdictions participating in the planning process. This letter serves as Region 10's commitment to approve the plan upon receiving documentation of its adoption by participating jurisdictions.

Formal adoption documentation must be submitted to FEMA Region 10 by at least one jurisdiction within one calendar year of the date of this letter, or the entire plan must be updated and resubmitted for review. Once FEMA approves the plan, the jurisdictions are eligible to apply for FEMA Hazard Mitigation Assistance grants.

Please contact Jake Grabowsky, Oregon FIT Hazard Mitigation Community Planner, at (202) 856-1901 or james.grabowsky@fema.dhs.gov with any questions.

Sincerely,

X

Tamra Biasco
Chief, Risk Analysis Branch
Mitigation Division

JG