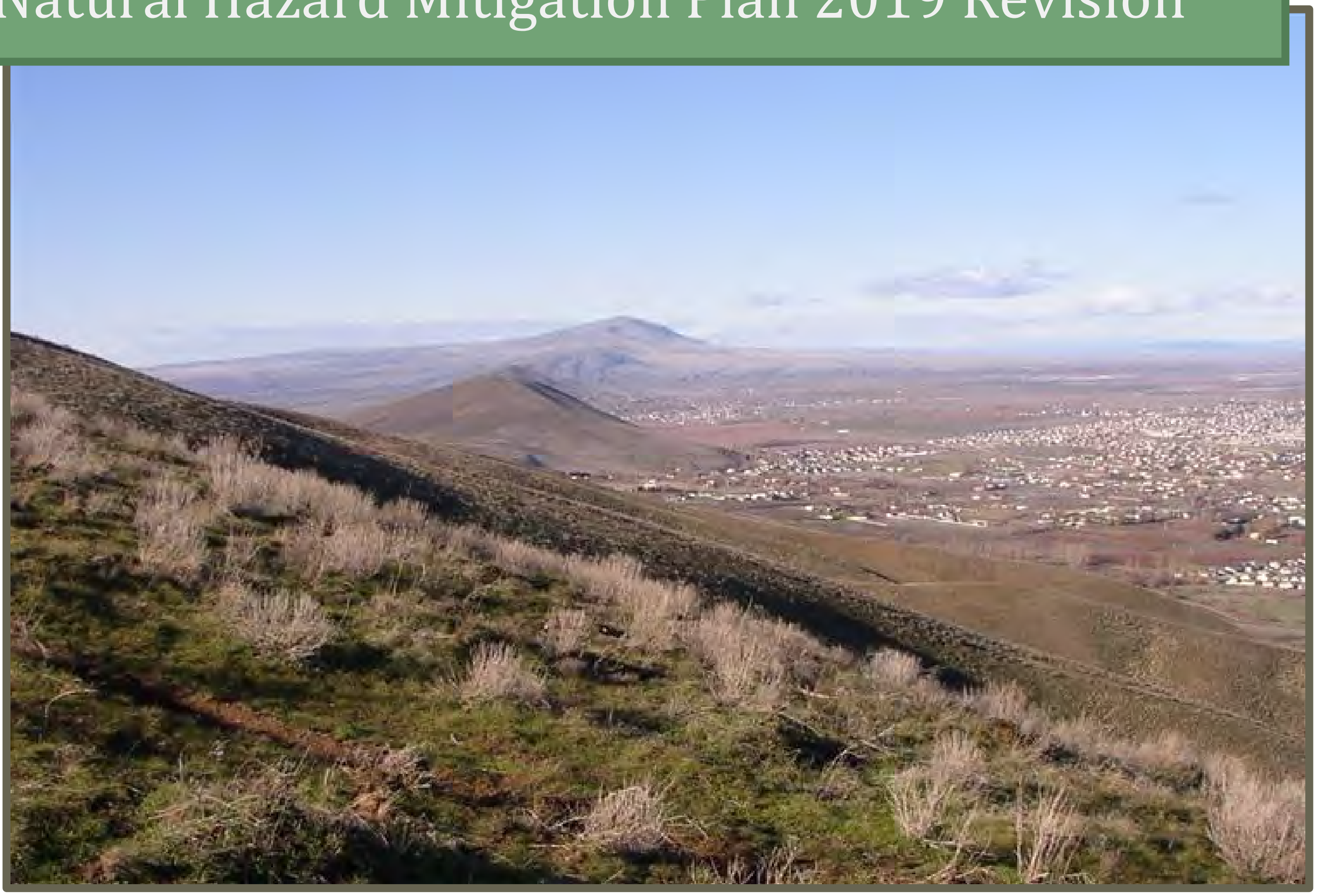
Benton County, Washington

Natural Hazard Mitigation Plan 2019 Revision



Benton County Emergency Management

651 Truman Avenue

Richland, WA 99352

(509) 628-2600

Prepared By

Northwest Management, Inc.

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Foreword

Benton County Emergency Services is dedicated to the protection of life, property, economic and environmental resources throughout Benton County. Seeking to inform and educate citizens, provide training and resource coordination and ultimately reduce the vulnerability of Benton County citizens through comprehensive disaster planning and mitigation.

"Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Mitigation activities may be implemented prior to, during, or after an incident…however, it has been demonstrated that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs."[1]

The **Benton County, Washington Hazard Mitigation Plan** was updated in 2017-19 by the Benton County NHMP planning committee in cooperation with Northwest Management, Inc. of Moscow, Idaho.

This plan satisfies the requirements for a local natural hazard mitigation plan under 44 CFR Part 201.6, in addition this plan fully integrated the processes of FEMA's Natural Hazard Mitigation Plan with the Community Wildfire Protection Plan as outlined in the Healthy Forest Restoration Act. Full integration was accomplished through the creation of a single committee that through a collaborative process provided oversight and expertise to the entire planning process.

[1] Federal Emergency Management Agency. "Local Multi-Hazard Mitigation Planning Guidance." July 1, 2008

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This is to certify that the City of Richland (Community Identification Number 535533) participates in the NFIP and is a member in good standing in that program. Richland established eligibility in the Regular Phase of the NFIP on March 31, 1970. A Community Assistance Visit (CAV) was conducted by Ecology on August 20, 2010 and was closed on August 25, 2010.

This is to certify that the City of West Richland (Community Identification Number 530014) participates in the NFIP and is a member in good standing in that program. West Richland established eligibility in the Regular Phase of the NFIP on September 30, 1981. A Community Assistance Visit (CAV) was conducted by Ecology on July 29, 2008 and was closed on August 4, 2008.

If you have any questions, please feel free to contact me at (509) 457-7139 or matt.gerlach@ecy.wa.gov.

Sincerely,

Matt Gerlach
Central Washington NFIP Coordinator

ec: Suzanne Sarpong, FEMA
Dave Radabaugh, Ecology

Approval Letter from FEMA

U.S. Department of Homeland Security
FEMA Region 10
130 – 228th Street, SW
Bothell, Washington 98021

FEMA

November 19, 2019

The Honorable Shon Small
Chair, Benton County Board of Commissioners
620 Market Street
Prosser, Washington 99350

Dear Chair Small:

On November 19, 2019, the United States Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the Benton County Natural Hazard Mitigation Plan as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance (HMA) grants projects through November 18, 2024, through your state:

City of Prosser	City of Benton City	City of Richland
City of Kennewick	Benton County	City of West Richland

FEMA individually evaluates all application requests for funding according to the specific eligibility requirements of the applicable program. Though a specific mitigation activity or project identified in the plan may meet the eligibility requirements, it may not automatically receive approval for FEMA funding under any of the aforementioned programs.

Approved mitigation plans may be eligible for points under the National Flood Insurance Program's Community Rating System (CRS). For additional information regarding the CRS, please visit: www.fema.gov/national-flood-insurance-program-community-rating-system or contact your local floodplain manager. Over the next five years, we encourage your communities to follow the plan's schedule for monitoring and updating, and to develop further mitigation actions. 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 Kevin Zerbe, State Mitigation Strategist with Washington Emergency Management Division, at (253) 512-7467, who coordinates and administers these efforts for local entities.

Sincerely,

Mark Carey, Director
Mitigation Division

cc: Tim Cook, Washington Emergency Management Division

Enclosure

JS:vl

www.fema.gov

Adoption Resolutions

RESOLUTION 2019 547

BEFORE THE BOARD OF COMMISSIONERS BENTON COUNTY, WASHINGTON:

IN THE MATTER OF COUNTY PLANNING RELATING TO THE ADOPTION OF THE BENTON COUNTY NATURAL HAZARD MITIGATION PLAN

A resolution of the Benton County Board of Commissioners declaring support and adoption of the Benton County Natural Hazard Mitigation Plan.

WHEREAS, Benton County Board of Commissioners realizes the importance of reducing or eliminating those vulnerabilities for the overall good and welfare of the community; and

WHEREAS, Benton County has been as active participant in the preparation and development of the Benton County Natural Hazard Mitigation Plan which has addressed hazards and risks within the county; and

WHEREAS, The Benton County Natural Hazard Mitigation Plan has been reviewed by the Washington Emergency Management Division and the Federal Emergency Management Agency (FEMA); and

WHEREAS, FEMA has issued a letter of commitment to approve the plan upon receiving documentation of the Benton County Natural Hazard Mitigation Plan adoption by Benton County and incorporated communities; and

WHEREAS, The Benton County Natural Hazard Mitigation Plan will be utilized as guidance related to planning and project proposals, eligibility for mitigation project grants once FEMA approves the plan and other purposes as deemed prudent and appropriate by the adopting communities and

BE IT RESOLVED that the Benton County Board of County Commissioners do hereby adopt, support, and will facilitate the Benton County Natural Hazard Mitigation Plan's implementation, as deemed appropriate.

Dated this 23 day of July 2019

Chairman of the Board

Member

Member

Constituting the Board of County Commissioners of Benton County Washington

Attest

Clerk of the Board

RESOLUTION NO. 106-19

A RESOLUTION of the City of Richland adopting the Benton County Natural Hazard Mitigation Plan.

WHEREAS, a Hazard Mitigation Plan (HMP) is created to protect the health, safety and economic interests of residents by reducing the impacts of natural hazards through mitigation planning, awareness and implementation of mitigation alternatives; and

WHEREAS, the Disaster Mitigation Act of 2000 requires the development of a Hazard Mitigation Plan as a condition of receiving mitigation funds should a disaster occur; and

WHEREAS, Benton County Emergency Services (BCES) has developed the Benton County Natural Hazard Mitigation Plan; and

WHEREAS, once adopted by Richland, the Benton County Natural Hazard Mitigation Plan will be utilized as guidance for city mitigation planning, as related to mitigation projects and other purposes, as deemed appropriate by City Council; and

WHEREAS, the City intends to consider and incorporate applicable Benton County Natural Hazard Mitigation Plan community risk assessments and mitigation strategies to address hazard conditions as new policies, plans and projects are evaluated; and

WHEREAS, City Council has participated in the development of and supports the Benton County Natural Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Richland that the Benton County Natural Hazard Mitigation Plan is hereby adopted.

BE IT FURTHER RESOLVED that this resolution shall take effect immediately.

ADOPTED by the City Council of the City of Richland, Washington, at a regular meeting on the 20th day of August, 2019.

ROBERT J. THOMPSON
Mayor

ATTEST:

Debby Barham
DEBBY BARHAM, Deputy City Clerk

APPROVED AS TO FORM:

Heather Kintzley
HEATHER KINTZLEY, City Attorney

Adopted 08/20/2019

Resolution No. 106-19

CITY OF KENNEWICK
RESOLUTION NO. 19-23

A RESOLUTION DECLARING SUPPORT FOR AND ADOPTION OF THE BENTON COUNTY NATURAL HAZARD MITIGATION PLAN

WHEREAS, the City Council of Kennewick supports the Benton County Multi-Hazard Mitigation Plan; and

WHEREAS, the City of Kennewick has participated in the development of the Benton County Multi-Hazard Mitigation Plan; and

WHEREAS, the Benton County Natural Hazard Mitigation Plan will be utilized as guidance for city mitigation planning, as related to mitigation projects and other purposes, as deemed appropriate by the City Council of Kennewick; and

WHEREAS, the City of Kennewick intends to consider and incorporate applicable Benton County Natural Hazard Mitigation Plan community risk assessments and mitigation strategies to address hazard conditions, as new policies, plans and projects are evaluated; NOW, THEREFORE,

BE IT HEREBY RESOLVED BY THE CITY COUNCIL OF THE CITY OF KENNEWICK, WASHINGTON that the City Council of Kennewick does hereby adopt, support and will facilitate the Benton County Natural Hazard Mitigation Plan's implementation, as deemed appropriate.

PASSED BY THE CITY COUNCIL OF THE CITY OF KENNEWICK, WASHINGTON, this 15th day of October, 2019, and signed in authentication of its passage this 15th day of October, 2019.

Don Britain

DON BRITAIN, Mayor

Attest:

Terri L. Wright

TERRI L. WRIGHT, City Clerk

RESOLUTION NO. 19-23 filed and recorded in the office of the City Clerk of the City of Kennewick, Washington, this 16th day of October, 2019.

Approved as to Form:

Lisa Beaton

LISA BEATON, City Attorney

Terri L. Wright

TERRI L. WRIGHT, City Clerk

RESOLUTION 19-23 - Page 1

CITY OF WEST RICHLAND
RESOLUTION NO. 25-19

A RESOLUTION OF THE CITY OF WEST RICHLAND, WASHINGTON, DECLARING SUPPORT FOR AND ADOPTION OF THE BENTON COUNTY NATURAL HAZARD MITIGATION PLAN

WHEREAS, The City Council of West Richland supports the Benton County Multi-Hazard Mitigation Plan; and

WHEREAS, West Richland City Staff has participated in the development of the Benton County Multi-Hazard Mitigation Plan; and

WHEREAS, The Benton County Natural Hazard Mitigation Plan will be utilized as guidance for city mitigation planning, as related to mitigation projects and other purposes, as deemed appropriate by the City Council of West Richland; and

WHEREAS, The City of West Richland intends to consider and incorporate applicable Benton County Natural Hazard Mitigation Plan community risk assessments and mitigation strategies to address hazard conditions, as new policies, plans and projects are evaluated;

NOW THEREFORE, be it resolved that the City Council of West Richland does hereby adopt, support and will facilitate the Benton County Natural Hazard Mitigation Plan's implementation, as deemed appropriate.

Pursuant to law, one copy of this resolution shall be maintained in the office of the West Richland City Clerk, available for public inspection upon request.

PASSED BY THE CITY COUNCIL OF THE CITY OF WEST RICHLAND, WASHINGTON, at a regular meeting thereof held this 30th day of July, 2019.

Brent Gerry, Mayor

ATTEST:

Julie Richardson

Julie Richardson, City Clerk

APPROVED AS TO FORM:

Bronson Brown, City Attorney

RESOLUTION NO. 2019-23

A RESOLUTION OF THE CITY OF BENTON CITY, WASHINGTON DECLARING SUPPORT FOR AND ADOPTION OF THE BENTON COUNTY NATURAL HAZARD MITIGATION PLAN

WHEREAS, The City Council of Benton City supports the Benton County Multi-Hazard Mitigation Plan, and

WHEREAS, The City Council of Benton City has participated in the development of the Benton County Multi-Hazard Mitigation Plan, and

WHEREAS, The Benton County Natural Hazard Mitigation Plan will be utilized as guidance for city mitigation planning, as related to mitigation projects and other purposes, as deemed appropriate by the City Council of Benton City, and

WHEREAS, The City of Benton City intends to consider and incorporate applicable Benton County Natural Hazard Mitigation Plan community risk assessments and mitigation strategies to address hazard conditions, as new policies, plans and projects are evaluated. NOW THEREFORE,

THE CITY COUNCIL OF THE CITY OF BENTON CITY, WASHINGTON, hereby resolves as follows:

That the City Council of Benton City does hereby adopt, support and will facilitate the Benton County Natural Hazard Mitigation Plan's implementation, as deemed appropriate

ADOPTED this 20 day of August, 2019, by the City Council of the City of Benton City, Washington, and signed in authentication of its passage this 20 day of August, 2019.

Resolution 2019-23 filed and recorded in the office of the City Clerk of the City of Benton City, Washington, this 20 day of August, 2019.

L. Lehman

Linda Lehman,
Mayor

Attest:

Stephanie Haug

Stephanie Haug, MMC
City Clerk/Treasurer

Approved as to Form:

Kerr Ferguson Law, PLLC
City Attorney

CITY OF PROSSER, WASHINGTON
RESOLUTION NO. 19-1616

A RESOLUTION OF THE CITY OF PROSSER ADOPTING THE BENTON COUNTY NATURAL HAZARD MITIGATION PLAN.

WHEREAS, a Hazard Mitigation Plan (HMP) is created to protect the health, safety and economic interests of residents by reducing the impacts of natural hazards through mitigation planning, awareness and implementation of mitigation alternatives; and

WHEREAS, the Disaster Mitigation Act of 2000 requires the development of a Hazard Mitigation Plan as a condition of receiving mitigation funds should a disaster occur; and

WHEREAS, Benton County Emergency Services (BCES) has developed the Benton County Natural Hazard Mitigation Plan; and

WHEREAS, once adopted by Prosser, the Benton County Natural Hazard Mitigation Plan will be utilized as guidance for city mitigation planning, as related to mitigation projects and other purposes, as deemed appropriate by City Council; and

WHEREAS, the City intends to consider and incorporate applicable Benton County Natural Hazard Mitigation Plan community risk assessments and mitigation strategies to address hazard conditions as new policies, plans and projects are evaluated; and

WHEREAS, City Council has participated in the development of and supports the Benton County Natural Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Prosser that the Benton County Natural Hazard Mitigation Plan is hereby adopted.

BE IT FURTHER RESOLVED that this resolution shall take effect immediately.

ADOPTED by the City Council of the City of Prosser and **APPROVED** by the Mayor of the City of Prosser this 13th day of August, 2019.

MAYOR RANDY TAYLOR

ATTEST:

RACHEL SHAW, CITY CLERK

CITY OF PROSSER, WASHINGTON
Incorporated 1899
Official Seal

Chapter 1: Plan Overview

Overview of this Plan and its Development

This county Hazard Mitigation Plan is the result of analyses, professional cooperation and collaboration, assessments of hazard risks and other factors considered with the intent to reduce the potential for hazards that threaten people, structures, and infrastructure within Benton County, Washington. The Benton County Hazard Mitigation Plan (Hazard Mitigation Plan) was originally approved by Washington Military Department, Emergency Management Division (EMD) and the Federal Emergency Management Agency (FEMA) in 2004. This document serves as an update of the Hazard Mitigation Plan under the Pre-Disaster Mitigation program and will be in effect until 2024. This update will also include the County's Community Wildfire Protection Plan update as a component within the main document. This document assists with the identification and assessment of various potential hazards and helps maintain the County's eligibility for grants and other funding.

The planning team responsible for implementing this project was led by Benton County Emergency Management with assistance from Northwest Management, Inc. Agencies and organizations that participated in the planning process included:

- Benton City
- Benton County
- Benton County Fire District #1
- Benton County Fire District #2
- Benton County Fire District #4
- Benton County Fire District #5
- Benton County Fire District #6
- Bureau of Land Management
- City of Kennewick
- City of Prosser
- City of Richland
- City of West Richland
- Irrigation Districts
- Kennewick Fire Departments
- Port of Benton
- Richland Fire & Emergency Services
- U.S. Fish and Wildlife Services
- West Benton Regional Fire Authority

Planning Philosophy and Goals

Benton County Planning Philosophy

This effort will utilize the best and most appropriate science from all partners and will integrate local and regional knowledge about hazards while meeting the needs of local citizens and the regional economy.

Mission Statement

To make Benton County residents, communities, state agencies, local governments, and businesses less vulnerable to the effects of hazards through the effective administration of hazard mitigation grant programs, hazard risk assessments, wise and efficient infrastructure hardening, and a coordinated approach to mitigation policy through federal, state, regional, and local planning efforts. Our combined prioritization will be the protection of people, structures, infrastructure, and unique ecosystems that contribute to our way of life and the sustainability of the local and regional economy.

Jurisdictional Planning and Mitigation Goals

As part of the 2017-19 revision process, each participating jurisdiction in Benton County was asked to develop its own set of planning and mitigation goals to help reflect and keep track of individual priorities and changes in hazard vulnerability over time. During the first planning committee meeting, the group discussed several overall short-term and long-term goals as well as goals for the planning process itself. Members of the committee were given a list of example goals statements and a blank goals worksheet to fill out and return. The goals submitted by each jurisdiction are summarized as follows:

1. The 2017-19 planning process will involve planning for natural hazards of Flood, Earthquake, Landslides, Wildland Fire (Integration of the CWPP), Severe Storms, Volcanos, and Drought, but other hazards may be added during subsequent updates.
2. Prioritize the protection of people, structures, infrastructure, and unique ecosystems that contribute to our way of life and the sustainability of the local and regional economy;
3. Educate communities about the unique challenges of natural hazard preparedness in the county;
4. Reduce the impact of hazard events and potential losses incurred by both public and private residents and entities;
5. Consider land use policies to alleviate potential hazard risks and impacts for future development;
6. Improve enrollment in the National Flood Insurance Program within communities that are at risk to floods through increased outreach and education;
7. Establish mitigation priorities and develop mitigation strategies in Benton County & adopting jurisdictions;
8. Strategically locate and plan infrastructure and risk reduction projects that take into consideration the impacts of natural hazards;

9. Reduce the area of wildland-urban interface (WUI) land burned and losses experienced because of wildland fires where these fires threaten communities in the wildland-urban interface;
10. Provide recommendations for alternative mitigation methods.
11. Meet or exceed the requirements of the National Fire Plan and FEMA Natural Hazard Mitigation Plan and Community Wildfire Protection Plan.

Integration with Other Local Planning Mechanisms

During the development of this Hazard Mitigation Plan, several planning and management documents were reviewed in order to avoid conflicting goals and objectives. Existing programs and policies were reviewed in order to identify those that may weaken or enhance the hazard mitigation objectives outlined in this document. The following narratives help identify and briefly describe some of the existing planning documents and ordinances considered during the development of this plan. This list does not necessarily reflect every plan, ordinance, or other guidance document within each jurisdiction; however, this is a summary of the guidance documents known to and recommended for review by members of the planning committee.

Benton County Comprehensive Plan (2018):

Benton County Comprehensive Plan guides all development within the unincorporated portions of Benton County and addresses the goals and community's values for land use, transportation, infrastructure, housing, economic development, and natural resources.

It is anticipated that the coordination between the Benton County Comprehensive Plan and the Hazard Mitigation Plan will enable the development of resilient communities through land use planning that incorporates the risk assessments conducted in the Hazard Mitigation Plan.

Benton County Comprehensive Emergency Management Plan (2015):

The Benton County Comprehensive Emergency Management Plan (CEMP) establishes the framework for a comprehensive approach to mitigation, planning, response and recovery activities by defining the roles and responsibilities of local government, State and Federal agencies and volunteer organizations.

It is anticipated that the Hazard Mitigation Plan (Hazard Mitigation Plan) & Community Wildfire Protection Plan (CWPP) will support the efforts set forth by the Benton County CEMP. The identification, risk assessments, and vulnerability assessments for each hazard will provide the information to better mitigate and respond to hazards affecting all jurisdictions adopting the Hazard Mitigation Plan.

Benton County Wildfire Protection Plan (2019):

The Benton County's Wildfire Protection Plan identifies the fire risks throughout the County through the collaboration between planning members, stakeholders, and the public to determine areas that need fuel treatments to protect life and property.

Benton County is conducting an integrated approach to the Hazard Mitigation Plan and CWPP processes, review of the existing CWPP was used to record past projects, assess the fire risk to communities of Benton County in 2005 and determine what information was still relevant to the current efforts.

Benton County Flood Hazard Management Plan (Not Adopted):

The Flood Hazard Management Plan was developed in 2001 by a contractor in an effort to identify flooding hazards within Benton County. While not an official planning document the risk analysis and mitigation strategies presented were assessed to determine their applicability to the Benton County Hazard Mitigation Plan update.

Table 1) City and county plans that have been adopted by jurisdictions participating in the Benton County, WA Hazard Mitigation Plan per the capabilities assessments completed by each jurisdiction.

Plan Name / Type of Plan	Benton County	Kennewick	Richland	Prosser	West Richland	Benton City
Comprehensive / Master Plan	Y; 2018	Y; 2017	Y	Y; 2018	Y; 2017	Y; 2017
Capital Improvement Plan	Y; 2017	Y; 2016	Y; 2018	Y; 2018	Y; 2017	Y
Economic Development Plan	Y; 2015	N	N	N	Y; 2017	N
Local Emergency	N/A	Y	Y	Y	N/A	N
Continuity of Operations Plan	N/A	Y; 2015 / 2017	N/A	N	N/A	N
Transportation Plan	Y; 2017	Y; 2008	Y; 2005	Y	Y; 2018	Y
Stormwater Management Plan	N	Y; 2007	Y; 2016	N/A	Y; 2018	N
Community Wildfire Protection Plan	Y; 2019	Y; 2019	Y; 2019	2019	2019	2019

Y: Yes, a plan of the given type has been adopted by the jurisdiction in the year listed.
N: No, a plan of the given type has not been adopted by the jurisdiction listed.

Incorporating Other Plans: Descriptions of the Process by Jurisdiction

This section provides additional details explaining how the hazard mitigation plan will be incorporated into other planning mechanisms, ensuring consistency and efficiency when planning and preparing for natural hazard events. This is also an opportunity to accomplish Mitigation Action Items (MAI) through other plans as well. Mitigation Action Items are projects/initiatives that either reduce risk and/or exposure associated with a given hazard or increase preparedness in post-disaster scenarios. Examples of Mitigation Action Items include modification of building codes to restrict construction in known flood zones and the strategic placement of generators to ensure the continuation of essential services in the event of a power outage.

Benton County

Comprehensive Plan: The Benton County Comprehensive Plan (CP) was adopted in February of 2018 and is reviewed annually. During the annual review process Benton County will identify Mitigation Action Items that can be incorporated into and implemented through the CP. Most of the non-fire Mitigation Action Items will be eligible for inclusion in and implementation through the CP.

Plan URL: https://www.co.benton.wa.us/pView.aspx?id=1425&catid=45

The Following Mitigation Action Items (MAI) will be prioritized during the next plan update:

- Benton County Flood MAI No. 1

Capital Improvement Plan: The County's Capital Improvement Plan is updated at least every two (2) years prior to the County's biennium budget adoption but can be updated more frequently if the need arises. The Capital Improvement Plan was last updated on November 20, 2018 prior to, but on the same day as the County's biennium budget adoption for 2019-2020. The next update to the Capital Improvement Plan is scheduled for November of 2020.

Economic Development Plan: The Benton County Economic Development Plan was last updated in 2015. The next plan revision and adoption is scheduled for early 2019. During the next plan update, Benton County will identify Mitigation Action Items that can be incorporated into the Economic Development Plan.

Transportation Plan: The Benton County Transportation plan is incorporated in the Comprehensive Plan and was last updated in 2018. Any relevant Mitigation Action Items will be reviewed and incorporated in the Hazard Mitigation Plan at the time of each update. The County also has a Six (6) Year Transportation Improvement Plan or Six (6) Year TIP. The Six (6) Year TIP is updated on an annual basis, typically in the summer or fall, and covers a time period looking ahead six (6) years. The last Six (6) Year TIP (2018-2023) was adopted/updated on June 27, 2017 and amended on August 29, 2017.

Community Wildfire Protection Plan: The Benton County Community Wildfire Protection Plan is updated every 5 years and will be updated next in 2024. The Mitigation Action Items Mitigation Action Items included in the Hazard Mitigation Plan 18that pertain to wildfire will be carried over and accomplished through the Benton County Community Wildfire Protection Plan.

City of Kennewick

Comprehensive Plan: The City of Kennewick Comprehensive Plan was updated and adopted on June 6, 2017. The Comprehensive plan is reviewed annually and during the annual review process, the City of Kennewick will identify Mitigation Action Items Mitigation Action Items that can be incorporated into and implemented through the Comprehensive Plan.

Plan URL: ***https://www.go2kennewick.com/249/Comprehensive-Plan-Update***

The Following Mitigation Action Items (MAI) will be prioritized during the next plan update:

- Kennewick Flood MAI No. 1
- Kennewick Windstorm MAI No. 1

Capital Improvement Plan: The Capital Improvement plan for the City of Kennewick will be updated in 2020. During the annual review process, the City of Kennewick will identify Mitigation Action Items Mitigation Action Items that can be incorporated into the Hazard Mitigation Plan.

Local Emergency: The City of Kennewick Local Emergency Plan is reviewed every annually and will be updated again in 2019. Any relevant Mitigation Action Items will be reviewed and incorporated into the Hazard Mitigation Plan at the time of each update.

Continuity of Operations Plan: The City of Kennewick Continuity of Operations Plan is reviewed every year and will be updated again in 2019. Any relevant Mitigation Action Items will be reviewed and incorporated into the Hazard Mitigation Plan at the time of each update.

Transportation Plan: The City of Kennewick Transportation Plan is incorporated in the Comprehensive Plan and will be updated again in 2018. Any relevant Mitigation Action Items will be reviewed and incorporated into the Hazard Mitigation Plan at the time of each update.

Stormwater Management Plan: The Stormwater Management Plan is reviewed every 10 years and was last adopted in 2007. During the next update of the plan, the City of Kennewick will identify Mitigation Action Items that can be incorporated in the Hazard Mitigation Plan.

Community Wildfire Protection Plan: The Benton County Community Wildfire Protection Plan is updated every 5 years and will be updated next in 2024. The Mitigation Action Items included in the Hazard Mitigation Plan that pertain to wildfire will be carried over and accomplished through the Benton County Community Wildfire Protection Plan.

City of Richland

Comprehensive Plan: The City of Richland Comprehensive Plan was adopted on October 2017 and is amended annually. During the annual review process, the City of Richland will identify Mitigation Action Items that can be incorporated into and implemented through the Comprehensive Plan.

Plan URL: ***https://www.ci.richland.wa.us/departments/community-development-services/planning/comprehensive-plan***

The Following Mitigation Action Items (MAI) will be prioritized during the next plan update:

- Richland Multi-Hazard MAI 2
- Richland Multi-Hazard MAI 6
- Richland Multi-Hazard MAI 7
- Richland Multi-Hazard MAI 9

Capital Improvement Plan: The Capital Improvement plan for the City of Richland will be updated each year as part of the annual budget adoption. The 2019 CIP will be approved by Council in November 2018. During the annual review process, the City of Richland will identify Mitigation Action Items that can be incorporated into the Hazard Mitigation Plan.

Local Emergency: The City of Richland Local Emergency Plan is reviewed every year. Any relevant Mitigation Action Items will be reviewed and incorporated into the Hazard Mitigation Plan at the time of each update.

Transportation Plan: The City of Richland Transportation Plan is incorporated in the Comprehensive Plan and will be updated again in 2025. Any relevant Mitigation Action Items will be reviewed and incorporated into the Hazard Mitigation Plan at the time of each update.

Stormwater Management Plan: The Stormwater Management Plan is reviewed approximately every 10 years and was last adopted in 2015. During the next update of the plan, the City of Richland will identify Mitigation Action Items that can be incorporated in the Hazard Mitigation Plan.

Community Wildfire Protection Plan: The Benton County Community Wildfire Protection Plan is updated every 5 years and will be updated next in 2024. The Mitigation Action Items included in the Hazard Mitigation Plan that pertain to wildfire will be carried over and accomplished through the Benton County Community Wildfire Protection Plan.

City of Prosser

Comprehensive Plan: The City of Prosser Comprehensive Plan was adopted on April 10, 2018 and is amended annually. During the annual review process, the City of Prosser will identify Mitigation Action Items that can be incorporated into and implemented through the Comprehensive Plan.

Plan URL: ***https://cityofprosser.com/planning***

The Following Mitigation Action Items (MAI) will be prioritized during the next plan update:

- Prosser Multi-Hazard MAI No. 2
- Prosser Flood MAI No. 1
- Prosser Flood MAI No. 2
- Prosser Windstorm MAI 1

Capital Improvement Plan: The Capital Improvement plan for the City of Prosser will be updated in 2019. During the annual review process, the City of Prosser will identify Mitigation Action Items that can be incorporated into the Hazard Mitigation Plan.

Local Emergency: The City of Prosser Local Emergency Plan is reviewed every 6 years and will be updated again in 2020. Any relevant Mitigation Action Items will be reviewed and incorporated in the Hazard Mitigation Plan at the time of each update.

Transportation Plan: The City of Prosser Transportation Plan is incorporated in the Comprehensive Plan and will be updated again in 2019. Any relevant Mitigation Action Items will be reviewed and incorporated in the Hazard Mitigation Plan at the time of each update.

Community Wildfire Protection Plan: The Benton County Community Wildfire Protection Plan is updated every 5 years and will be updated next in 2024. The Mitigation Action Items included in the Hazard Mitigation Plan that pertain to wildfire will be carried over and accomplished through the Benton County Community Wildfire Protection Plan.

City of West Richland

Comprehensive Plan: The City of West Richland 20-Year Comprehensive Plan was adopted in 2017 and is amended annually. During the annual review process, the City of West Richland will identify Mitigation Action Items that can be incorporated into and implemented through the Comprehensive Plan.

Plan URL*: http://www.westrichland.org/wpfb-file/2017-comprehensive-plan-adopted-ord-14-17-2-pdf/*

The Following Mitigation Action Items (MAI) will be prioritized during the next plan update:

- West Richland Multi-Hazard MAI No. 1
- West Richland Multi-Hazard MAI No. 2
- West Richland Multi-Hazard MAI No. 3
- West Richland Flood MAI No. 1
- West Richland Windstorm MAI No.1

Capital Improvement Plan: The Capital Improvement plan for the City of West Richland will be updated in 2019. During the annual review process, the City of West Richland will identify Mitigation Action Items that can be incorporated into the Hazard Mitigation Plan.

Economic Development Plan: The City of West Richland Economic Development Plan is updated as needed and was last updated in 2013 with no immediate plans to update it as the 20-Year Comprehensive Plan included economic development as an element. During the next plan update, West Richland will identify Mitigation Action Items that can be incorporated into the Economic Development Plan.

Transportation Plan: The City of West Richland Transportation Plan is incorporated in the Comprehensive Plan and will be updated again in 2019. Any relevant Mitigation Action Items will be reviewed and incorporated in the Hazard Mitigation Plan at the time of each update.

Stormwater Management Plan: The Stormwater Management Plan is reviewed every year is not adopted by council but referenced in Municipal Code. During the next update of the plan, the City of West Richland will identify Mitigation Action Items that can be incorporated in the Hazard Mitigation Plan.

Community Wildfire Protection Plan: The Benton County Community Wildfire Protection Plan is updated every 5 years and will be updated next in 2024. The Mitigation Action Items included in the Hazard Mitigation Plan that pertain to wildfire will be carried over and accomplished through the Benton County Community Wildfire Protection Plan.

Benton City

Comprehensive Plan: The Benton City Comprehensive Plan (CP) was adopted on August 2017 and is amended annually if needed. During the annual review process Benton City will identify Mitigation Action Items that can be incorporated into and implemented through the CP. Most of the non-fire Mitigation Action Items will be eligible for inclusion in and implementation through the CP but the following will be a priority:

Plan URL: ***https://www.ci.benton-city.wa.us/pView.aspx?id=28918&catid=671***

The Following Mitigation Action Items (MAI) will be prioritized during the next plan update:

- Benton City Multi Hazard MAI No. 1
- Benton City Multi Hazard MAI No. 2
- Benton City Flood MAI No. 1
- Benton City Flood MAI No. 5

Capital Improvement Plan: The Capital Improvement plan for Benton City will be updated in 2019. During the annual review process, Benton City will identify Mitigation Action Items that can be incorporated into the Hazard Mitigation Plan.

Transportation Plan: The Benton City Transportation Plan is incorporated in the Comprehensive Plan and will be updated again in 2019. Any relevant Mitigation Action Items will be reviewed and incorporated in the Hazard Mitigation Plan at the time of each update.

Community Wildfire Protection Plan: The Benton County Community Wildfire Protection Plan is updated every 5 years and will be updated next in 2024. The Mitigation Action Items included in the Hazard Mitigation Plan that pertain to wildfire will be carried over and accomplished through the Benton County Community Wildfire Protection Plan.

Guiding Principles

Effective November 1, 2004, a Hazard Mitigation Plan approved by the Federal Emergency Management Agency (FEMA) is required for Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation Program (PDM) eligibility. These programs provide funding, through state emergency management agencies, to support local mitigation planning and projects to reduce potential disaster damages.

The new local Natural Hazard Mitigation Plan requirements for HMGP and PDM eligibility is based on the Disaster Mitigation Act of 2000, which amended the Stafford Disaster Relief Act to promote an integrated, cost effective approach to mitigation. Local Natural Hazard Mitigation Plans must meet the minimum requirements of the Stafford Act-Section 322, as outlined in the criteria contained in 44 CFR Part 201. The plan criteria cover the planning process, risk assessment, mitigation strategy, plan maintenance, and adoption requirements.

In order to be eligible for project funds under the Flood Mitigation Assistance (FMA) program, communities are required under 44 CFR Part 79.6(d)(1) to have a mitigation plan that addresses flood hazards. On October 31st, 2007, FEMA published amendments to the 44 CFR Part 201 at 72 Federal Reg. to incorporate mitigation planning requirements for the FMA program (44 CFR Part 201.6). The revised Local Mitigation Plan Review Crosswalk (October 2011) used by FEMA to evaluate local hazard mitigation plans is consistent with the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended by Section 322 of the Disaster Mitigation Act of 2000, the National Flood Insurance Act of 1968, as amended by the National Flood Insurance Reform Act of 2004 and 44 Code of Federal Regulations (CFR) Part 201 – Mitigation Planning, inclusive of all amendments through July 1, 2008, was used as the official guide for development of a FEMA-compatible Benton County, Washington Natural Hazard Mitigation Plan.

FEMA will only review a local Natural Hazard Mitigation Plan submitted through the appropriate State Hazard Mitigation Officer (SHMO). Draft versions of local Natural Hazard Mitigation Plans will not be reviewed by FEMA. FEMA will review the final version of a plan prior to local adoption to determine if the plan meets the criteria, but FEMA will be unable to approve it prior to adoption.

A FEMA designed plan will be evaluated on its adherence to a variety of criteria, including:

- Adoption by local governing bodies and multi-jurisdictional plan adoption
- Multi-jurisdictional planning participation and documentation of the planning process
- Identifying hazards and profiling hazard events

- Assessing vulnerability by identifying assets, estimating potential losses, and analyzing development trends
- Multi-jurisdictional risk assessment
- Local hazard mitigation goals and identification, analysis, and implementation of mitigation measures
- Multi-jurisdictional mitigation strategy
- Monitoring, evaluating, and updating the plan
- Implementation through existing programs
- Continued public involvement

United States Government Accountability Office (GAO)

Since 1984, wildland fires have burned an average of more than 850 homes each year in the United States and, because more people are moving into fire-prone areas bordering wildlands, the number of homes at risk is likely to grow. The primary responsibility for ensuring that preventative steps are taken to protect homes lies with homeowners. Although losses from fires made up only 2.2 percent of all insured catastrophic losses from 1991 to 2010, fires can result in billions of dollars in damages.

GAO was asked to assess, among other issues, (1) measures that can help protect structures from wildland fires, (2) factors affecting use of protective measures, and (3) the role technology plays in improving firefighting agencies' ability to communicate during wildland fires.

The two most effective measures for protecting structures from wildland fires are: (1) creating and maintaining a buffer, called defensible space, from 30 to 100 feet wide around a structure, where flammable vegetation and other objects are reduced; and (2) using fire-resistant roofs and vents. In addition to roofs and vents, other technologies – such as fire-resistant windows and building materials, surface treatments, sprinklers, and geographic information systems mapping – can help in protecting structures and communities, but they play a secondary role.

Although protective measures are available, many property owners have not adopted them because of the time or expense involved, competing concerns such as aesthetics or privacy, misperceptions about wildland fire risks, and lack of awareness of their shared responsibility for fire protection. Federal, state, and local governments, as well as other organizations, are attempting to increase property owners' use of protective measures through education, direct monetary assistance, and laws requiring such measures. In addition, some insurance companies have begun to direct property owners in high risk areas to take protective steps.

State and Federal CWPP Guidelines

This Community Wildfire Protection Plan includes compatibility with FEMA requirements for a Hazard Mitigation Plan, while also adhering to the guidelines proposed in the National Fire Plan, and the Healthy Forests Restoration Act (2003). This Community Wildfire Protection Plan has been prepared in compliance with:

- Healthy Forests Restoration Act (2003).

- The Federal Land Assistance, Management and Enhancement (FLAME) Act (2009).
- The National Fire Plan: A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment 10-Year Comprehensive Strategy Implementation Plan (December 2006).
- National Cohesive Wildland Fire Management Strategy (March 2011). The Cohesive Strategy is a collaborative process with active involvement of all levels of government and non-governmental organizations, as well as the public, to seek national, all-lands solutions to wildland fire management issues.
- The Federal Emergency Management Agency's Region 10 guidelines for a Local Hazard Mitigation Plan as defined in 44 CFR parts 201 and 206, and as related to a fire mitigation plan chapter of a Multi-Hazard Mitigation Plan.
- National Association of State Foresters – guidance on identification and prioritizing of treatments between communities (2003).

Update and Review Guidelines

Deadlines and Requirements for Regular Plan Reviews and Updates: In order to apply for a FEMA PDM project grant, Tribal and local governments must have a FEMA-approved mitigation plan. Tribal and local governments must have a FEMA-approved mitigation plan in order to receive HMGP project funding for disasters declared on or after November 1, 2004. States and Tribes must have a FEMA-approved Standard or Enhanced Mitigation Plan in order to receive non-emergency Stafford Act assistance (i.e., Public Assistance Categories C-G, HMGP, and Fire Management Assistance Grants) for disasters declared on or after November 1, 2004. State mitigation plans must be reviewed and reapproved by FEMA every three years. Local Mitigation Plans must be reviewed and reapproved by FEMA every five years.

- *Plan updates*. In addition to the timelines referenced above, the Rule includes the following paragraphs that pertain directly to the update of State and local plans:

  - ✓ §201.3(b)(5) [FEMA Responsibilities] …Conduct reviews, at least once every three years, of State mitigation activities, plans, and programs to ensure that mitigation commitments are fulfilled….
  - ✓ §201.4(d) Review and updates. [State] Plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities and resubmitted for approval…every three years.
  - ✓ §201.6(d) [Local] plans must be reviewed, revised if appropriate, and resubmitted for approval within five years in order to continue to be eligible for project grant funding.

Plan updates must demonstrate that progress has been made in the past three years (for State plans), or in the past five years (for local plans), to fulfill commitments outlined in the previously approved plan. This will involve a comprehensive review and evaluation of each section of the plan and a discussion of the results of evaluation and monitoring activities detailed in the Plan Maintenance section of the previously approved plan. FEMA will leave to State discretion, consistent with this plan update guidance, the documentation of progress made. Plan updates may validate the information in the previously approved plan or may involve a major plan rewrite. In any case, a plan update is NOT an annex to the previously approved plan; it must stand on its own as a complete and current plan.

The objective of combining these complementary guidelines is to facilitate an integrated wildland fire risk assessment, identify pre-hazard mitigation activities, and prioritize activities and efforts to achieve the protection of people, structures, the environment, and significant infrastructure in Benton County while facilitating new opportunities for pre-disaster mitigation funding and cooperation.

National Flood Insurance Program Compliance

Effective October 1, 2008, the Federal Emergency Management Agency (FEMA) will require jurisdictions that participate in the National Flood Insurance Program (NFIP) to link their mitigation strategy with continued compliance with the National Flood Insurance Program. As of 2019, Benton County and all of the jurisdictions within Benton County to include; the City of Richland, City of Kennewick, City of West Richland, City of Prosser and City of Benton City are participating in NFIP and are in good standing. Refer to the letter from the State of Washington Department of Ecology in Appendix D.

The Benton County Hazard Mitigation Plan was originally developed in 2004 following the process outlined by the Disaster Mitigation Act of 2000 as well as the NFIP so that the plan would fully coordinate with and compliment NFIP flood mitigation programs that exist now or may exist in the future within Benton County. To comply with NFIP standards, no development in Benton County to include the City of Richland, City of Kennewick, City of West Richland, City of Prosser or City of Benton City is occurring in designated flood zones and construction projects must be inspected by Planning, Zoning & Building Code Enforcement.

Since January 1, 1978, Benton County and cities within the county have received almost $1.3 million in NFIP claims for 102 losses as a result of flooding. (Table 2). As defined by the NFIP, there are no “repetitive loss” or “severe repetitive loss” properties located within Benton County’s planning area.

Table 2) Total value of flood insurance claims made since January 1, 1978 by Benton County, WA and communities within Benton County.

Community	Total Losses	Closed Losses	Open Losses	CWOP Losses	Total Payments
Benton City	20	15	0	5	$211,461.44
Benton County	50	40	0	10	$674,290.93
Kennewick	4	2	0	2	$7,288.3
Prosser	1	1	0	0	$8,154.3
Richland	17	11	0	6	$175,651.79
West Richland	10	9	0	1	$207,335.97
Total	**102**	**78**	**0**	**24**	**$1,284,182.73**

Chapter 2: Planning Process

Documenting the Planning Process

Documentation of the planning process, including public involvement, is required to meet FEMA's DMA 2000 (44CFR§201.6(b) and §201.6(c)(1)) for an updated local mitigation plan. This section includes a description of the planning process used to update this plan, including how it was prepared, who was involved in the process, and how all of the involved agencies participated.

The Planning Team

Benton County Emergency Management team led the planning committee efforts alongside the Northwest Management, Inc. team. This team of resource professionals included county and city staff, fire protection districts, State and Federal Agencies:

Deanna Davis	Manager, Benton County Emergency Management
Kyle Kurth	Maintenance Foremen, City of Benton City
Shane O'Neill	Community Development Senior Planner, City of Richland
Scott Clemenson	Captain, Richland Fire Department
Pete Rogalsky	Public Works Director, Richland Public Works
Cary Roe	Public Works Director, City of Kennewick
Anthony Muai	Community Development Senior Planner, City of Kennewick
Neil Hines	Operations Chief, Kennewick Fire Department
Aaron Lambert	Community Development Director, City of West Richland
Steve Zetz	Planning and Economic Development Director, City of Prosser
Kevin Howard	Director of Airports and Operations, Port of Benton
Michelle Cooke	Senior Planner, Benton County
Jerrod MacPherson	Planning Director, Benton County
John Janak	Fire Management Officer, United States Fish & Wildlife Service
Lori Ferris	Emergency Planner, Benton County Emergency Management
Charles Cronk	Supervisory Range Tech, Bureau of Land Management
Lonnie Click	Chief, Benton County Fire District #1
Ron Duncan	Chief, Benton County Fire District #2
Bonnie Benitz	Captain, Benton County Fire District #4
William Whealan	Chief, Benton County Fire District #4
Seth Johnson	Chief, West Benton Fire Rescue
Tera King	Consultant, Northwest Management Inc.
Eric Nelson	Consultant, Northwest Management Inc.
Mark Corrao	Consultant, Northwest Management Inc.

The planning committee met with residents of the county during the community risk assessments and at public meetings. Additionally, the press releases encouraged interested citizens to contact their county Emergency Management coordinator or attend planning committee meetings to ensure that all issues, potential solutions, and ongoing efforts were thoroughly discussed and considered by the committee. When the public meetings were held, several of the committee members were in attendance and shared their support and experiences with the planning process and their interpretations of the results.

The planning philosophy employed in this project included open and free sharing of information with interested parties. Information from federal and state agencies was integrated into the database of knowledge used in this project. Meetings with the committee were held throughout the planning process to facilitate a sharing of information between cooperators.

Description of the Planning Process

The Benton County Hazard Mitigation Plan was developed through a collaborative process involving all of the organizations and agencies listed above. The planning effort began by organizing and convening a multijurisdictional planning committee. Following the first meeting in October of 2017 the committee identified other individuals/agencies that should be invited. The planning committee consists of any and all individuals who participated in planning committee meetings. The planning process included seven distinct phases:

1. **Organization of Resources** — Benton County Emergency Management and NMI worked together to develop a comprehensive list of potential participants as well as a project timeline and work plan. The 2017-19 planning committee served as the basis for identifying stakeholders; however, that list was expanded in order to provide a comprehensive review and update of the risk assessments and mitigation strategies during the update process.
2. **Collection of Data** — NMI coordinated with the planning team to gather any new data and information about the extent and periodicity of hazards in Benton County to ensure a robust dataset for making inferences about hazards.
3. **Field Observations and Estimations** — Members of the planning team and NMI conducted field tours to help train and validate risk analyses. The planning team and NMI developed risk models and identified problem areas in order to better understand risks, juxtaposition of structures and infrastructure to risk areas, access, and potential mitigation projects. Many of the analyses used in the previous plan were reviewed and updated to incorporate new hazard vulnerabilities or changes in development. Additionally, several new risk models and analyses were included in the 2018 update process to better represent actual conditions in Benton County.
4. **Mapping** — NMI developed a comprehensive database and map files relevant to pre-disaster mitigation control and mitigation, structures, resource values, infrastructure, risk assessments, and other related data. All of the maps and databases were updated as part of the 2017-18 plan update.
5. **Public Involvement** —Benton County Emergency Management and NMI developed a plan to involve the public from the formation of the planning committee. Using news releases, public meetings, public review of the draft documents, and acknowledgement of the final updated plan by the signatory representatives.
6. **Strategies and Prioritization —** NMI and the planning team representatives worked together to review the risk analyses and develop realistic mitigation strategies. The Benton County Emergency Manager met with representatives from each jurisdiction individually to identify informational needs for the plan and develop a strategy for continued involvement in the planning process.

7. **Drafting of the Report—**NMI drafted a final update report and worked with members of the planning team to review each section, incorporate public comments, proceed with the state and federal review processes, and adopt the final document.

Multi-Jurisdictional Participation

CFR requirement §201.6(a)(4) calls for multi-jurisdictional planning in the development of Hazard Mitigation Plans that impact multiple jurisdictions. To be included as an adopting jurisdiction in the Benton County Multi-Hazard Mitigation Plan jurisdictions were required to participate in at least one planning committee meeting or meet with planning team leadership individually, provide a goals statement, submit at least one mitigation strategy, and adopt the final Plan by resolution.

The following is a list of jurisdictions that have met the requirements for an adopting jurisdiction and are thereby included in the Natural Hazard Mitigation Plan:

- Benton County
- Benton City
- City of Kennewick
- City of Prosser
- City of Richland
- City of West Richland

The monthly planning committee meetings were the primary venue for authenticating the planning record. However, additional input was gathered from each jurisdiction in a combination of the following ways:

- Planning committee leadership attended local government meetings where planning updates were provided, and information was exchanged. Additionally, representatives on the planning committee periodically attended city council meetings to provide municipality leadership with updates on the project and to request reviews of draft material. All of the adopting jurisdictions maintained active participation in the monthly planning committee meetings.
- One-on-one correspondence and discussions between the planning committee leadership and the representatives of the municipalities and special districts was facilitated as needed to ensure understanding of the process, collect data and other information, and develop specific mitigation strategies.
- Public meetings were hosted by the communities of Kennewick, Richland, and Prosser. Each meeting involved representatives of BCEM, NMI, as well as Fire and Rescue personnel.
- Written correspondence was provided at least monthly between the planning committee leadership and the contractor to provide updates to the cooperators on the document's progress, making requests for information, and facilitating feedback from participating jurisdictions. Benton County Emergency Management representatives used an email distribution list of all the stakeholders to announce meetings, distribute meeting minutes, provide draft sections for review, and request information. All of the participating jurisdictions provided comments to the draft document during the data gathering phase as well as during the various committee and public review processes.

Planning Committee Meetings

Benton County Emergency Management solicited participation from each jurisdiction and State and Federal Agencies throughout the county as well as local hazard experts. With the full integration of the Community Wildfire Protection Plan and the Hazard Mitigation Plan processes, local fire districts were also asked to participate in the committee meetings (see *Meeting Sign-in Sheets* section in Appendix C). Throughout the meetings, the committee reviewed the updated plan, aided in the risk and vulnerability analysis, developed public outreach efforts, and determined the best mitigation strategies for each jurisdiction. The planning kickoff meeting was held in October of 2017 with periodic meetings through July 2018 and a final review meeting on January 30th, 2019.

Public Involvement

Public involvement in this plan was made a priority from the inception of the project. There were a number of ways that public involvement was sought and facilitated. In some cases, this led to members of the public providing information and seeking an active role in protecting their communities, while in other cases it led to the public becoming more aware of the process without becoming directly involved in the planning.

Under the auspices of the Benton County Emergency Management, periodic press releases were submitted to local papers and radio stations and posted on the BCEM websites Facebook page. Additional press releases provided information regarding the public meetings and public comment period including how to find electronic versions of the draft on the BCES Facebook page for review and instructions on how to submit comments through the BCES webpage. A record of published articles regarding the Hazard Mitigation Plan is included in the Appendices.

Public Meetings

Public meetings were held on April 25th, 2018 in Richland and Kennewick and on April 26th, 2018 in Prosser. Committee member leadership presented a PowerPoint overview of the purpose of the plan, risk assessments for each hazard, and mitigation activities that may benefit Benton County. There were map displays to help facilitate open discussion. In total there were at least 2 committee members at each meeting and a total of 4 public participants. See Appendix D for documentation of public meetings.

Documented Review Process

Review and comment on this Plan have been provided through a number of avenues for the committee members as well as for members of the general public. A record of the document's review process has been established through email correspondence, press releases, published articles, meeting minutes, and meeting sign-in sheets.

During regularly scheduled committee meetings in 2017-18, the committee members met to discuss findings, review mapping analysis, and provide written comments on draft sections of the document. During the public meetings attendees observed map analyses, discussed general findings from the risk assessments, and made recommendations on potential project areas.

Sections of the draft Plan were delivered to the planning committee members during the regularly scheduled committee meetings. The completed first draft of the document was presented to the committee in June for full committee review. The committee spent several weeks proofreading and editing sections of draft. Many jurisdictions met individually to review and revise their specific risk assessment and mitigation strategy including the prioritization of action items. Once the committee's review was completed, the draft document was released for public review and comment. The public review period remained open from February 11, 2019 to February 22, 2019.

Plan Maintenance

Evaluating and Updating the Plan

The Benton County Hazard Mitigation Plan will be reviewed on an annual basis by the planning team to determine the effectiveness of mitigation programs, projects, or other related activities, and to reflect changes in land development or programs that may affect mitigation priorities and/or strategies. The plan will be updated every five years. These five-year updates will be delivered to the Washington State Hazard Mitigation Program Manager for review and forwarding to the Federal Emergency Management Agency, Region X Office.

Annual Plan Review

To facilitate the annual plan review process, the Benton County Hazard Mitigation Planning Committee will remain a semi-active group following the formal adoption of this plan and shall be charged with the responsibility of conducting an annual plan review. The Director of the Benton County Emergency Management or his/her designee will be responsible for contacting the chairperson and members of the Benton County Hazard Mitigation Planning Committee and organizing the annual plan review process.

The Benton County Hazard Mitigation Planning Committee will review the current hazard mitigation strategies to determine their relevance to changing situations within Benton County, integrate known changes in State or Federal policy, and ensure mitigation strategies are addressing current and expected conditions.

Following the annual plan review process, the Chairperson of the Benton County Hazard Mitigation Planning Committee, in cooperation with Benton County Emergency Management, will prepare a written report describing: 1) the plan review process; 2) the status of any current mitigation activities or projects; and 3) any deficiencies identified as a result of the plan evaluation. Copies of this report shall be mailed to the governing body of each of the participating jurisdictions each calendar year. Additionally, a copy of this report will be mailed to the Washington State Hazard Mitigation Program Manager each calendar year.

Five-Year Plan Update

Updates to the Benton County Hazard Mitigation Plan shall be conducted on a five-year cycle and shall commence at the direction of the Director of Benton County Emergency Management. Upon such direction, staff from Benton County Emergency Management, in cooperation with the chairperson of the Benton County Hazard Mitigation Planning Committee, will begin the process of updating the plan. It is advised that during the third annual update the committee should begin the FEMA grant process for updating the plan with the following year (fourth year) used to update the plan. The governing body of each of the participating jurisdictions shall approve the updated plan and a copy of the updated plan shall be submitted to the Washington State Hazard Mitigation Program Manager.

Continued Public Involvement

All participating entities are dedicated to the continued involvement of the public in the hazard mitigation process. The plan will be available on the BCES website with the understanding that questions or comments can be directed to staff at any time. Any formal meetings to discuss the plan will be "advertised" on our website so the public can attend if they wish.

Copies of the Benton County Hazard Mitigation Plan will be kept and made available for public review at the following locations:

- Benton County Emergency Management
- Benton County Emergency Services Website (www.bces.wa.gov)
- Benton County Building Department
- Richland Public Library
- Mid-Columbia Library (Kennewick and West Richland)

Benton County Emergency Management shall be responsible for receiving, tracking, and filing public comments regarding the Benton County Hazard Mitigation Plan. Contact information for Benton County Emergency Management is listed below. A public meeting will be held as a part of the review process as well as the final five-year plan update. Additional meetings may also be held as deemed necessary by the Chairperson of the Benton County Hazard Mitigation Planning Committee. The purpose of these meetings is to provide a public forum so that citizens can express concerns, opinions, or ideas about the Benton County Hazard Mitigation Plan. The Benton County Hazard Mitigation Planning Committee will continue to meet at least annually and be made up of representatives from the participating jurisdictions as well as entities, departments, and agencies involved or impacted by hazard events in Benton County.

Benton County Emergency Management: (509) 628-2600

Chapter 3: Hazard Profiles

Floods

Flooding typically occurs when climate (or weather patterns), geology, and hydrology combine to create conditions where water flows outside of its usual channel onto surrounding lands. In Benton County, geography and climate combine to create chronic seasonal flooding conditions, typically in the winter and spring. In addition to meteorological-related flooding, failure of man-made structures, such as dams and irrigation canals, can also present flood hazards.

Flooding in Benton County typically occurs along the Yakima River. Although flooding has occurred in the past along the Columbia River, a system of dams, including the McNary Dam located along the southern edge of Benton County, now protect most of the developed areas along the Columbia River in Benton County. However, there was flooding and damage that occurred along the Columbia River, in park areas, in May of 2018 due to spring run-off and dams upriver releasing water. In the event of a heavy rain event or rapid snow melt, flash flooding can occur in canyons and gullies. Zintel Canyon, located in Kennewick, presented a flash flood risk to nearby communities until the Zintel Canyon Dam was constructed to mitigate flash flood hazards in December of 1992.

Winter floods are historically the largest in magnitude, although their duration is typically less than one week. The total volume of runoff from winter floods is less than those of spring floods. Spring flooding is usually caused by snowmelt during periods of warm weather and/or rain. Although the magnitude of spring floods is usually less than winter floods, spring flooding can last up to four weeks. The total volumes of runoff experienced during spring floods can be significant.

Two types of flooding primarily affect Benton County: riverine flooding and urban flooding (see descriptions below). In addition, any low-lying area has the potential to flood. The flooding of developed areas may occur when the amount of water generated from rainfall and runoff exceeds a storm water system's (ditch or sewer) capability to remove it.

Definitions

Riverine Flooding: Riverine flooding is over-the-bank flooding of rivers and streams. The natural processes of riverine flooding add sediment and nutrients to fertile floodplain areas. Flooding in large river systems typically results from large-scale weather systems that generate prolonged rainfall over a wide geographic area, causing flooding in hundreds of smaller streams, which then drain into the major rivers. Shallow area flooding is a special type of riverine flooding. FEMA defines shallow flood hazards as areas that are inundated by the 100-year flood with flood depths of only one to three feet. These areas are generally flooded by low-velocity sheet flows of water.

Urban Flooding: As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization of a watershed changes the hydrologic systems of the basin. Heavy rainfall collects and flows faster on impervious concrete and asphalt surfaces. The water moves from the clouds to the ground and into streams at a much faster rate in urban areas. Adding these elements to the hydrological systems can result in floodwaters that rise very rapidly and peak with violent force. Benton County's incorporated towns and cities have a relatively high concentration of impermeable surfaces that either collect water or concentrate the flow of water in man-made channels. During periods of urban flooding, streets can become swift moving rivers and basements can fill with water. Storm drains often back up with vegetative debris causing additional localized flooding.

Floodplain: A floodplain is a land area adjacent to a river, stream, lake, estuary, or other water body that is subject to flooding. This area, if left undisturbed, acts to store excess floodwater. The floodplain is made up of two sections: the floodway and the flood fringe.

Floodway: The floodway is one of two main sections that make up the floodplain. Floodways are defined for regulatory purposes. Unlike floodplains, floodways do not reflect a recognizable geologic feature. For NFIP purposes, floodways are defined as the channel of a river or stream, and the overbank areas adjacent to the channel. 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 that would obstruct or divert flood flows onto other properties. The NFIP floodway definition is "the channel of a river or other watercourse and adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot." Floodways are not mapped for all rivers and streams but are generally mapped in developed areas.

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.

Development: For floodplain ordinance purposes, development is broadly defined to mean "any manmade change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation, or drilling operations located within the area of special flood hazard." The definition of development for floodplain purposes is generally broader and includes more activities than the definition of development used in other sections of local land use ordinances.

100-Year Flood: The 100-year flooding event is the flood having a one percent chance of being equaled or exceeded in magnitude in any given year. Contrary to popular belief, it is not a flood occurring once every 100 years. The 100-year floodplain is the area adjoining a river, stream, or watercourse covered by water in the event of a 100-year flood.

Base Flood Elevation (BFE): The term "Base Flood Elevation" refers to the elevation (normally measured in feet above sea level) that the base flood is expected to reach. Base flood elevations can be set at levels other than the 100-year flood. Some communities choose to use higher frequency flood events as their base flood elevation for certain activities, while using lower frequency events for others. For example, for the purpose of storm water management, a 25-year flood event might serve as the base flood elevation, while the 500-year flood event may serve as base flood elevation for the tie down of mobile homes. The regulations of the NFIP focus on development in the 100-year floodplain.

Dam Failure Flooding: Loss of life and damage to structures, roads, utilities and crops may result from a dam failure. Economic losses can also result from a lowered tax base and lack of utility profits. These effects would certainly accompany the failure of one of the major dams affecting the Columbia, Snake, or Yakima rivers. Because dam failure can have severe consequences, FEMA requires that all dam owners develop Emergency Action Plans (EAP) for warning, evacuation, and post-flood actions. Although there may be coordination with municipal officials in the development of the EAP, the responsibility for developing potential flood inundation maps and facilitation of emergency response is the responsibility of the dam owner.

Background Information

Some of the following information was excerpted or derived from the Benton County Comprehensive Flood Hazard Management Plan (CFHMP) draft from 2001.

Effect of Development on Floods

When structures or fill are placed in the floodway or floodplain, water is displaced. Development raises the river levels by forcing the river to compensate for the space obstructed by the inserted structures and/or fill. When structures or materials are added to the floodway or floodplain and no fill is removed to compensate, serious problems can arise. Floodwaters may be forced away from historic floodplain areas. As a result, other existing floodplain areas may experience floodwaters that rise above historic levels.

Local governments must require engineer certification to ensure that proposed developments will not adversely affect the flood carrying capacity of the Special Flood Hazard Area (SFHA). Displacement of only 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 should be given to development that occurs within the floodway to ensure that structures are prepared to withstand base flood events. In highly urbanized areas, increased paving can lead to an increase in volume and velocity of runoff after a rainfall event, exacerbating the potential flood hazards. Care should be taken in the development and implementation of storm water management systems to ensure that these runoff waters are dealt with effectively.

Sediment Transport and Deposition

Sediment deposited in the river channel can promote channel migration and reduce the channel's conveyance capacity for high flows. Large quantities of sediment can be moved over short periods during flood events. Sediment deposition occurs where the river becomes flatter or wider, reducing the energy of its flow and thus its sediment transport capacity, its ability to carry sediment downstream. Sediment transport increases and deposition decreases near channel constrictions or areas where flow velocity increases.

Effects of Levees

Levees attempt to keep floodwaters within a designated channel by confining them instead of allowing them to spill over into the floodplain. Levees provide a certain level of protection to floodplain residents; however, they can raise floodwater elevations upstream by creating a backwater effect, increase flow velocities, reduce side channel fish habitat, increase channel migration, and negate the effects of floodplain storage, leading to greater flood magnitudes downstream.

All levees and berms provide some level of flood protection. Many only protect during low-level, high-frequency floods, such as 1 to 10-year events. Small levees typically fail during significant flood events. In spite of their shortcomings during major floods, many farmers and businesses construct levees to prevent small frequent floods from causing damage by killing crops, eroding banks, and depositing unwanted silt.

The West Richland Levee, located along the inside of a meander curve on the Yakima River, is the only true levee in Benton County. It is operated and maintained by the Benton County Diking District No. 1[2].

Identification of Flood-Prone Areas

Flood maps and Flood Insurance Studies (FIS) are often used to identify flood-prone areas. The NFIP was established in 1968 as a means of providing low-cost flood insurance to the nation's flood-prone communities. The NFIP also reduces flood losses through regulations that focus on building codes and "sound floodplain management". NFIP regulations (44 Code of Federal Regulations [CFR] Chapter 1, Section 60.3) require that all new construction in floodplains must be elevated at or above base flood level. The Washington Building Code requires new construction to be elevated to one foot above the base flood elevation. Communities participating in the NFIP may adopt regulations that are more stringent than those contained in 44 CFR 60.3, but not less stringent.

Flood Insurance Rate Maps (FIRM) and Flood Insurance Studies (FIS)

Floodplain maps are the basis for implementing floodplain regulations and for delineating flood insurance purchase requirements. A Flood Insurance Rate Map (FIRM) is the official map produced by FEMA, which delineates SFHA in communities where NFIP regulations apply. FIRMs are also used by insurance agents and mortgage lenders to determine if flood insurance is required and what insurance rates should apply.

Water surface elevations are combined with topographic data to develop FIRMs. FIRMs illustrate areas that would be inundated during a 100- year flood, floodway areas, and elevations marking the 100-year-flood level. In some cases, they also include base flood elevations (BFEs) and areas located within the 500-year floodplain.

Flood Insurance Studies and FIRMs produced for the NFIP provide assessments of the probability of flooding at a given location. FEMA conducted many Flood Insurance Studies in the late 1970s and early 1980s. These studies and maps represent flood risk at the point in time when FEMA completed the

[2] U.S. Army Corps of Engineers. *Levee System Summary: West Richland-Yakima River Right Bank*, U.S. Army Corps of Engineers. , 2017, https://www.calvin.edu/library/knightcite/index.php. Accessed 30 May 2018.

studies. However, it is important to note that not all 100-year or 500-year floodplains have been mapped by FEMA.

FEMA flood maps are not entirely accurate. These studies and maps represent flood risk at the point in time when FEMA completed the studies and does not incorporate planning for floodplain changes due to new development since the studies were completed. Although FEMA is considering changing that policy, it is optional for local communities. Since the FEMA flood maps were completed for Benton County, man-made and natural changes to the environment have changed the course of many of the rivers and watercourses, as well as their associated floodplain boundaries.

Historical Flood Events

Yakima River Floods: Historically, the most damaging floods in Benton County have been associated with the Yakima River. Benton County is the downstream end-point for the Yakima River drainage, which contains 6,155 sq. miles, or four million acres. The areas along the lower Yakima in Benton County that are particularly susceptible to frequent flooding extend from Benton City downstream through West Richland to the delta where the Yakima empties into the Columbia River. This area is characterized by low lying river bottom lands and ancient river channels which are historically the river's natural floodway and floodplain (Benton County Comprehensive Plan). Since 1970, Benton County has been included within the area of five nationally declared flood disasters, all associated with the Yakima River.

Representative Yakima River flood events are described below (excerpted from the 2001 draft Benton County Comprehensive Flood Hazard Management Plan (CFHMP)[3]. Additional detail is available in the draft CFHMP.

February 21, 2017 Flood: Above-freezing temperatures initiated snow-melt and heavy rain caused rapid melting and increased runoff across Benton County. Numerous county roads had washouts, erosion, slides and undermining[4].

May 18, 2011 Flood (Crest: 15.5 ft): The Yakima River at Kiona crested at 15.5 feet on May 18th, which was 2.5 feet above flood stage. The flooding damaged several businesses in Prosser and farmland, roads, businesses, and residential areas from Prosser to Richland, including the Beach RV Park in Benton City and the West Richland Golf Course[5].

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[3] Benton County Comprehensive Flood Hazard Management Plan (CFHMP), March 2001. Prepared for Benton County by Tetra Tech/KCM Inc. Note – the CFHMP has not been adopted by Benton County, and therefore is referred to herein as the draft CFHMP. The draft CFHMP provides an excellent source of information on Benton County flood issues, however, it does not represent County policy.

[4] National Oceanic Atmospheric Administration: Storm Events Database. Accessed May 30, 2017. https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=683393

[5] National Oceanic Atmospheric Administration: Storm Events Database. Accessed May 30, 2017.https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=312828

January 8, 2009 Flood[6]: Heavy rainfall on deep snowpack resulted in excessive runoff and moderate flooding on the Yakima River from Easton, WA to the Columbia River. The Kiona river gage rose to 2.55 feet above flood stage.

February 11, 1996 Flood (Crest: 20.98 ft): The Feb. 11, 1996 flood is the fourth largest flood on record, it was a winter flood caused by warm weather and rainfall on top of a significant snowpack. The flood affected most of the Yakima River basin. In Benton County, Benton City, West Richland, and Richland were affected the most. Parts of Benton City were evacuated. In West Richland, two of three routes leading to Hanford and the Tri-Cities were cut off (the east approach to the Van Giesen Street Bridge and the south span of the Old Twin Bridges were inundated). Total damages were estimated at $11, 363,448 (damages from the City of West Richland not included). Note: The crest of this flood may have been 3-6 inches higher than what is listed.

December 2, 1995 Flood (Crest: 15.88 ft): This flood was a winter flood caused by unusually warm temperatures and rainfall. Benton City, West Richland, and Richland received the brunt of the flood impacts in Benton County. Trailers were moved to higher ground from the Beach Trailer Park in Benton City. West Richland evacuated residents in the Twin Bridges area and from a neighborhood northwest of the golf course, which flooded. Lowland areas surrounding Richland reported severe damage, with several houses surrounded by water. Several roads were closed, and both the Twin Bridges and Pederson Road outside of West Richland sustained damage.

November 27, 1990 Flood (Crest: 14.36 ft): This was a relatively minor winter flood also caused by high temperatures and rainfall occurring upstream. Losses were fairly minor, although approximately 40 residents within the floodplain around Benton City and West Richland were evacuated.

January 18, 1974 Flood (Crest: 18.65 ft): The January 1974 flood is the fifth largest flood on record, caused by a combination of warm weather, rainfall, and ice jams. Flood damage was extensive, and affected Prosser, Benton City, West Richland, and Richland. It was reported that 145 homes countywide had standing water at depths of 2 to 10 feet. A County Commissioner estimated total damages to roads and bridges as exceeding $175,000. Many roads were closed, including SR 22 and SR 221 between Patterson and Prosser, SR 224 from Kiona to the SR 240 junction in Richland, Horn Road between Benton City and Hanford, SR 24, and others.

December 23, 1933 Flood (Crest: 21.57 ft): The December 23, 1933 flood is the largest Yakima River flood on record. Although a winter flood caused by warm weather and heavy rains, the flood was of unusually long duration. The Yakima River had a rate of rise of six feet per day and remained out of bank for a total of 12 days. Low-lying areas around Benton City were the hardest hit, with the river near SR 224 reportedly one to two miles wide. Residents were evacuated by boat. Richland was cut off by the

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[6] National Oceanic Atmospheric Administration: Storm Events Database. Accessed June 5, 2018, https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=141623

flood except for long-distance detours, as the flood closed the SR 224 bridge and the Twin Bridges (then known as Grosscup Road). Newspaper accounts report damage to dikes, irrigation structure, highways, and loss of numerous livestock and outbuildings. The County Commissioners estimated damage to county roads at $6,300 (1933 dollars). The damage estimate did not include replacement costs for the Twin Bridges, which was washed out entirely. As a result of this flood, an extensive system of levees and flood control structures was implemented in Yakima County by the federal government, greatly reducing the threat of future floods of such magnitude for Benton County.

Columbia River Floods: Flooding has occurred in the past along the Columbia River. A flood in May 1948 inundated much of Kennewick as well as transportation routes along the river. Property damage in Benton and Franklin counties totaled $702,000 – a significant amount for the time. The most recent high-water event on the Columbia crested on June 12, 1997 at a peak flow of around 447,000 cfs outflow recorded at Priest Rapids Dam. On May 14, 2018 flow on the Columbia River reached approximately 413,000 cfs as a result of a release of water from Priest Rapids Dam. The event caused some damage to parks in Richland and Kennewick. However, these events are infrequent as Benton County, particularly the Cities of Richland and Kennewick, is now protected by dam systems along the Columbia River, including the McNary Dam.

Other County Floods: In January 1997, several small streams tributary to the Columbia River in the southern half of Benton County flooded. The flooding was caused by heavy rainfall in the lowlands that melted accumulated snow. County roads were washed out, reportedly due to inadequate sizing of roadside ditches and culverts, as well as debris and sediment blocking many structures. Total damage was estimated at $359,660 (draft CFHMP).

Wildfire

Definitions

Structure Fire: A fire of accidental or human-caused origin that results in the uncontrolled destruction of homes, businesses, and other structures in populated, urban or suburban areas.

Wildland Fire: A fire of exposure or human-caused origin that results in the uncontrolled destruction of forests, field crops and grasslands.

Wildland-Urban Interface: A fire of natural or human-caused origin that occurs in or near forest or grassland areas where isolated homes, subdivisions, and small communities are also located.

Wildland Fire Characteristics

In general, wildland fire behavior describes how fire reacts to available fuels, local topography, and current weather conditions. The relationships between these three components are dynamic; changing one condition can often exacerbate the affects that the other conditions have on fire behavior. As such, fire behavior is often modeled as a triangle with fuels, topography, and weather serving as the three sides (Figure 1). Understanding the relationships between the fire behavior components has important implications for not only managing an active wildfire but also mitigating wildfire risk. Since fuel is the only component that can be managed directly, management decisions regarding fuel types and fuel loading across the landscape need to be made based on characteristics that are inherent of the region; climate and topography. Strategic fuel breaks, conservation and restoration of native species, and prescribed burns are examples of management activities that can reduce wildfire risk and simplify the process of assessing potential wildfire behavior.

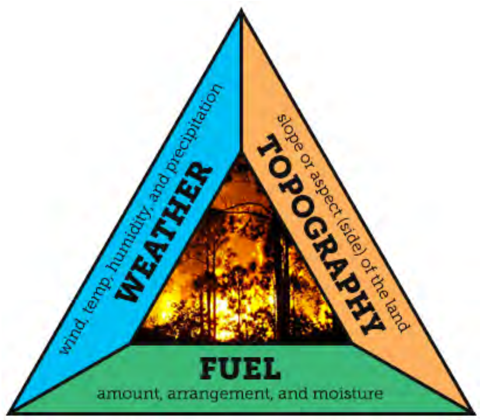

Figure 1) Fire Behavior Triangle (learn.weatherstem.com)

A brief description of each of the fire behavior elements follows in order to illustrate their effect on fire behavior.

Weather

Fire behavior is largely influenced by weather conditions. Wind, moisture levels, temperature, and relative humidity are all factors that determine the rates and which fuels dry and vegetation cures. The ignition potential of fuels is also determined by these factors; weather patterns and trends can be analyzed to determine how likely or easily a certain fuel type will ignite and if a fire will be sustained. Once started, the behavior of a wildfire is further determined by atmospheric stability and local and regional weather. As temperature, wind speed, wind direction, precipitation, storm systems, and prevailing winds all influence fire behavior, weather is the most difficult component of the fire triangle to predict and interpret. As observed in the Yarnell Hill fire in Arizona that killed 19 firefighters, a storm cell can cause a flaming front to change direction abruptly, 90 degrees in the case of the Yarnell Hill fire, and rapidly accelerate up to speeds of 10 to 15 mph.

Topography

Fires burning in similar fuel types will burn differently under varying topographic conditions. Topography alters heat transfer and localized weather conditions, which in turn influences vegetative growth and resulting fuels. Changes in slope and aspect can have significant influences on how fires burn. In General, north slopes tend to be cooler, wetter, more productive sites. This typically results in heavy fuel accumulations, high fuel moistures, lower rates of curing for fuels, and lower rates of spread. In contrast, south and west slopes tend to receive more direct sun and therefore have the highest temperatures, lowest soil and fuel moistures, and lightest fuels. The combination of light fuels and dry sites leads to fires that typically display the highest rates of spread. These slopes also tend to be on the windward side of mountains which means they tend to be “available to burn” for a greater portion of the year. Slope also plays a significant role in the rate of spread of a fire as fuels upslope from the flaming front are subjected to preheating which means that they readily combust as the fire draws closer. The preheating process is exacerbated as slope increases which results in greater rates of spread and increased flame lengths. Therefore, steep slopes with a south –southwest aspect generally promote intense fire behavior due to dry fuels and the likelihood of predominant, westerly winds.[7]

Fuels

In the context of wildfire, fuels describe any organic material, dead or alive, found in the fire environment. Grasses, brush, branches, logs, logging slash, forest-floor litter, conifer needles, and buildings are all examples of fuel types. The physical properties and characteristics of fuels govern how fires burn. Fuel loading, size and shape, moisture content, and continuity and arrangement all have an effect on fire behavior. In general, the smaller and finer the fuels, the faster the potential rate of fire spread. Small fuels such as grass, needle litter and other fuels less than a quarter inch in diameter are most responsible for fire spread. Fine fuels, those with high surface to volume ratios, are considered the primary carriers of surface fire. As fuel size increases, the rate of spread tends to decrease due to a decrease in the surface to volume ratio. Fires in large fuels generally burn at a slower rate but release much more energy and burn with much greater intensity. This increased energy release, or intensity, makes these fires more difficult to control.[8]

Fuels are classified by diameter as that has important implications for fuel moisture retention. The smaller the diameter, the more quickly the moisture content of a given fuel type changes while larger diameter fuels take longer to change. In terms of fire potential on the landscape and fire suppression, the amount of time that is required for a fuel type to become volatile is critical which is why instead of referring to fuels by size, they are referred to as either one hour, ten-hour, 100 hour, or 1000 hour fuels.

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[7] Auburn University website https://fp.auburn.edu/fire/topos_effect.htm. Accessed December 2016

[8] Gorte, R. 2009. Congressional Research Service, Wildfire Fuels and Fuel Reduction.

This method of classifying fuels describes the amount of time required for a particular fuel's status to change from non-combustible to combustible as a result of altered moisture levels in the surrounding environment.

Wildfire Hazards

In the 1930s, wildfires consumed an average of 40 to 50 million acres per year in the contiguous United States, according to US Forest Service estimates. By the 1970s, the average acreage burned had been reduced to about 5 million acres per year. Accounting for the substantial reduction in burned acreage was an increase in fire suppression efforts and development of firefighting equipment and strategy. Since 1970, about 3.5 million acres burn annually in the western U.S. The 2014 wildfire season set a new record for 31 days at Preparedness Level (PL) 5 and had one of the largest wildfires in Washington History, the Carlton Complex at 256,108 acres. There was a total of 425,136 acres consumed in the state of Washington.

The potential volatility of a fire season can be predicted from winter snowfall, snowpack longevity, spring temperatures, and total precipitation. When winter snowfall is limited and snowpack melts early due to warm spring temperatures, conditions begin to favor fire activity as fine fuels dry out and spring storms generate lighting and high winds. Additionally, human activity increases in natural areas and recreation areas in warm weather months; typically, April through October in the Columbia River Basin. This increases the likelihood of a human-caused ignition, particularly in natural areas where fuels are abundant, that could result in a wildfire, threatening both populated areas and natural resources.

Fire History

Historically, most plant communities in the state of Washington were fire-adapted and burned at fairly regular intervals. Frequent, low intensity fires limited fuel accumulation across the landscape and contributed to the distribution of native, fire-adapted plant communities. In contrast to modern day conditions, fire return intervals (the amount of time between fires in a defined area) were shorter but fires burned with less intensity. Shorter return intervals between fire events often resulted in less dramatic changes in plant species composition. Across the landscape, fires typically burned 1 to 50 years apart in a given area with most fire returning between 5 and 20 years. With infrequent return intervals, plant communities tended to burn more severely and be replaced by vegetation communities different in composition, structure, and age. Native plant communities in this region developed under the influence of fire. These adaptations to fire are evident at the species, community, and ecosystem levels.

Fire history for Benton County is largely unknown, but large fires that have occurred since the 1980's are well document and have been mapped. Local knowledge suggests that Native Americans did historically perform burns which played an important role in shaping the vegetation throughout the county. The Bureau of Land Management is helping to fund future research to further map fire history in central Washington through fire scars and charcoal deposits. Although this data is not available for the development of this document, it should be available for a future update of this plan.

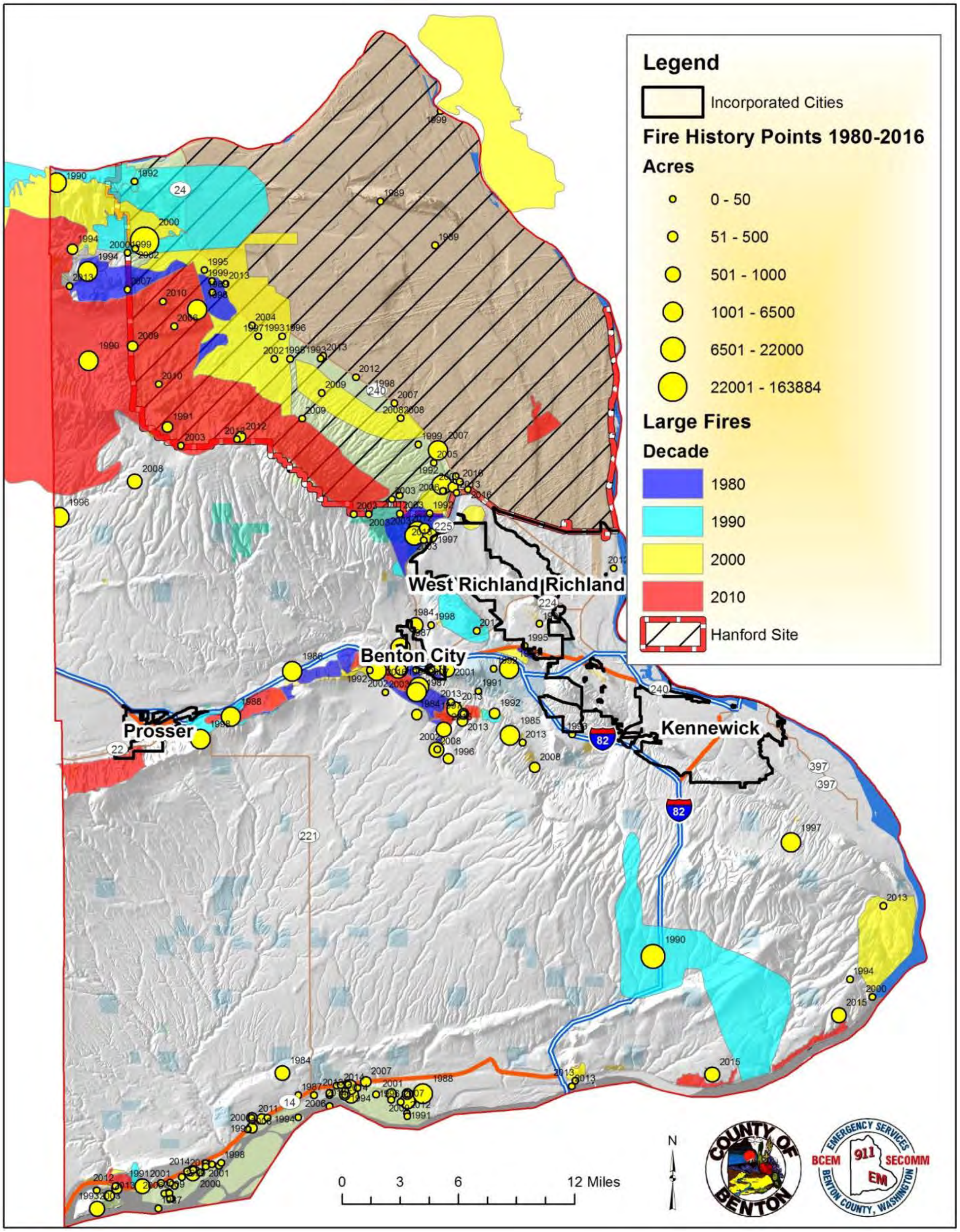

Figure 2) Fires by decade and acreage for Benton County, WA.

Since 1980, fire activity has largely been concentrated in the northern third of Benton County as well as the slopes of the Horse Heaven Hills along the south side of I-82 and in the Badger Mountain area. Numerous small fires have also occurred along at the southern end of the county along the Columbia River (Figure 2). Looking at Figure 2, it appears that most of wildfires that have occurred in Benton County were in proximity to road systems or recreational areas which would support that most fires were human-caused. Ignition causes are displayed in Figure 3 in the Wildfire Ignition Profile section. Historical fires at least 1000 acres in size that have occurred in Benton County since 1980 are summarized in Table 3. Benton County has had six wildfires between 10,000-99,000 acres and two that were 100,000 acres or larger. The 24 Command fire that occurred in 2000 was the largest wildfire in Benton County since 1980. It burned upwards of 192,000 acres and came within two miles of the radioactive waste storage tanks located at the Hanford Site. Most recently was the Bofer Fire that started on August 8th, 2018. It started along the highway and destroyed five homes and damaged four others.

Table 3) History of wildfires 300 acres in size or larger for Benton County, WA since 1981. Acres denoted with an asterisk (*) were taken from wildfire GIS layers.

Name of Fire (Street)	Date	Cause	Acres Burned	Agency	Source
Horse Heaven Hills	1981	Unknown	5,440		BLM
SR395 (HWY14/27th)	6/26/1981	Unknown	600	BC#1	Tri City Herald
Rancho Reata	6/27/1981	Unknown	900	BC#1	Tri City Herald
Silver Dollar	7/1/1981	Unknown	25,600	HFD	Tri City Herald
Candy Mountain #1	7/25/1981	Unknown	3000	BC#4	Tri City Herald
Keene (Hwy 12)	7/28/1981	Human	700	BC#4	Tri City Herald
Coyote Canyon (Clodfelter)	8/4/1981	Welder / Grinder	500	BC#1	Tri City Herald
1981 -TOTAL ACRES			**36,740**		
Yakima Ridge	1982	Unknown	26,880		
1982 -TOTAL ACRES			**26,880**		
Meals (Yellepit)	7/9/1985	Unknown	2,000	BC#1	Tri City Herald
Badger Canyon	7/21/1985	Unknown	3,000	BC#1	Tri City Herald
1985 -TOTAL ACRES			**5,000**		
Chandler	1986	Natural	1,207	BC#2 (?)	BLM
Jump Off Joe	8/24/1986	Unknown	500	BC#1	Tri City Herald
Goose Gap (182)	9/4/1986	Controlled Burn	500	BC#1	Tri City Herald
1986 -TOTAL ACRES			**2,207**		
Drilling	1987	Human	3,190		
Benton	1987	Human	2,070		BLM

Trinity & Horne	9/3/1987	Unknown	2,150	BC#2	Tri City Herald
Nine Mile (Lower Blair)	9/1/1987	Human	900	BC#1	Tri City Herald
1987 -TOTAL ACRES			**8,310**		
Gibbon	1988	Human	1,320		BLM
Candy Mountain	7/1/1988	Exhaust Sparks	650	BC#4	Tri City Herald
1988 -TOTAL ACRES			**1970**		
Ely (53rd)	8/19/1989	Lightning	300	KFD	Tri City Herald
1989 -TOTAL ACRES			**300**		
Locust Grove (I-82)	7/30/1990	Lightning	30,000	BC#1	Tri City Herald
Emerson	1990	Natural	3,700		BLM
Nake	1990	Human	1,345		BLM
Wilkerson Ranch	8/1/1990	Unknown	3,500	BC#1	Tri City Herald
1990 -TOTAL ACRES			**38,545**		
Coline	1991	Human	767*		
1991 -TOTAL ACRES			**767***		
Webber 2	1992	Unknown	323*		
Edwards (Locust)	6/26/1992	Exhaust Pipe	1,200	BC#1	Tri City Herald
Jump Off Joe	7/4/1992	Fireworks		BC#1	
Flat Top	7/19/1992	Controlled Burn (?)	400	BC#4	Tri City Herald
1992 -TOTAL ACRES			**1,600**		
McNary Dam	6/7/1993	Unknown	400	BC#1/BC#6	Tri City Herald
Ely (53rd; Inspiration Point)	7/11/1993	Unknown	2,000	KFD	Tri City Herald
Candy Mountain	7/21/1993	Unknown	300	BC#4	Tri City Herald
Red Mountain (Ruppert)	11/3/1993	Unknown	2,000	BC#4	Tri City Herald
1993 -TOTAL ACRES			**4,700**		
Cold Creek (Silver Dollar)	7/22/1994	Unknown	11,520	HFD	Tri City Herald
Johnson Butte (Bateman)	7/28/1994	Unknown	1,500	BC#1	Tri City Herald
Badger Canyon (Triple Vista, Clodfelter)	8/15/1994	Unknown	2,000	BC#1	Tri City Herald
1994 -TOTAL ACRES			**15,020**		
North of Plymouth	8/7/1995	Unknown	500	BC#6	Tri City Herald
1995 -TOTAL ACRES			**500**		
Silver Dollar	1996	Unknown	1,094*		BLM
Appaloosa	1996	Unknown	2,687*	RFD (?)	BLM
Ayers Road	1996	Unknown	7,000	BC#1	Ch. Click

Red Mountain	7/30/1996	Unknown	2,000	BC#4	Tri City Herald
Cold Creek	1996	Unknown	58,000	HFD	Tri City Herald
1996 -TOTAL ACRES			**70,781**		
Corral Canyon	1997	Unknown	1,313*	BC#2	BLM
Meals (Hover)	7/31/1997	Lightning (?)	750	BC#1	Tri City Herald
Hover (Ayers)	8/14/1997	Equipment (?)	1,500	BC#1	Tri City Herald
Olympia St. Fire (Oly & 73rd)	8/26/1997	Unknown	6,000	BC#1/KFD	Tri City Herald
1997 -TOTAL ACRES			**9,563**		
Coyote Canyon (Clodfelter)	1998	Unknown	500	BC#1	Tri City Herald
Prosser View Point (SR 221)	7/7/1998	Human	3,880	BC#3(WBFD) / BC#5	Tri City Herald
I-82 (Yakitat)	7/8/1998	Unknown	2,000	WBFR/BC#2	Tri City Herald
Rattlesnake Mtn. West of Hanford	7/28/1998	Lightning	6,000	HFD	Tri City Herald
1998 -TOTAL ACRES			**12,380**		
Command 24	2000	Human / Car Accident	192,000	HFD, BC#2, US F&W	BLM
2000 -TOTAL ACRES			**192,000**		
Rt 4 N/Rt 1	6/1/2001	Lightning	1,250	HFD	State Fire Marshal's Office
Candy Mountain	6/18/2001	Unknown	750	BC#4	State Fire Marshal's Office
Ayers Rd	7/12/2001		4,000	BC#1	State Fire Marshal's Office
2001 -TOTAL ACRES			**6,000**		
Hwy 24	2002	Human	4,800		BLM
McBee	2002	Unknown	1,771*		BLM
Nine Canyon (Holtziner Farms	6/12/2002	Debris Burning / Torch	600	BC#1	State Fire Marshal's Office
(Hinzerling N of Prosser (?))	7/13/2002	Lightning	1,200	BC#3 (WBFR)	State Fire Marshal's Office
Johnson Butte	7/16/2002	Unknown	1,200	BC#1	State Fire Marshal's Office
Ayers (Meals)	7/28/2002	Unknown	400	BC#1	State Fire Marshal's Office
2002 -TOTAL ACRES			**9,971**		
Horn Rapids Fire	2003	Unknown	1,227*		BLM
Shooting Range	2003	Human	1,391		BLM
(12510 E Kennedy Rd)	6/30/2003	Equipment	300	BC#2	State Fire Marshal's Office

(MP 9 SR 225)	7/16/2003	Unknown	1,750	BC#2	State Fire Marshal's Office
(32203 Clodfelter Rd)	10/12/2003	Unknown	3,000	BC#1	State Fire Marshal's Office
2003 -TOTAL ACRES			**7,668**		
(MP 118 I-82)	7/14/2004	Unknown	700	BC#1	State Fire Marshal's Office
(MP 118 I-82)	8/26/2004	Unknown	700	BC#1	State Fire Marshal's Office
2004 -TOTAL ACRES			**1,400**		
Lincoln Grade	5/26/2005	Unknown	300	BC#6	State Fire Marshal's Office
Painted Hills (1415 Scenic)	5/26/2005	Incendiary / Model Rocket	1,000	Prosser FD (WBFR)	State Fire Marshal's Office
Hammer Command	6/17/2005	Incendiary / Blasting Agent	1,270	Hanford FD	State Fire Marshal's Office
Kirk (Meals)	7/25/2005	Unknown	3,500	BC#1	State Fire Marshal's Office
McNary Farms Dr.	8/14/2005 (@1400)	Unknown	500	BC#6	State Fire Marshal's Office
McNary Farms Dr.	8/14/2005 (@2000)	Unknown	500	BC#6	State Fire Marshal's Office
MP 86 I-82	8/15/2005	Unknown	600	BC#4	State Fire Marshal's Office
MP 87 I-82	8/19/2005	Equipment	1500	BC#3 (WBFR)	State Fire Marshal's Office
2005 -TOTAL ACRES			**9,170**		
Les Blair	2007	Unknown	7,038*	BC#1	BLM
Wautoma (SR 241)	8/16/2007	Unknown	67,303*	Hanford FD	BLM
Milepost 17	2007	Unknown	6,453*		BLM
(SR 225)	5/12/2007	Shooting	2,500	BC#2	State Fire Marshal's Office
(Harrington / Twin Bridges / Berto)	6/13/2007	Equipment	400	BC#4	State Fire Marshal's Office
(MP 126 I-82)	6/16/2007	Unknown	3,000	BC#6	State Fire Marshal's Office
(MP 126 I-82)	6/17/2007	Unknown	2,000	BC#6	State Fire Marshal's Office
(MP 88 I-82)	6/25/2007	Unknown	400	Hanford FD	State Fire Marshal's Office
(Hover Rd)	7/2/2007	Unknown	740	BC#1	State Fire Marshal's Office
McBee	7/13/2007	Natural	4,000	BC#2	State Fire Marshal's Office

(Finley Rd/Lower Les Blair)	7/29/2007	Equipment	3,000	BC#1	State Fire Marshal's Office
(Meals/Gamefarm (?))	8/4/2007	Incendiary	300	BC#1	State Fire Marshal's Office
2007 -TOTAL ACRES			**97,134**		
(I-82 / Beck EB)	6/30/2008	Natural	450	BC#1	State Fire Marshal's Office
(Hammer Training Facility)	8/8/2008	Lightning	549	Hanford FD	State Fire Marshal's Office
(Jump Off Joes Near West Powerlines)	8/15/2008	Unknown	1,200	BC#1	State Fire Marshal's Office
2008 -TOTAL ACRES			**2,199**		
(38714 W Oie)	6/9/2009	Unknown	2,000	BC#2	State Fire Marshal's Office
(SR 397 / Nine Canyon)	6/29/2009	Equipment	586	BC#1	State Fire Marshal's Office
Dry Creek Complex	8/21/2009	Natural	48,931*	HFD / BC#1 (Multiple)	BLM
2009 -TOTAL ACRES			**51,517**		
	8/6/2010		1,164	Hanford FD	State Fire Marshal's Office
FFTF	8/18/2010		1,265	Hanford FD	State Fire Marshal's Office
(Lower Blair W of Nine Canyon)	8/21/2010	Natural	542	BC#1	State Fire Marshal's Office
(Jump Off Joe?)	8/21/2010	Natural	1,200	Hanford FD	State Fire Marshal's Office
(Ayers/Meals)	8/26/2010	Equipment	500	BC#1	State Fire Marshal's Office
2010 -TOTAL ACRES			**4,671**		
(Finley Rd./E. Kirk)	7/20/2011	Other	1300	BC#1	State Fire Marshal's Office
(Finley Rd./Albright)	7/22/2011	Explosives	1300	BC#1	State Fire Marshal's Office
	8/2/2011	Equipment	400	Hanford FD	State Fire Marshal's Office
(Meals/Ayers)	8/6/2011	Equipment	400	BC#1	State Fire Marshal's Office
(Ownes/HWY 397)	8/12/2011	Other	400	BC#1	State Fire Marshal's Office
2011 -TOTAL ACRES			**3,800**		
(SR 241 MP 24)	7/19/2012	Human	4,515	Hanford FD	BLM
(56205 E. Badger Rd.)	7/19/2012	Natural	400	BC#1	State Fire Marshal's Office

(38507 E. Ridge Crest Dr.)	8/13/2012	Equipment	300	BC#4	State Fire Marshal's Office
(SR 397)	8/17/2012	Other	305	BC#1	State Fire Marshal's Office
(Beck Rd.)	9/16/2012	Other	400	BC#1	State Fire Marshal's Office
2012 -TOTAL ACRES			**5,920**		
(106207 E 297 PR SE / Clodfelter)	6/11/2013	Other	750	BC#1	State Fire Marshal's Office
	6/17/2013	Natural	500	BC#1 (ST 160 Area)	State Fire Marshal's Office
Kelandren Dr.	8/6/2013	Electrical Distribution	350	BC#3 (WBFR)	State Fire Marshal's Office
Les Blair	8/9/2013	Unknown	11,000	BC#1	State Fire Marshal's Office
2013 -TOTAL ACRES			**12,600**		
132016 E. Locust Grove Rd.	5/27/2014	Equipment	310	BC#1	State Fire Marshal's Office
26604 Badger Rd.	7/6/2014	Unknown	600	BC#1	State Fire Marshal's Office
(I82 EB MP 87)	7/15/2014	Other	2,100	BC#3 (WBFR)	State Fire Marshal's Office
(I82 MP 126)	7/23/2014	Unknown	500	BC#1	State Fire Marshal's Office
(ST 62 (?))	8/20/2014	Natural	500	KFD	State Fire Marshal's Office
2014 -TOTAL ACRES			**4,010**		
Clodfelter	2015	Unknown	485	BC#1	CH Click
(Meals/Ayers)	6/5/2018	Undetermined	485	BC#1 & BC#3 (WBFR)	State Fire Marshal's Office
(143504 Finley / Spaw Canyon)	6/27/2015	Other	2800	BC#1	State Fire Marshal's Office
(SR 397/OLY/I-82)	7/12/2015	Undetermined	350	BC#1	State Fire Marshal's Office
(I82 / MP88)	10/10/2015	Other	460	BC#3 (WBFR)	State Fire Marshal's Office
2015 -TOTAL ACRES			**4,580**		
McBee Command	7/14/2016	Shooting	5,000	BC#2 & WBFR	State Fire Marshal's Office
327255 E SR 397	7/13/2016	Other	400	BC#1	State Fire Marshal's Office
Bennett Rd.	7/30/2016	Other	12,800	WBFR	State Fire Marshal's Office

Range 12	7/30/2016	Shooting	175,491	Multiple	BLM
South Ward Gap	7/31/2016		7,000	WBFR	State Fire Marshal's Office
2016 -TOTAL ACRES			**198,691**		
Silver Dollar	7/2/2017	Unknown	15,000	HFD (?)	Inciweb
Candy Mountain	9/8/2017	Other	450	BC#4	Fire Marshall
2017 -TOTAL ACRES			**15,450**		
Rt 4 South	2018	Lightning	2,800	Hanford FD	Hanford FD
Les Blair	6/4/2018	Railroad Maintenance	875	BC#1	BC#1
Easterday	6/22/2018	Power pole malfunction	1,000	BC#1	BC#1
Shooting Range	6/25/2018	Shooting	500	BC#2 / USFWS	BC#2
Montecito Fire (Kelandren)	6/27/2018	Possible Electrical Fire	1,877	WBFR	WBFR
Weber Canyon	7/13/2018	Shooting or fireworks	300	BC#2 & BLM (?)	BC#2
Locust Grove	7/21/2018	Farm Equipment	2,275	BC#1	BC#1
Bofer	8/11/2018	Human	5,000	BC#1 / KFD	BC#1
Wagon Wheel	9/1/2018	Electrical Distribution and Squirrel	4,000	BC#2	BC#2
2018 -TOTAL ACRES			**18,627**		

Wildfire Ignition Profile

Detailed records of wildfire ignitions and extents from the Washington Department of Natural Resources (DNR) and Bureau of Land Management (BLM) have been analyzed. In interpreting these data, it is important to keep in mind that the information represents only the lands protected by the agency specified and may not include all fires in areas covered only by local fire departments or other agencies. Because the data that was used was only a subset and did not contain all ignitions from 1983 to 2016, it seemed reasonable to assume that the ratio of ignition causes could be a fair representation of average annual fire activity in Benton County.

From 1983 to 2016, almost 7,700 acres burned per year in Benton County (Table 4). The majority of fires that occurred were related to human activity, 83% of total ignitions per year on average, while others originated naturally, or the source of ignition was unknown (Figure 3). The greatest number of acres burned in a single year in Benton County occurred during the 2000 fire season with just over 164,000 acres burned.

Table 4) Number and type of ignitions and acreage burned by wildfire from 1983 to 2016 in Benton County, Wa. Due to uncertainty over the dataset, only the ratio of ignition causes is presented in the table while actual ignition count values are omitted.

Cause	Percent of Total Ignitions by Cause	Total Acreage	Avg. Annual Acreage Burned
Human	83%	216,891	6,379
Natural	15%	39,764	1,170
Unknown	2%	5,029	148
Total	**100%**	**261,684**	**7,697**

Based on the agencies' combined datasets specific to Benton County, there has been an increase in the number of ignitions occurring annually within Benton County and, based on data provided by Benton County, an increase in acreage burned annually since 1983.

The increasing trend observed in annual acreage burned by wildfire in Benton County (Figure 4) matches the national trend (Figure 7). One factor that likely explains the trend is the extensive grassland fuel type found throughout most of Benton County and the increasing component of cheat grass and other invasive species found across the landscape. Fuel loading and distribution across the landscape is largely dependent on spring precipitation. Increased fuel loads and greater fuel continuity often mean that the potential for wildfire and more severe fire behavior also increases. Cheat grass and other invasive species have almost certainly spread and become a greater component of grassland landscapes in Benton County since 1983. Cheat grass changes the fire regime of native plant communities by altering fire behavior and reducing fire return intervals. As cheat grass becomes a greater component of grasslands in Benton County, any infested areas will burn more often, and more acreage will likely burn before a fire is suppressed. This may also explain the increase in the number of annual fire starts occurring in Benton County since 1983 (Figure 5) which is the opposite of the national trend which indicates a decrease in the number of fire starts occurring each year (Figure 8). As population, vehicle traffic, and human activity increase in Benton County an increased number of fire-starting events should be expected.

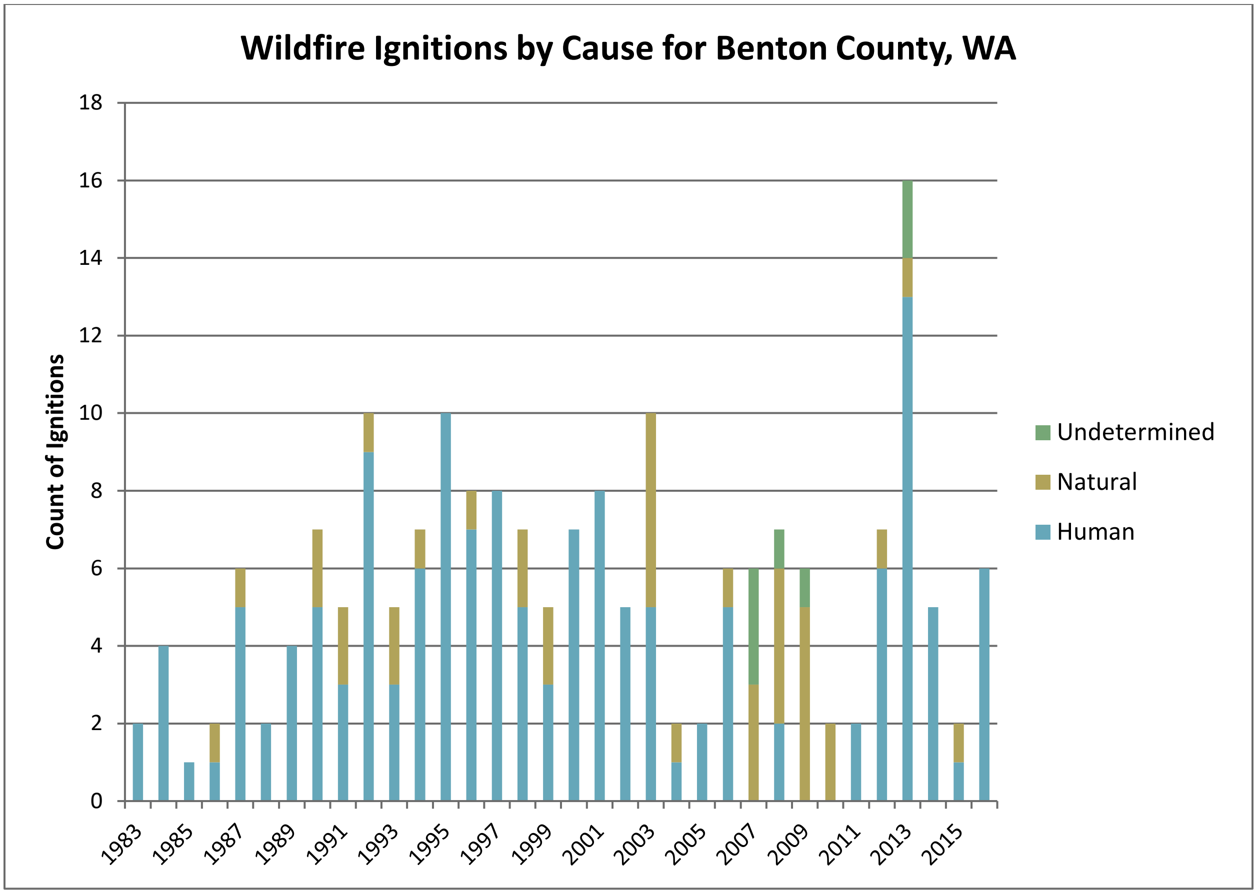

Figure 3) Number of wildfire ignitions by cause for Benton County, Washington from 1983 to 2016.

The data reviewed above provides a general picture regarding the level of wildland-urban interface fire risk within Benton County. There are several reasons why the fire risk may be even higher than suggested above, especially in developing wildland urban interface areas.

1) Large fires may occur infrequently, but statistically they will occur. One large fire could significantly change the statistics. In other words, 40 years of historical data may be too short to capture large, infrequent wildland fire events.
2) The level of fire hazard depends profoundly on weather patterns. A several year drought period would substantially increase the probability of large wildland fires in Benton County. For smaller areas, with grass, brush and small trees, a much shorter drought period of a few months or less would substantially increase the fire hazard.
3) The level of fire hazard in WUI areas is likely significantly higher than for wildland areas as a whole due to the greater risk to life and property. The probability of fires starting in interface areas is much higher than in wildland areas because of the higher population density and increased activities. Many fires in the WUI are not recorded in agency datasets because the local fire department responded and successfully suppressed the ignition without mutual aid assistance from the state or federal agencies.

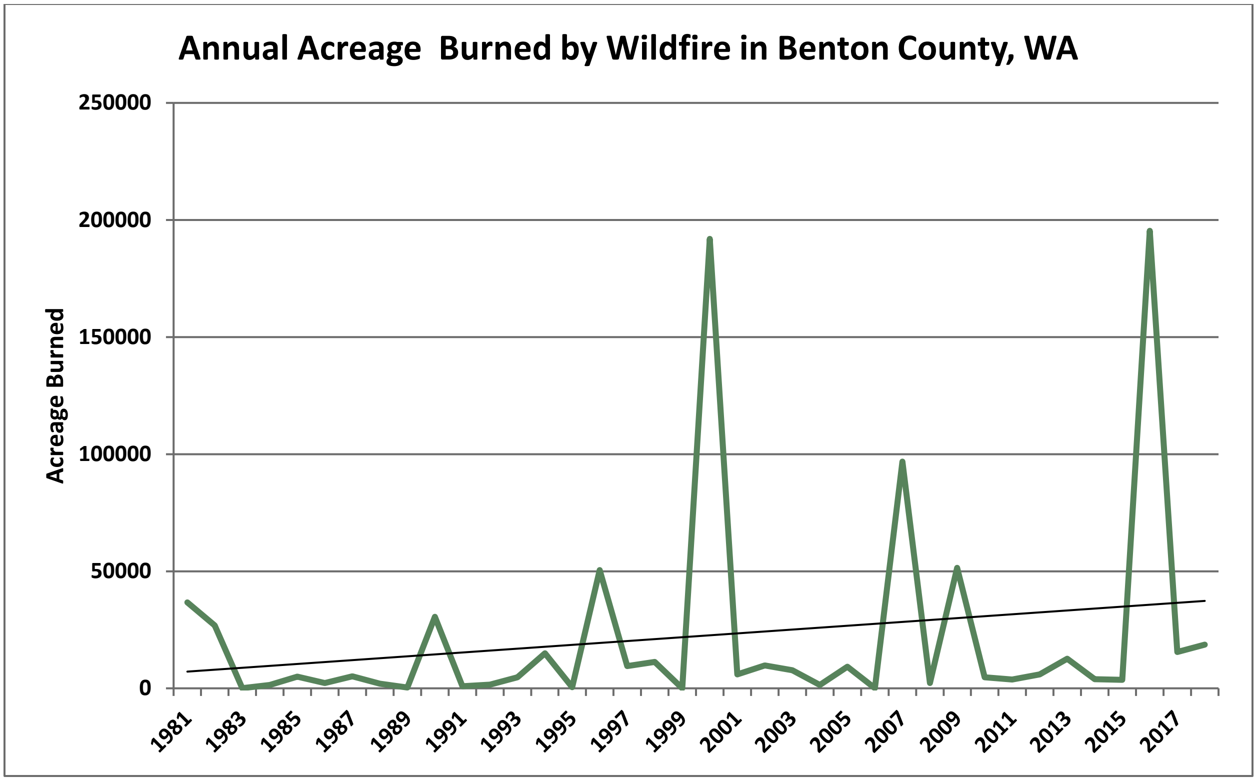

Figure 4) Acreage burned annually by wildfire in Benton County, WA from 1983 to 2016.

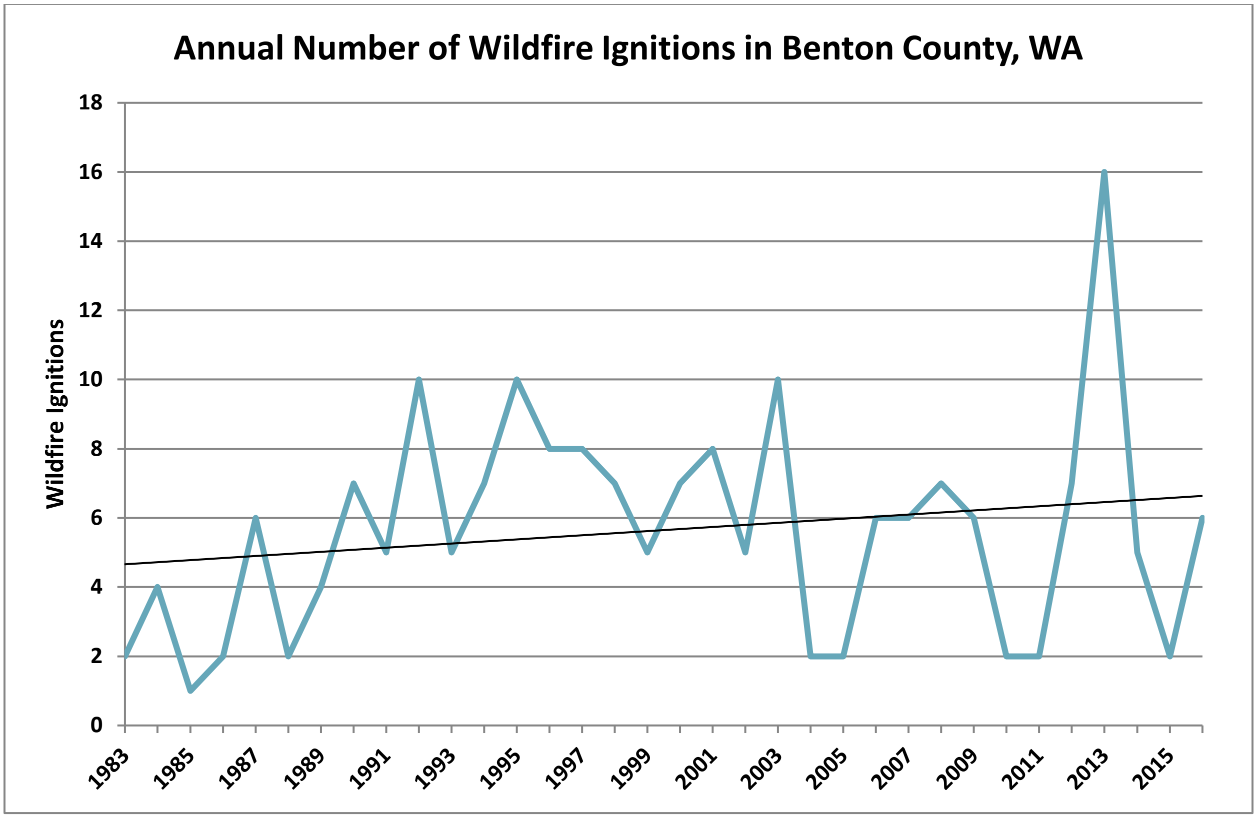

Figure 5) Annual number of wildfire ignitions in Benton County, WA from 1983 to 2016.

Wildfire Extent Profile

The National Interagency Fire Center and the National Incident Coordination Center maintains records of fire costs, extent, and related data for the entire nation. The number of wildland fire starts, total acreage burned, and annual cost to control figures were created using data from end-of-year reports compiled by all wildland fire agencies after each fire season. The agencies include the Bureau of Land Management, Bureau of Indian Affairs, National Park Service, US Fish and Wildlife Service, Forest Service, and all state agencies.

Across the west, wildfires have been increasing in extent and cost of control (Figure 6). Even though the number of fires that occur annually has decreased since 1990 (Figure 8), the total number of acres burned has increased (Figure 7). Over the last few decades summers have become warmer and drier; this trend has had significant implications for the severity of recent fire seasons, particularly in areas where decades of fire suppression have resulted in overstocked stands and heavy fuel loading. However, the inverse relationship between total number of fires and total acres burned can likely be attributed to a few other factors as well. Fire awareness programs have likely reduced the number of fire starts per season by making the public more cognizant of the impacts of wildfire and therefore more diligent when recreating or working in high risk areas. While in addition to recent climate trends, the increase in acreage burned each year can partially be attributed to changes in wildland firefighting tactics and emphasis on safety. In some situations, fire management teams are electing to intentionally burn additional acreage with a back-burn operation or let the fire burn itself out or burn to a point where it can be contained with a greater level of assurance and under safer conditions.

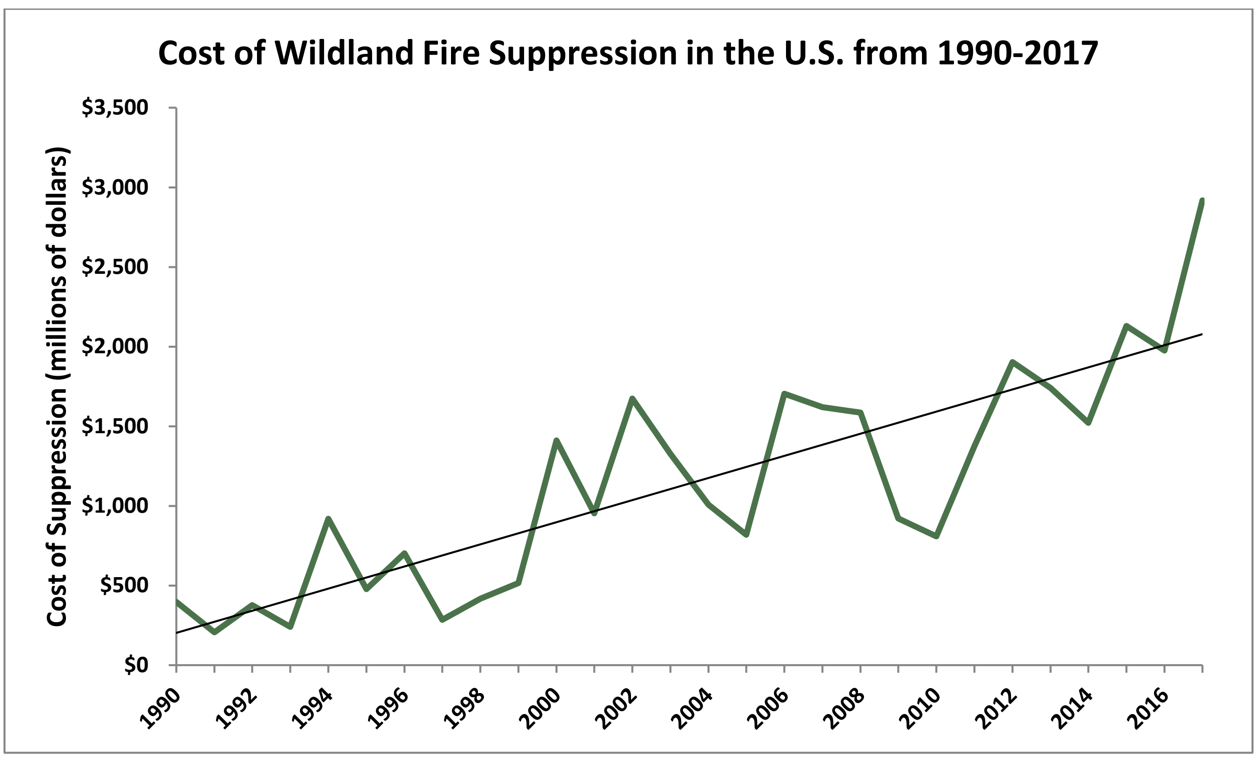

Figure 6) Annual cost of wildland fire suppression in the United States from 1990 to 2017. Values were not adjusted for inflation.

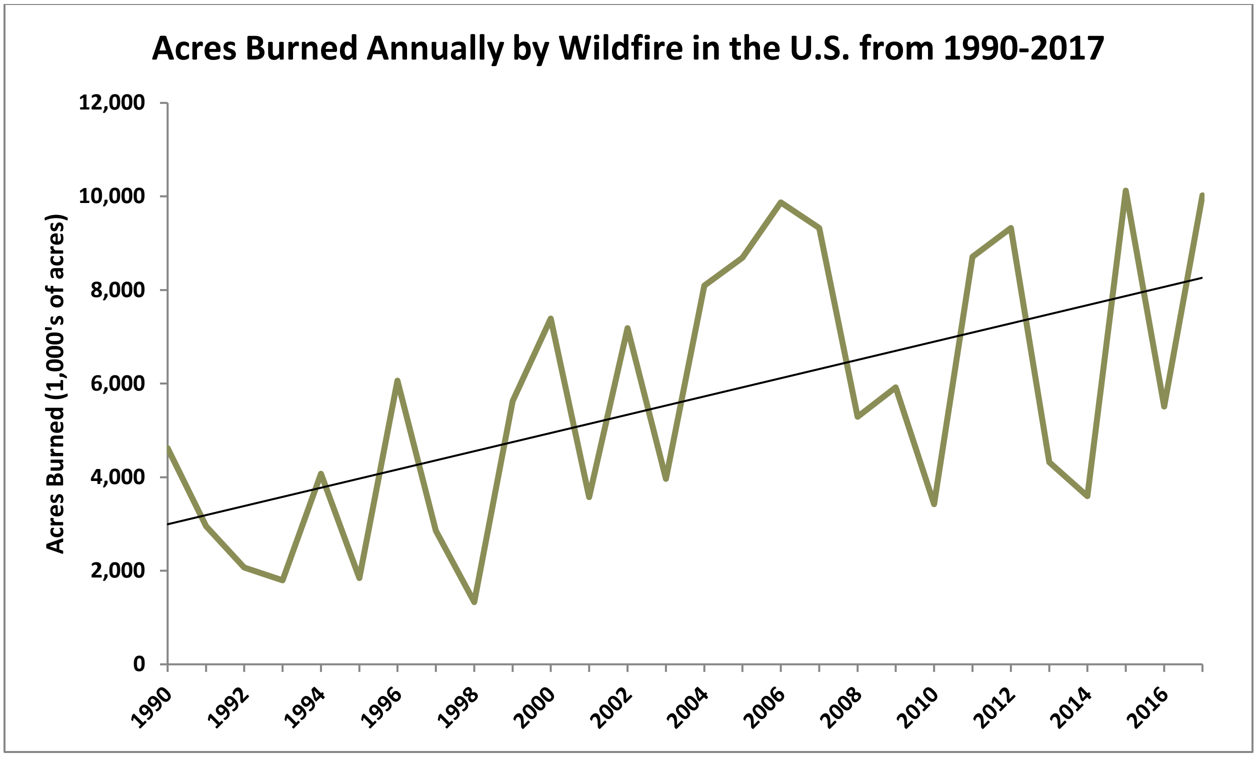

Figure 7) Annual acreage burned as a result of wildfire in the United States from 1990 to 2017.

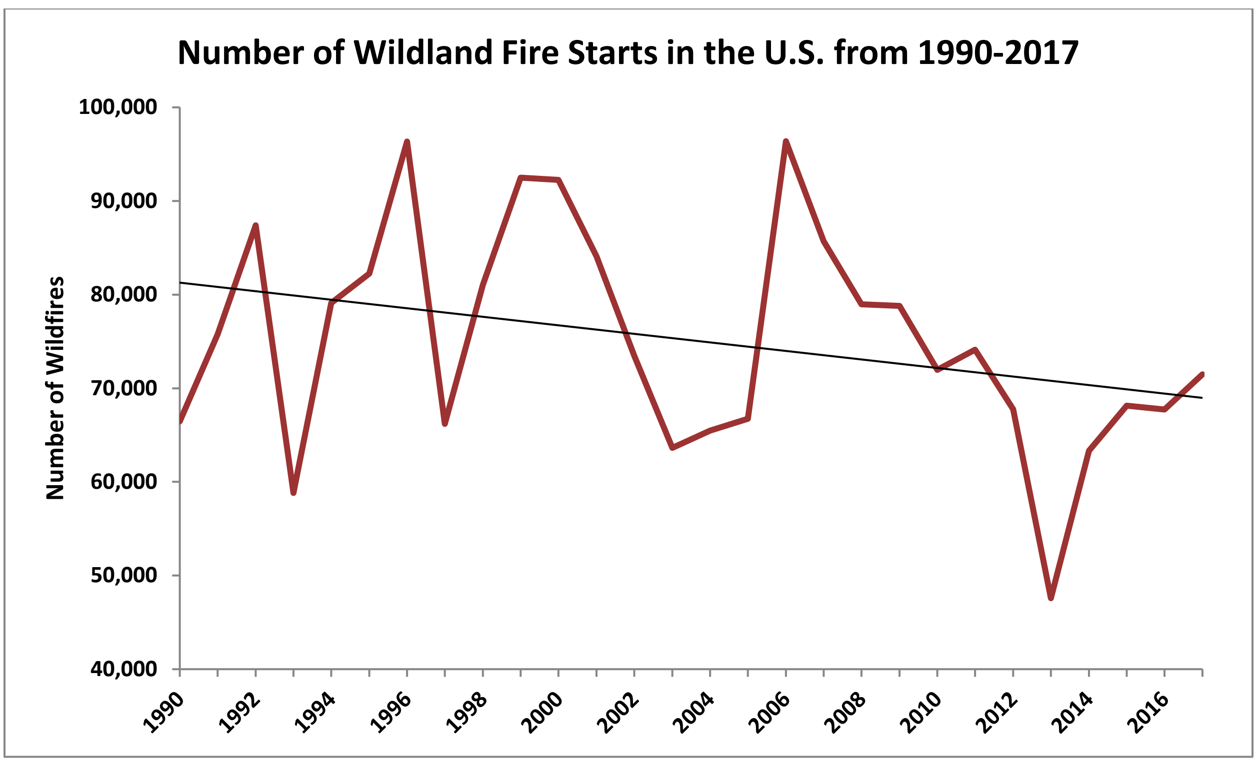

Figure 8) Annual number of wildland fire starts in the United States from 1990 to 2017.

The trends displayed in these figures are likely to continue into future fire seasons. Particularly as fire seasons extend earlier and later into the year and conditions become more volatile at the hottest and driest times of the year. As populations continue to increase and the WUI expands, more people, structures, and infrastructure will be exposed to wildfire risks which continue to increase the value of fire planning and fire mitigation work.

The fire suppression agencies in Benton County respond to numerous wildland fires each year, but few of those fires grow to a significant size. According to national statistics, only 2% of all wildland fires escape initial attack. However, that 2% accounts for the majority of fire suppression expenditures and threatens lives, properties, and natural resources. These large fires are characterized by a size and complexity that require special management organizations drawing suppression resources from across the nation. These fires create unique challenges to local communities by their quick development and the scale of their footprint.

Wildfire Hazard Assessment

Benton County was analyzed using a variety of models, managed on a Geographic Information System (GIS) system. Physical features of the region including roads, streams, soils, elevation, and remotely sensed images were represented by data layers. Field visits were conducted by Benton County Emergency Management personnel and specialists from Northwest Management, Inc. Discussions with area residents and local fire suppression professionals augmented field visits and provided insights into forest health issues and treatment options. This information was analyzed and combined to develop an objective assessment of wildland fire risk in the region.

Historic Fire Regime

Historical variability in fire regime is a conservative indicator of ecosystem sustainability, and thus, understanding the natural role of fire in ecosystems is necessary for proper fire management. Fire is one of the dominant processes in terrestrial systems that constrain vegetation patterns, habitats, and ultimately, species composition. Land managers need to understand historical fire regimes, the fire return interval (frequency) and fire severity prior to settlement by Euro-Americans, to be able to define ecologically appropriate goals and objectives for an area. Moreover, managers need spatially explicit knowledge of how historical fire regimes vary across the landscape.

A primary goal in ecological restoration is often to return an ecosystem to a previously existing condition that no longer is present at the site, under the assumption that the site's current condition is somehow degraded or less desirable than the previous condition and needs improvement.

Many ecological assessments are enhanced by the characterization of the historical range of variability which helps managers understand: (1) how the driving ecosystem processes vary from site to site; (2) how these processes affected ecosystems in the past; and (3) how these processes might affect the ecosystems of today and the future. Historical fire regimes are a critical component for characterizing the historical range of variability in fire-adapted ecosystems. Furthermore, understanding ecosystem departures provides the necessary context for managing sustainable ecosystems. Land managers need to understand how ecosystem processes and functions have changed prior to developing strategies to maintain or restore sustainable systems. In addition, the concept of departure is a key factor for assessing risks to ecosystem components. For example, the departure from historical fire regimes may serve as a useful proxy for the potential of severe fire effects from an ecological perspective.

This model uses only the current vegetation types to determine the historic fire regime. Native Americans reportedly burned throughout the county on a regular basis. The vegetation types were much different pre-Euro-American settlement than they are today and believed to be a more grassland dominated landscape.

Using the Fire Regime Group model, fire return intervals and anticipated fire behavior can be mapped for Benton County based on current vegetative cover (Figure 9). Fire return interval describes the amount of time that can be expected to elapse before a given area will burn again and severity describes the duration and intensity at which a fire burns. Just over 93% of Benton County is classified as Fire Regime Groups III and IV which means that most of the county has an expected fire return interval of 35 to 200 years and will burn with low to stand-replacement levels of severity (Table 5). Areas classified as Fire Regime Group III will likely burn with low to mixed severity while areas that are classified as Fire Regime Group IV can be expected to burn with high severity. The remaining area of Benton County either falls into different Fire Regime Groups (2.1% of remaining area) or is non-burnable.

Table 5) Fire Regime Groups for Benton County, WA.

Designation	Description	Acres	% Total
Fire Regime Group I	<= 35 Year Fire Return Interval, Low and Mixed Severity	1,216	0.1%
Fire Regime Group II	<= 35 Year Fire Return Interval, Replacement Severity	8,221	0.7%
Fire Regime Group III	35 - 200 Year Fire Return Interval, Low and Mixed Severity	372,737	33.1%
Fire Regime Group IV	35 - 200 Year Fire Return Interval, Replacement Severity	676,879	60.1%
Fire Regime Group V	> 200 Year Fire Return Interval, Any Severity	14,609	1.3%
Water	Water	40,104	3.6%
Barren	Barren	452	0.0%
Sparsely Vegetated	Sparsely Vegetated	12,183	1.1%
Total		1,126,400	100.0%

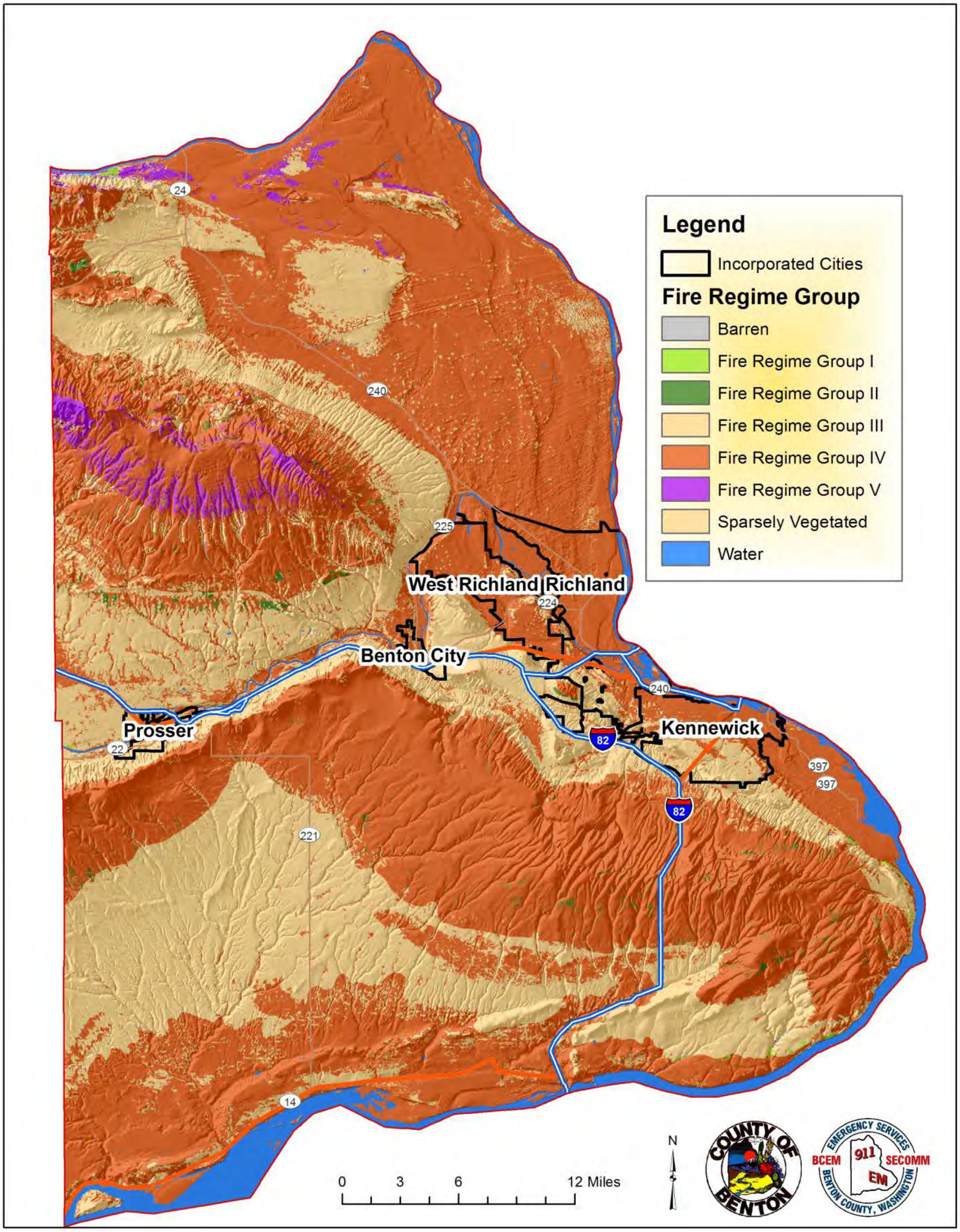

Figure 9) Fire history through the Fire Regime Group dataset. Majority of the County (60%) historically experienced high severity fires on a return interval between 35 and 200 years.

Fire Regime Condition Class

A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning.[9, 10] Coarse scale definitions for historic fire regimes have been developed by Hardy et al[11] and Schmidt et al[12] and interpreted for fire and fuels management by Hann and Bunnell.

A fire regime condition class (FRCC) is a classification of the amount of vegetative departure from the historic regime.[13] The three classes are based on low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) departure from the central tendency of the natural (historical) regime.[14,15] The central tendency is a composite estimate of vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated natural disturbances. Low departure is considered to be within the natural (historical) range of variability, while moderate and high departures are outside.

An analysis of Fire Regime Condition Class in Benton County shows that 38% of the land is considered to be highly departed from its historic fire regime and associated vegetation and fuel characteristics (Table 6). Just over 12% of the land is moderately departed while less than 8% is classified as low departure. Almost 30% of the land in the county is in agriculture, half of which is non-burnable.

The current Fire Regime Condition Class model shows that almost 60% of Benton County is considered to be departed, most of which is highly departed (Figure 10). A majority of the county is characterized by various shrub species and grasses which primarily include sagebrush, bluebunch wheatgrass, Idaho fescue, and cheat grass. The current structure and species composition of the shrub-steppe ecosystem increases the likelihood that it will burn with greater severity and burn more frequently, particularly as invasive species become a greater component of the shrub-steppe ecosystem in Benton County.

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[9] Agee, J. K. Fire Ecology of the Pacific Northwest forests. Oregon: Island Press. 1993.

[10] Brown. J. K. "Fire regimes and their relevance to ecosystem management." *Proceedings of Society of American Foresters National Convention*. Society of American Foresters. Washington, D.C. 1995. Pp 171-178.

[11] Hardy, C. C., et al. *"Spatial data for national fire planning and fuel management."* International Journal of Wildland Fire. 2001. Pp 353-372.

[12] Schmidt, K. M., et al. *"Development of coarse scale spatial data for wildland fire and fuel management."* General Technical Report, RMRS-GTR-87. U.S. Department of Agriculture, Forest Service. Rocky Mountain Research Station. Fort Collins, Colorado. 2002.

[13] Hann, W. J. and D. L. Bunnell. "Fire and land management planning and implementation across multiple scales." International Journal of Wildland Fire. 2001. Pp 389-403.

[14] Hardy, C. C., et al. *"Spatial data for national fire planning and fuel management."* International Journal of Wildland Fire. 2001. Pp 353-372.

[15] Schmidt, K. M., et al. *"Development of coarse scale spatial data for wildland fire and fuel management."* General Technical Report, RMRS-GTR-87. U.S. Department of Agriculture, Forest Service. Rocky Mountain Research Station. Fort Collins, Colorado. 2002.

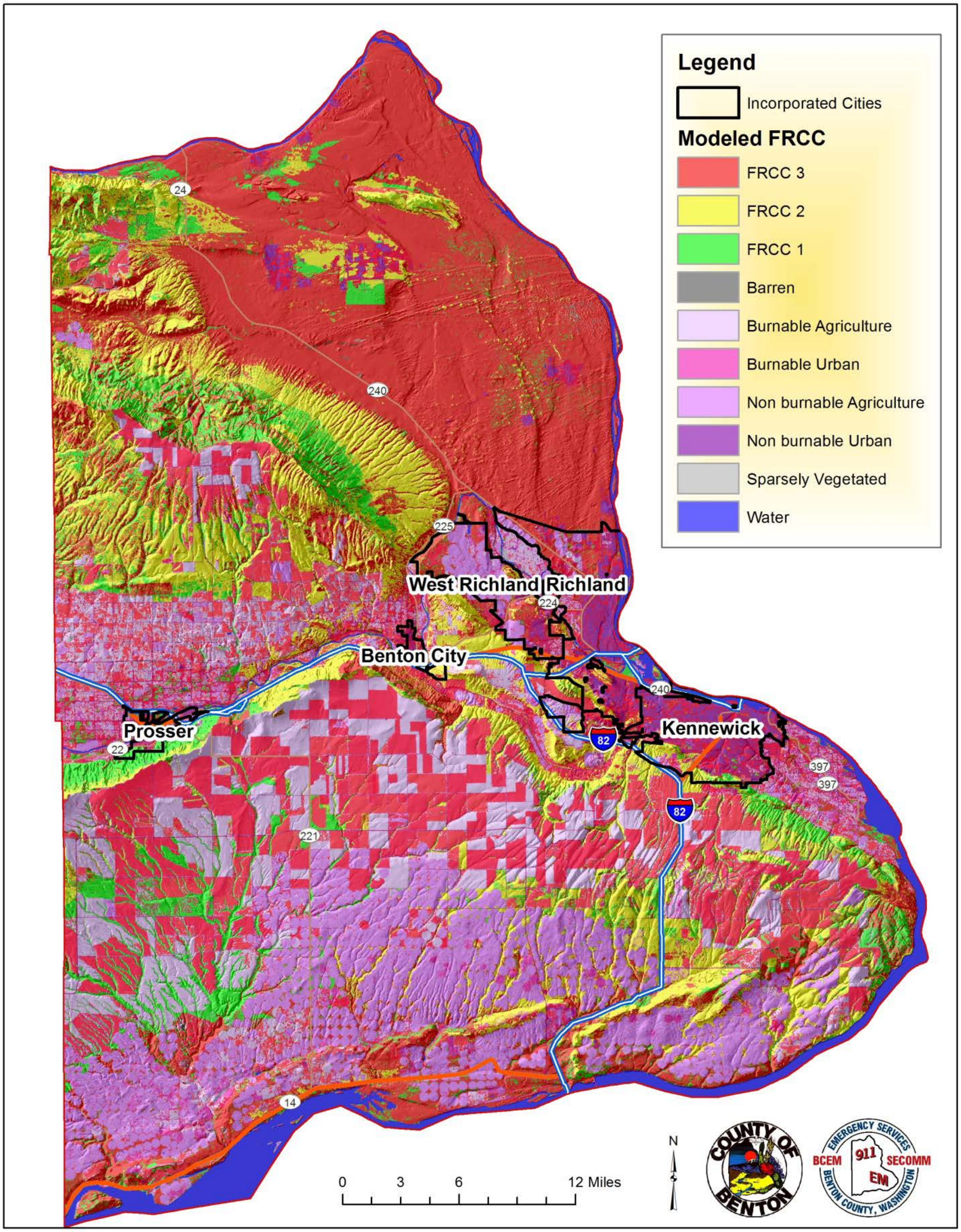

Figure 10) Fire Regime Condition Classes for Benton County, WA.

Table 6) Fire Regime Condition Classes for Benton County, WA.

Fire Regime Condition Class	Description	Acres	Percent of Total
Fire Regime Condition Class I	Low Vegetation Departure	86,275	7.7%
Fire Regime Condition Class II	Moderate Vegetation Departure	136,953	12.2%
Fire Regime Condition Class III	High Vegetation Departure	432,679	38.4%
Water	Water	31,786	2.8%
Urban	Urban	42,535	3.8%
Burnable Urban	Burnable Urban	50,073	4.4%
Barren	Barren	358	<1%
Sparsely Vegetated	Sparsely Vegetated	9,560	<1%
Agriculture	Agriculture	166,960	14.8%
Burnable Agriculture	Burnable Agriculture	169,221	15.0%
Total		**1,126,400**	**100.0%**

Wildland Urban Interface

The wildland urban interface (WUI) has gained attention through efforts targeted at wildfire mitigation; however, this analysis technique is also useful when considering other hazards because the concept looks at where people and structures are concentrated in any particular region.

A key component in meeting the underlying need for protection of people and structures is the protection and treatment of hazards in the WUI. The WUI refers to areas where wildland vegetation meets urban developments or where forest fuels meet urban fuels such as houses. The WUI encompasses not only the interface (areas immediately adjacent to urban development), but also the surrounding vegetation and topography. Reducing the hazard in the WUI requires the efforts of federal, state, and local agencies and private individuals.[16] "The role of [most] federal agencies in the WUI includes wildland firefighting, hazard fuels reduction, cooperative prevention and education, and technical experience. Structural fire protection [during a wildfire] in the WUI is [largely] the responsibility of Tribal, state, and local governments".[17] The role of the federal agencies in Benton County is and will be much more limited. Property owners share a responsibility to protect their residences and businesses and minimize danger by creating defensible areas around them and taking other measures to minimize the risks to their structures.[18] With treatment, a WUI can provide

[16] Norton, P. Bear Valley National Wildlife Refuge Fire Hazard Reduction Project: Final Environmental Assessment. Fish and Wildlife Services, Bear Valley Wildlife Refuge. June 20, 2002.

[17] USFS. 2001. United States Department of Agriculture, Forest Service. Wildland Urban Interface. Web page. Date accessed: 25 September 2001. Accessed at: http://www.fs.fed.us/r3/sfe/fire/urbanint.html

[18] USFS. 2001. United States Department of Agriculture, Forest Service. Wildland Urban Interface. Web page. Date accessed: 25 September 2001. Accessed at: http://www.fs.fed.us/r3/sfe/fire/urbanint.html

firefighters a defensible area from which to suppress wildland fires or defend communities against other hazard risks. In addition, a WUI that is properly treated will be less likely to sustain a crown fire that enters or originates within it. [19]

By reducing hazardous fuel loads, ladder fuels, and tree densities, and creating new and reinforcing existing defensible space, landowners can protect the WUI, the biological resources of the management area, and adjacent property owners by:

- Minimizing the potential of high-severity ground or crown fires entering or leaving the area;
- Reducing the potential for firebrands (embers carried by the wind in front of the wildfire) impacting the WUI. Research indicates that flying sparks and embers (firebrands) from a crown fire can ignite additional wildfires as far as 1¼ miles away during periods of extreme fire weather and fire behavior;[20]
- Improving defensible space in the immediate areas for suppression efforts in the event of wildland fire.

Three WUI conditions have been identified (Federal Register 66(3), January 4, 2001) for use in wildfire control efforts. These include the Interface Condition, Intermix Condition, and Occluded Condition. Descriptions of each are as follows:

- **Interface Condition** – a situation where structures abut wildland fuels. There is a clear line of demarcation between the structures and the fuels along roads or back fences. The development density for an interface condition is usually 3+ structures per acre;
- **Intermix Condition** – a situation where structures are scattered throughout a wildland area. There is no clear line of demarcation; the wildland fuels are continuous outside of and within the developed area. The development density in the intermix ranges from structures very close together to one structure per 40 acres; and
- **Occluded Condition** – a situation, normally within a city, where structures abut an island of wildland fuels (park or open space). There is a clear line of demarcation between the structures and the wildland fuels along roads and fences. The development density for an occluded condition is usually similar to that found in the interface condition and the occluded area is usually less than 1,000 acres in size.

In addition to these classifications detailed in the Federal Register, Benton County has included two additional classifications to augment these categories:

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[19] Norton, P. Bear Valley National Wildlife Refuge Fire Hazard Reduction Project: Final Environmental Assessment. Fish and Wildlife Services, Bear Valley Wildlife Refuge. June 20, 2002.

[20] McCoy, L. K., et all. Cerro Grand Fire Behavior Narrative. 2001.

- **Low Density Rural Areas** – a situation where the scattered small clusters of structures (ranches, farms, resorts, or summer cabins) are exposed to wildland fuels. There may be miles between these clusters.
- **High Density Urban Areas** – those areas generally identified by the population density consistent with the location of incorporated cities, however, the boundary is not necessarily set by the location of city boundaries or urban growth boundaries; it is set by very high population densities (more than 7-10 structures per acre).

In summary, the designation of areas by the Benton County planning committee includes:

- Interface Condition: WUI
- Intermix Condition: WUI
- Occluded Condition: WUI
- Low Density Rural Areas: WUI
- High Density Urban Areas: WUI

Benton County's wildland urban interface (WUI) is mostly based on population density (Figure 11). Relative population density across the county was estimated using a GIS based kernel density population model that uses object locations to produce, through statistical analysis, concentric rings or areas of consistent density. To graphically identify relative population density across the county, structure locations are used as an estimate of population density. The county's 911 address layer (GIS) was used to identify the locations of possible structures. The resulting output identified the extent and level of population density throughout the county.

In addition, the planning committee determined that the entire county should be classified under WUI designation due to the rapid rates of spread that commonly occur within the county.

By evaluating structure density in this way, WUI areas can be identified on maps by using mathematical formulae and population density indexes. The resulting population density indexes create concentric circles showing high density areas, interface, and intermix condition WUI, as well as low density WUI (as defined above). This portion of the analysis allows us to "see" where the highest concentrations of structures are located in reference to relatively high-risk landscapes, limiting infrastructure, and other points of concern.

The WUI, as defined here, is unbiased, consistent, and, most importantly, it addresses all of the county, not just federally-identified communities at risk. It is a planning tool showing the locations and density of homes and businesses, information that is used to develop WUI categories. It can be determined again in the future, using the same criteria, to show how the WUI has changed in response to increasing population densities. It uses a repeatable and reliable analysis process that is unbiased.

The Healthy Forests Restoration Act makes a clear designation that the location of the WUI is at the determination of the county or reservation when a formal and adopted Community Wildfire Protection Plan is in place. It further states that the federal agencies are obligated to use this WUI designation for all Healthy Forests Restoration Act purposes. The Benton County Community Wildfire Protection Plan steering committee evaluated a variety of different approaches to determining the WUI for the county and selected this approach and has adopted it for these purposes. In addition to a formal WUI map for use with the federal agencies, it is hoped that it will serve as a planning tool for the county, state and federal agencies, and local fire districts.

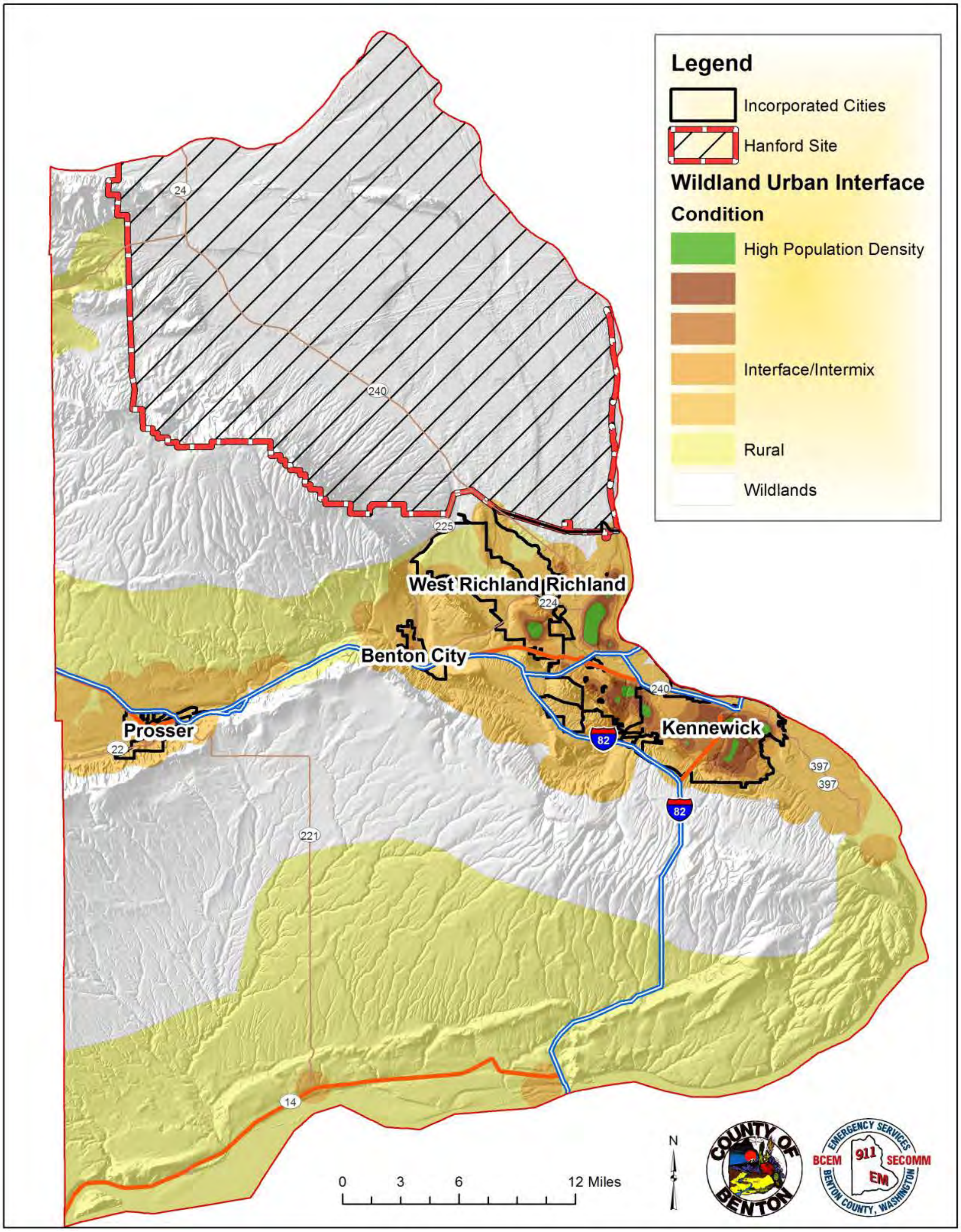

Figure 11) Wildland Urban Interface (WUI) map of Benton County, WA.

Potential WUI Treatments

The definition and mapping of the WUI is the creation of a planning tool to identify where structures, people, and infrastructure are located in reference to each other. This analysis tool does not include a component of fuels risk. There are a number of reasons to map and analyze these two components separately (population density vs. fire risk analysis). Primary among these reasons is the fact that population growth often occurs independent from changes in fire risk, fuel loading, and infrastructure development. Thus, making the definition of the WUI dependent on all of them would eliminate populated places with a perceived low level of fire risk today, which may in a year become an area at high risk due to forest health issues or other concerns.

By examining these two tools separately, the planner is able to evaluate these layers of information to see where the combination of population density overlays areas of high current relative fire risk and then take mitigative actions to reduce the fuels, improve readiness, directly address factors of structural ignitability, improve initial attack success, mitigate resistance to control factors, or (more often) a combination of many approaches.

It should not be assumed that just because an area is identified as being within the WUI, that it will therefore receive treatments because of this identification alone. Nor should it be implicit that all WUI treatments will be the application of the same prescription. Instead, each location targeted for treatments must be evaluated on its own merits: factors of structural ignitability, access, resistance to control, population density, resources and capabilities of firefighting personnel, and other site-specific factors.

It should also not be assumed that WUI designation on national or state forest lands automatically equates to a treatment area. The Forest Service, Bureau of Land Management, and Washington Department of Natural Resources are still obligated to manage lands under their control according to the standards and guides listed in their respective forest plans (or other management plans). The adopted forest plan has legal precedence over the WUI designation until such a time as the forest plan is revised to reflect updated priorities.

Most treatments may begin with a home evaluation, and the implicit factors of structural ignitability (roofing, siding, deck materials) and vegetation within the treatment area of the structure. However, treatments in the low population areas of rural lands (mapped as yellow) may look closely at access (two ways in and out) and communications through means other than land-based telephones. On the other hand, a subdivision with densely packed homes (mapped as brown – interface areas) surrounded by forests and dense underbrush, may receive more time and effort implementing fuels treatments beyond the immediate home site to reduce the probability of a crown fire entering the subdivision.

Relative Threat Level Mapping

The predicted Wildland Fire Threat layer shown on the map below was produced by combining weighted data sets that relate to wildfire risk in an additive model. Datasets considered for the model included; fire behavior fuel models, percent slope, aspect, fire protection capabilities, ignition probability, wildland fire rate of spread, wildland fire intensity, precipitation, and population. Each of these data layers was reviewed by members of the steering committee who confirmed whether or not they fairly represented those characteristics of Benton County. Once the layers were compiled the committee reviewed the final threat level map for accuracy. Consequently, the committee opted to remove the wildland fire rate of spread, wildland fire intensity, precipitation, and population layers as they tended to reduce the level of fire risk in areas where it is considered to be higher. Table 7 provides more information about the data layers that were used to create the Benton County Relative Threat Level Map.

Table 7) Parameters for Threat Level Mapping exercise. Bolded layers were included in the final version of the Threat Level Map.

Dataset	Source
Fuel Models	**Scott and Burgen 40 Fire Behavior Fuel Model from LANDFIRE**
Slope	**10 Meter Digital Elevation Model (DEM)**
Aspect	**10 Meter Digital Elevation Model (DEM)**
Fire Protection	Benton County Fire Station Points
Ignition Probability	Density of Fire Occurrences
Wildland Fire Rate of Spread	30 Meter FlamMap Rate of Spread Raster
Wildland Fire Intensity	
Precipitation	PRISM Climate Data from Oregon State University
Population	911 Address Points

Risk Categories

Based on analysis of the various modeling tools, existing historical information, and local knowledge, a preliminary assessment of potentially high wildfire risk areas was completed. This assessment prioritized areas that may be at higher risk due to non-native or high fire risk vegetation, fire history profile, high risk fuel models, and/or limited suppression capabilities. This assessment also considered areas that had a high population or other valuable assets requiring protection from the impacts of wildland fires.

Non-native or High Fire Risk Vegetation

Fuel type, or vegetation, plays an important role in determining wildland fire danger. All fuel types can and will burn under the right conditions; however, some fuel types pose more danger than others due to the intensity at which they burn, the horizontal and vertical continuity of burnable material, and firefighters' ability to modify the fuel complex in front of an approaching wildfire. While rangeland or grass fires often spread rapidly, they burn quickly and at a lower intensity than forest fires. Additionally, local farmers and firefighters can often construct fuel breaks with dozers and other equipment relatively quickly. These tactics are not as effective in forested areas or on steep terrain.

Vegetation types that lead to increased wildfire intensity or severity were given a higher threat level rating.

High Risk Fire Behavior

Due to heavy fuel loads, much of the county could experience extreme wildfire behavior characteristics that result in very intense, replacement-level fires. The agriculture/grassland areas will likely experience lower intensity fires with rapid rates of spread, particularly under the influence of wind.

One of the factors contributing to potentially dangerous fire behavior is the preheating of fuels on steep slopes ahead of the actual flame front. Typically, fires spread very rapidly uphill, particularly in grass fuel types. Hot gases rise in front of the fire along the slope face preheating the upslope vegetation and moving a grass fire up to four times faster with flames twice as long as a fire on level ground. This preheating of fuels, or radiant heat, is capable of igniting combustible materials from distances of 100 feet or more.

Areas with a high potential for extreme fire behavior based on Fire Behavior Analysis Tool modeling and local knowledge were given a higher threat level rating. Based on local knowledge, the grass fuel model was given a higher intensity level than it normally would receive due to the vast amounts of available fuel. Although grass fires can generally be controlled relatively easily, fires burning in this fuel type can spread rapidly. Extreme rates of spread coupled with the remote nature of much of the county, can cause significant control issues for local fire districts.

Suppression Capabilities

Fire protection in Benton County is the responsibility of the local fire agencies. The county has six active fire districts, two municipalities, and the Hanford Fire Department with resources available for fire suppression. However, each agency is limited to the resources at hand until help from other agencies can arrive.

Some parts of the county fall under Washington DNR or BLM fire protection responsibility. The Washington DNR and BLM have cooperative agreements with Benton County Fire Districts to provide initial attack on their respective districts. The response times for the DNR and BLM can be several hours or longer due to the logistical challenge of mobilizing both crews and equipment from their respective duty stations.

Population Centers and Developing Areas

Due to the increased human activity within and surrounding Benton County communities, these areas are inherently at a higher risk of ignitions. The perimeter and outskirts of population centers and known developing areas were given a high threat level rating.

High Protection Value

Of the areas and resources at risk to wildfire in Benton County, the planning committee has identified the following areas as *high protection values*. These areas include watersheds, recreation areas, and cultural areas.

- Watersheds: Yakima River Delta Vicinity, Zintel Canyon
- Recreation Areas: Badger Mountain, Rattlesnake Mountain
- Cultural Areas: Rattlesnake Mountain
- Nine Canyon Wind Project
- Communication Sites (Jump off Joe, Rattlesnake, Inspiration Point, Badger)
- Power Transmission lines and poles (Benton REA and Benton PUD)

Field Assessments

In an effort to visually confirm the output of the fuels analyses conducted for this plan, a multi-day field assessment was conducted in Benton County in May of 2018. A natural resource specialist from NMI drove through the county to get a general idea of the prominent fuel types found across Benton County. Select high risk areas, as identified by local fire personnel, featuring different fuel types and fuel loading were also toured. The field assessment started at the north end of Benton County on Highway 24 and continued south to the Tri-Cities area along Highway 240. In the Tri-Cities area, Horn Rapids County Park, W.E. Johnson Park, Bateman Island, and Badger Mountain were assessed as most were considered high risk areas and differed significantly from the rest of the county in regard to fuel types and fuel loading. To complete the overall fuels assessment, the tour of the county included the stretch of Highway 82 from the Tri-Cities to Prosser and then to the western edge of the county on Highway 22. The southern edge of the county was also evaluated by taking Highway 14 from the western most edge of the county to Highway 82 and then traveling north back to the Tri-Cities. See Chapter 5 for more information.

Determination of Relative Threat Level

Following the field assessments, the planning committee began development of the Relative Threat Level model. Risk categories included in the final analysis were fuel models, slope, aspect, wildland fire intensity, precipitation, and population density. The various categories, or layers, were ranked by the committee based on their significance pertaining to causal factors of high wildland fire risk conditions or protection significance. The ranked layers were then analyzed in a geographical information system to produce a cumulative effects map based on the ranking. Following is a brief explanation of the various categories used in the analysis and the general ranking scheme used for each.

- Environmental Factors – slope, aspect and precipitation all can have an enormous impact on the intensity of a wildfire. Therefore, areas with steep slopes, dry aspects, or lesser amounts of precipitation, relative to Benton County as a whole, were given higher threat rankings.
- Vegetation Cover Types – certain vegetation types are known to carry and produce more intense fires than other fuel types. For Benton County, shrub and grass fuel models were given

the higher rankings followed by short grass / agriculture, and forest types (shrub understory) fuel models.

- Fire Behavior – areas identified by fire behavior modeling as having high rate of spread potential or high fire intensity were given a higher threat level ranking.
- Populated Areas – these areas were ranked higher due to the presence of human populations, structures, and infrastructure requiring protection from fire.

Each data layer was developed, ranked, and converted to a raster format using ArcGIS 10.x. The data layers were then analyzed in ArcGIS using the Spatial Analyst extension to calculate the cumulative effects of the various threats. This process sums the ranked overlaid values geographically to produce the final map layer. The ranked values were then color coded to show areas of highest threat (red) to lowest threat (dark blue) relative to Benton County.

Relative Threat Level Map

The output of the analysis shows that most of Benton County is at moderate to high risk for wildfire (Figure 12). The northern portion of the county, including the Hanford Site (the area delineated by the purple boundary) and Rattlesnake Mountain, is at high risk of wildfire while the central portion of the county, including the Horse Heaven Hills and the heavily populated urban areas, is at moderate risk. Steeper slopes, south faces, and drainages also received higher threat ratings. Irrigated agricultural areas are at low risk for wildfire.

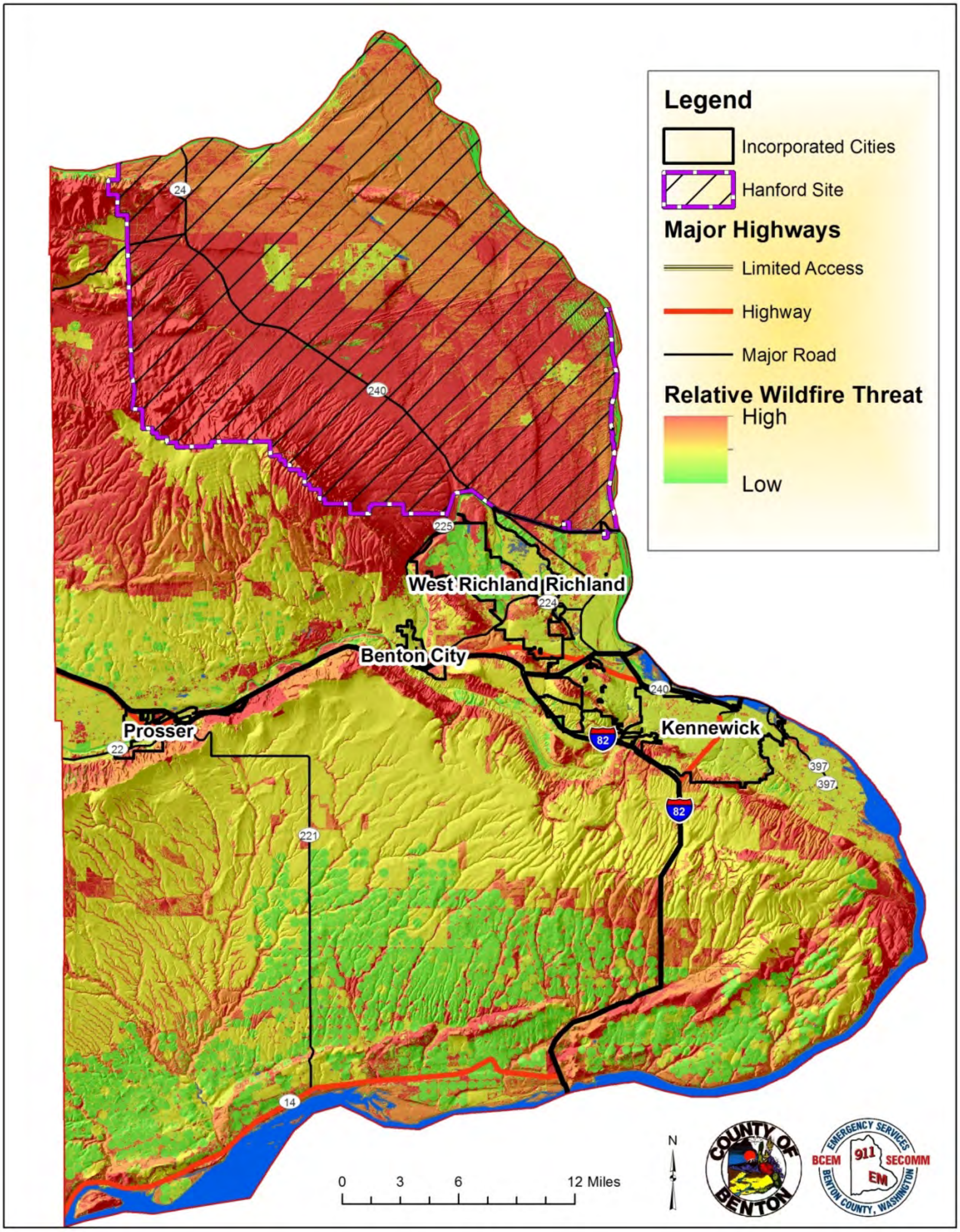

Figure 12) Relative threat level map for Benton County, WA.

Overview of Fire Protection Systems

A majority of the county has a local fire protection district that covers both structural and wildland fire response. The Washington DNR is responsible for wildland fire protection outside of fire district jurisdictions. Due to the lack of DNR resources in Benton County, the DNR maintains an agreement with Benton County to provide initial attack for the first 12 hours of the operational period.

Local Fire Department and District Summaries

The firefighting resources and capabilities information provided in this section is a summary of information provided by the fire chiefs or representatives of the wildland firefighting agencies listed. Most organizations completed a survey with written responses. Survey responses were used to create department and district profiles which may include descriptions of jurisdictions, current staffing, department/district resources, concerns, and needs, and an equipment inventory list.

Benton County Fire District #1

District Summary

Fire District #1 protects an area of approximately 320 square miles south the cities of Kennewick Richland and West Richland, serving a population of approximately 17,500 residents. Located within the District are heavily populated residential areas, commercial and industrial complexes, educational facilities, agricultural areas, wildland areas, and complex zones of interfaces between urban and wildland/agriculture uses. To provide timely service to this diverse area, there are currently six fire stations strategically located to provide efficient protection. Operating as a combination fire department, District #1 has 13 career staff and 90 dedicated volunteer firefighters, officers, EMT's, First Responders, and support personnel. The equipment utilized by the department is included in the table below. The District average's 1350 calls for service yearly, with 55 percent of those calls for EMS services and the remainder for fire. The District is comprised of a significant wildland urban interface area with many permanent homes and critical infrastructure contained within its boundaries. Additionally, we have large areas of wheat which poses a high fire danger during the summer months. The potential for the District to host a substantial wildland fire is high.

District Concerns

Wildland Urban Interface and Residential Growth: The Fire District has many permanent homes in the WUI and each year the WUI is being expanded in size and complexity as more homes are built. Defensible space and fire adapted community conditions are extremely important for the safety of these homes along with the safety of the residents and our firefighters. However, at times, it is challenging to motivate home and property owners to take the initiative to make their home better prepared to withstand a wildland fire. Creating fire breaks on lands within the Conservation Reserve Program (CRP) and around residential developments are a couple goals for area fire chiefs. We have had several large fires on CRP lands, wildland areas and areas with significant urban interface concerns due to large tracts of continuous fuels with no natural or manmade fire breaks.

Communications: The District is part of a County- wide Dispatch center (SECOMM) that is responsible for dispatching all fire (both city and county) and police (both city and county) personnel as well as City fire department resources. SECOMM has a rather sophisticated, intricate, and somewhat temperamental – repeater simulcast micro wave system. Although the system has gone through a major equipment update and fine tuning, the service area due to topography continues to have areas where radio communications between Dispatch and Fire/EMS responders is difficult or impossible.

Residential and Agricultural Burning: Provide education to County residents on the process of conducting and/or requesting permits for the four types of fires permitted within the County; recreational burns, agricultural burns, tumbleweeds, barbeques and woodstoves. Each burn type has specific requirements with regards to permitting, time, location and with respect to the rights of others. Provide education to agricultural producers on Washington State Department of Ecology regulations and permit requirements required to safely conduct agricultural burns within Benton County.

Other: As with most volunteer agencies, the District continues to seek ways to improve its ability to recruit and retain more firefighters and EMS personnel.

Cooperative Agreements: The District is part of a mutual aid agreement which includes all fire departments and fire districts within Benton, Franklin and Walla Walla Counties that has developed a dispatch matrix that allows us to put a large amount of resources on an incident in a very short period of time. This has proven to be very successful; we are able to control potentially large incidents from getting out of control and additionally reduce the need to call for State Mobilization Assistance. In addition to the previously identified mutual aid agreement, the District also has cooperative agreements or contracts with; Washington State Department of Natural Resources, Bureau of Land Management, U.S. Fish and Wildlife Service, U.S. Forest Service and Washington State Fire Marshal's Office. The District also participates in a County Strike Team that responds as an initial attack team to our neighboring counties, and in the Statewide Fire Mobilization Plan.

District Needs

Wildland Urban Interface Defensible Space: The fire district currently provides residents information on the Community Wildfire Protection Program and Firewise literature. The fire district has no current hazard fuel reduction program within the annual operating budget due to budget priorities. An increase in available grant funds would be beneficial to target some of the high hazard fuels reductions areas identified in the county wildfire plan.

Fire Breaks: Changes in the CRP rules that would allow fire breaks down to the dirt without a negative financial impact to the property owner would be beneficial.

Rural Water Supplies: Continue to seek and develop water supply systems in our rural areas for assistance in fire suppression.

Residential and Agricultural Burning: All open burning within the county, is subject to guidelines concerning, size, time, location and permit requirements. County residents can find the guidelines for non-agricultural open fires by referring to:

> ***http://bentoncleanair.org/index.php/burning/***

Agricultural burning in the County is regulated by the State Department of Ecology. These burns are subject to specific requirements and are limited by air quality management, weather and hazardous fire conditions. For Specific information on the permitting process, fees and restrictions regarding Agricultural burning in the County please refer to:

> ***http://bentoncleanair.org/index.php/burning/agricultural-burning/***

Others: As with most volunteer agencies, the District continues to seek ways to improve its ability to recruit and retain good firefighters and EMS personnel.

Apparatus Inventory

Table 8) Benton County Fire District #1 apparatus inventory.

Station #	Asset Type	Asset Description
STATION 100	2008 FORD F250	UTILITY, 3/4 TON, EXTENDED CAB, WIDE BOX, 8 FT, PU, 4X4
	2008 FORD F250	UTILITY, STAFF VEHICLE
	2012 FORD F150	UTILITY, STAFF PICKUP 4X4, 3/4 TON
	1989 UTILITY TRAILER	TRAILER, HOSE TESTING, 8'
	2004 FORD F150	UTILITY, STAFF PICKUP 4X4
	1984 UTILITY TRAILER	UTILITY TRAILER, 18 FT.
	1980 WISCONSIN	EQUIPMENT TRAILER, 16 FT. 6 TON, TILT DECK
	2017 RAM 2500	UTILITY, STAFF PICKUP 4X4
	2017 RAM 2500	UTILITY, STAFF PICKUP 4X4
	2017 RAM 2500	UTILITY, STAFF PICKUP 4X4
STATION 110	2000 INTERNATIONAL	WATER TENDER, 500 GPM, 3000 GAL. 6X4
	2005 INTERNATIONAL	ENGINE, TYPE 3, 500 GPM, 500 GAL, 4X4
	2005 FREIGHT	ENGINE, TYPE 1, 1000 GPM, 750 GAL, 2X4
	1978 CATERPILLAR	DOZER, D5B
	2006 WELLS	CSEPP WELLS UTILITY TRAILER
	1998 WELLS CARGO TRAILER	16 FT. UTILITY TRAILER, CSEPP
STATION 120	2000 INTERNATIONAL	WATER TENDER, 500 GPM, 3000 GAL. 6X4
	1979 GMC	CASCADE/BREATHING AIR, 4X2
	2005 FREIGHTLINER	ENGINE, TYPE 1, 1000 GPM, 750 GAL, 2x4
	2005 INTERNATIONAL	ENGINE, TYPE 3, 500 GPM, 500 GAL, 4X4
	1984 SHASTA MOTOR HOME	REHABILITATION UNIT, 26 FT.
	1998 ROSEBURY	UTILITY TRAILER, 12 FT, SUPPORT SERVICES
	1998 WELLS CARGO TRAILER	12 FT. UTILITY TRAILER, CSEPP
	2016 RAM 5500, SKEETER	ENGINE, TYPE 5 CREW 4X4, 125 GPM, 400 GAL.
STATION 130	1991 INTERNATIONAL	BRUSH, 125 GPM, 500 GAL. 4X4
	1999 FORD F350	ENGINE, TYPE 6, 125 GPM, 250 GAL 4X4
STATION 140	2000 INTERNATIONAL	WATER TENDER, 500 GPM, 3000 GAL. 6X4
	2005 INTERNATIONAL	ENGINE, TYPE 3, 500 GPM, 500 GAL, 4X4
	2005 FREIGHTLINER	ENGINE, TYPE 1, 1000 GPM, 750 GAL, 2x4
	1998 WELLS CARGO TRAILER	16 FT. UTILITY TRAILER, PUMP TEST
STATION 150	2005 INTERNATIONAL	ENGINE, TYPE 3, 500 GPM, 500 GAL, 4X4
	2005 FREIGHT	ENGINE, TYPE 1, 1000 GPM, 750 GAL, 2X4

STATION 160	2008 FORD F350	UTILITY, STATION SQUAD
	2003 FORD	UTLITY, MAINTENANCE, F3PU
	2001 UTILITY TRAILER	TRAILER, HOSE TESTING, 8'
	1999 CHEVROLET	UTILITY, SPARE STAFF VEHICLE
	2005 INTERNATIONAL TRACTOR	TRACTOR, TRANSPORT 860/DS
	1970 SHWTZ LOWBOY TRAILER	DOZER TRANSPORT, ___ TON LOWBOY
	1953 PRESSED STEEL	DOZER TRANSPORT, 25 TON LOWBOY
	1980 M35-A2 CARGO	TRUCK, FUEL, 6X6, 2.5 TON
	2008 INTERNATIONAL	ENGINE, TYPE 3, 500 GPM, 500 GAL, 4X5
	1966 INTERNATIONAL	DOZER, TD 15B
	2015 JOHN DEERE	DOZER 700K LGP
	1993 YAMAHA	ATV, 350, 4X4 BIG BEAR
	1992 PIERCE LANCE	AERIAL, QUINT 105'
	1979 JOHN DEERE	DISK, JOHN DEERE 425
	1993 UTILITY TRAILER	12 FT UTILITY TRAILER
	1994 UTILITY TRAILER	TRAILER, ATV, 10'
	1998 ARCTIC CAT	ATV, 400 CC 4X4
	2000 CHEVROLET	ASTRO MINI VAN
	1999 FREIGHTLINER	TRANSPORT, M915A4, 52000 GVWR
	2006 FREIGHTLINER	THOMAS BUS FS6 REHAB UNIT
	2016 CAN AM, UTV	UTILITY, UTV

Benton County Fire District #2

District Summary

Fire District 2 protects an area of approximately 88 square miles in Benton City and the unincorporated areas surrounding Benton City and lying within Benton County serving a population of approximately 10,000 residents. Located within the district are heavily populated residential areas, some commercial and industrial complexes, educational facilities, agricultural areas, wildland areas, and complex zones of interfaces between urban and wildland/agriculture uses. To provide timely service to this diverse area, there are currently two (2) fire stations strategically located to provide efficient protection. Operating as a combination fire department, District 2 has 5 career staff, 7 residents and 32 dedicated volunteer firefighters, officers, EMT's, Paramedics, and support personnel. The equipment utilized by the department is listed in the table below. The District average's 965 calls for service yearly, with 73 percent of those calls for EMS services and the remainder for fire. The District is comprised of a significant wildland urban interface area with many permanent homes and critical infrastructure contained within its boundaries. Additionally, we have large areas of open fields, mountains and hills which poses a high fire danger during the summer months. The potential for the District to host a substantial wildland fire is high. We have seen numerous large and some catastrophic fires in our district over the years. The largest in 2000 when we lost 53 homes due to a large uncontrolled wildfire that came from the Department of Energy/ALE properties.

District Concerns

Wildland Urban Interface and Residential Growth: The Fire District has many permanent homes in the WUI and each year the WUI is being expanded in size and complexity as more homes are built. Defensible space and fire adapted community conditions are extremely important for the safety of these homes along with the safety of the residents and our firefighters. However, at times, it is challenging to motivate home and property owners to take the initiative to make their home better prepared to withstand a wildland fire despite histories of large fires threatening their homes. Creating fire breaks on lands within the Conservation Reserve Program (CRP) is one goal for area fire chiefs. We have had several large fires on CRP/open wildlands and Department of Energy properties due to large tracts of continuous fuels with no natural or manmade fire breaks.

Communications: The District is currently part of a County- wide Dispatch center that is expanding to incorporate two Counties, Benton/Franklin in 2018. Dispatch center (SECOMM) is responsible for dispatching all FIRE/EMS (both city and county) and police (both city and county) personnel as well as City fire department resources. SECOMM has a rather sophisticated, intricate, and reliable – repeater simulcast micro wave system. The system has some limitations to cover the entire two counties due to topography despite the multiple channels and repeater sites.

Residential and Agricultural Burning: Provide education to County residents on the process of conducting and/or requesting permits for the four types of fires permitted within the County; recreational burns, agriculture, residential burns and land clearing fires. Each burn type has specific requirements with regards to permitting, time, location and with respect to the rights of others, weather and burn bans. Provide education to agricultural producers on Washington State Department of Ecology regulations and permit requirements required to safely conduct agricultural burns within Benton County.

Other: As with most volunteer agencies, The District continues to seek ways to improve its ability to recruit and retain good firefighters and EMS personnel.

Cooperative Agreements: The District is part of an automatic and mutual aid agreement system with Three counties; Benton, Franklin and Walla Walla. We have developed a dispatch matrix that allows us to put a large amount of resources on an incident in a relatively short period of time in the urban areas, but the rural areas take much longer to deploy resources due to the remote areas. This has proven to be very successful in the urban areas to control small fires before they become too large however; rural areas still are the largest risk and areas which have large areas of urban interface. These areas can have a wildfire start that grows exponentially due to the fast burning fuels, topography and lack of access to control fires quickly. These sometimes often require the requests of State Mobilizations. Resources often are expended and the need for outside help is frequent in our areas. The District also has mutual aid agreements with; WA DNR, USFW, BLM and in some cases and the USFS. The District also participates in a County Strike Team that responds as an initial attack team to our neighboring counties, and in the Statewide Fire Mobilization Plan.

District Needs

Wildland Urban Interface Defensible Space: The fire District has an agreement with the Department of Energy that also provides assistance to these adjacent lands to Federal ALE, DOE and BLM properties in addition to normal mutual aid. This has proven reliable and helps with some federal shared costs however, the defensible space around the urban areas is not in place due to sensitive conservation areas. Our Fire District for the last two years has instituted and developed a FIREWISE program to our district residents. This has proven to offer some reduction to our wildfire-related calls; however, it does not get much participation to the high majority of our community despite our public campaigns and strong community push. We wish to continue to use this program and maximize the use of our staff time to meet with property owners and educate them on the value of defensible space. Funding for staff time is a need of the fire District to enhance this program and complete structural assessments every two years has proven difficult. We have also teamed up with some local property owners which have receive permission annually to put in fire breaks with our area dozers on areas the butt up against some Urban Interface Areas however, this encompasses a small portion of the exposures.

Fire Breaks: These prove effective in the areas that allow them, many areas restrict fire breaks due to; negative impacts to agriculture, sensitive species, federal properties and private land owners not allowing them on their property. The costs associated with maintaining established fire breaks costs our small fire department thousands of dollars annually and cannot be sustained without some type of financial assistance.

Rural Water Supplies: Continue to seek and develop water supply systems in our rural areas for assistance in fire suppression. We have very few areas where we can draw water from in the rural areas due to remoteness and lack of developed water systems.

Residential and Agricultural Burning: All open burning within the county is subject to guidelines concerning, size, time, location and permit requirements from Benton County Clean Air Authority. Moreover, the BCCAA and the local cities have banned back yard burning except for blown in tumbleweeds. This is a two-fold problem. The first is that getting rid of some of the fuel loads reduces the fire potential to sustain burning. The other issue is that burning incorrectly causes numerous out of control fires.

Apparatus Inventory

Table 9) Benton County Fire District #2 apparatus inventory.

Fed ID Number: 91-124-0107								
Address	**Unit #**	**Year**	**Make**	**Tank Size**	**Type**	**GPM**	**Other Information**	**Available for Mob.**
Station 210: 1304 Dale Street Benton City, WA	CH121	2013	CHEVY TAHOE				Command	Yes
	CH122	2010	FORD EXPEDITION				Command	Yes
	CPT 121	2010	F-250				Command	Yes
	UT 121	2008	F-250				Command	Yes
	D/C121	2012	F-250				Command	Yes
	E1211	2017	HME	800	Type 1 Engine	1500	Structure w/ Foam	Yes
	E1213	1997	E-One	1000	Type 1 Engine	1250	Structure w/Foam	Yes
	L1211	1995	Central States	300	Type 1 Ladder	1500	Structure w/Foam	Yes
	E1251	2008	F-450 4x4	400	Type 5 Engine	200	Wildland w/Foam	Yes
	E1252	2008	F-450 4x4	400	Type 5 Engine	200	Wildland w/Foam	Yes
	E1254	2018	F-550 4x4	400	Type 5 Engine	260	Wildland w/Foam	Yes
	Dozer 1221	2010	John Deere 750K		Type 2 Dozer		Tractor/Bulldozer/disc	Limited
	Transport 1211	2010	Freightliner		Type 1		Transport 50T	Limited
	Dozer Trailer/Fuel	1998	Lowboy	300 gal. fuel	Dozer Trailer			Limited
	Tactical Tender 1211	2017	Freedom Fire	3000	Type 1 Tender	500	Pump/Roll/Structure	Yes
	Cascade 121	2012	Scott		Type 1 Air System		High/Low Press	Yes
	Medic 1221	2011	Taylor Made		Type 2 Medic		ALS Transport	Yes
	Medic 1222	2011	Taylor Made		Type 2 Medic		ALS Transport	Yes
	Medic 1223	2009	Road Rescue		Type 2 Medic		ALS Transport	Yes
Station 220: Whitmore	E1212	2017	HME	800	Type 1 Engine	1500	Structure w/Foam	Yes
	Tactical Tender 1212	2008	Freedom Fire	3000	Type 1 Tender	500	Pump/Roll/Structure	Yes
	E1253	2008	F-450 4x4	400	Type 5 Engine	200	Wildland w/Foam	Yes

Benton County Fire District #4

District Summary

Benton County Fire District 4 (BCFD 4) is a combination fire department protecting just over 52 square miles consisting of the City of West Richland and surrounding county area with a population just under 20,000. The district has a variety of property use types, including significant residential, some light industrial, agricultural (with a large vineyard component), and open area. The interfaces between open and agricultural areas result in a complex zone regarding fire protection. As the building within the district continues, some of the interface areas are becoming more important, as the population and overall exposure continues to increase.

Created in 1954, BCFD 4 currently operates out of two staffed stations. Staffing includes 15 full time firefighters (Fire Chief, Captains, Lieutenants, firefighters), 1 administrative assistant, 25 volunteer firefighters and 13 Logistic and Administrative volunteers. A list of current apparatus is included in the table below.

BCFD 4 responded to an average of about 1320 incidents per year (5-year average), with about 75% of those incidents being emergency medical calls. The remainder of the incidents are for fire related incidents or false alarms. The call volume for BCFD 4 has increased 25% over the past 5 years and continues to increase as more people and business move into the District. Over the past two years, BCFD 4 has seen large swaths of open land change to grape vineyards based on the Red Mountain American Viticultural Area (AVA) and success of several wineries in the area. While large parts of the open land in the Red Mountain AVA has been planted in grapes, there remains large areas outside of the AVA that are not as agriculturally valuable and remain undeveloped. The growth of individual housing on the borders of the open area result in the high potential for wildland/urban interface issues and the associated wild fire risk.

The district has experienced several larger wildland fires, mostly along/over the Red Mountain and Candy Mountain areas. The most recent larger fire was on Candy Mountain resulting in a total area burned of 450 acres and threatening approximately 50 to 75 homes. The cause of the fire was from a mechanical failure of a vehicle along Interstate 82, resulting in the fire burning over the top of Candy Mountain and threatening the homes and impacting trails on the mountain. At the time of the fire (12:30 am), there were no hikers on the mountain trails, minimizing a potentially dangerous situation of hikers in the path of a fast-moving wildland fire. Fortunately, with help from neighboring mutual aid fire and police agencies, no homes were damaged or destroyed and there was only one minor injury to a firefighter during the extinguishment of the fire.

District Concerns

Wildland Urban Interface and Residential Growth: The Fire District has many permanent homes in the WUI and each year the WUI is being expanded in size and complexity as more homes are built. Defensible space and fire adapted community conditions are extremely important for the safety of these homes along with the safety of the residents and our firefighters. However, at times, it is challenging to motivate home and property owners to take the initiative to make their home better prepared to withstand a wildland fire despite histories of large fires threatening their homes. BCFD 4 has worked with homeowners in some areas of the district in implementing the Firewise program as much as possible. The homeowners have worked with the District, but with limited resources only partial success has been observed. Additional resources could be used to help with more effective and complete implementation of the Firewise program.

Communications: The District is currently part of a County- wide Dispatch center that is expanding to incorporate two Counties, Benton/Franklin in 2018. Dispatch center (SECOMM) is responsible for dispatching all FIRE/EMS (both city and county) and police (both city and county) personnel as well as City fire department resources. SECOMM has a rather sophisticated, intricate, and reliable – repeater simulcast micro wave system. The system has some limitations to cover the entire two counties due to topography despite the multiple channels and repeater sites.

Residential and Agricultural Burning: The District continues to see a high number of controlled burning activities that are not allowed under the current Benton County Clean Air Authority rules. The types of allowed burning depend upon the urban growth boundaries as well as agricultural use of lands. Many of the residents who have lived in the area for longer, still conduct burning of natural vegetation even though they are inside the urban growth boundary, where this type of burning is not allowed. Efforts to educate the public on the rules continues to be a challenge based on the perceived rural nature of large portions of the District.

Other: As with most combination career/volunteer agencies, the District continues to seek ways to improve its ability to recruit and retain reliable personnel to assist with the variety of responses and other administrative activities that must occur to be a progressive and successful organization.

Cooperative Agreements: The District is part of an automatic and mutual aid agreement system with Three counties; Benton, Franklin and Walla Walla. We have developed a dispatch matrix that allows us to put a large amount of resources on an incident in a relatively short period of time in the urban areas, but the rural areas take much longer to deploy resources due to the remote areas. This has proven to be very successful in the urban areas to control small fires before they become too large however; rural areas still are the largest risk and areas which have large areas of urban interface. These areas can have a wildfire start that grows exponentially due to the fast burning fuels, topography and lack of access to control fires quickly. These often require the requests of State Mobilizations. Resources often are expended and the need for outside help is frequent in our areas. The District also has mutual aid agreements with Washington Department of Natural Resources (WADNR), United States Fish and Wildlife (USFW), Bureau of Land Management (BLM) and the United States Forest Service (USFS). The District also participates in a local County Strike Team that responds as an initial attack team to our neighboring counties, and in the Statewide Fire Mobilization Plan.

District Needs

Wildland Urban Interface Defensible Space: The District attempted to implement the FIREWISE program with some district residents, based on the higher risk areas. This has proven to offer some reduction to our wildfire calls however, participation rates could be much higher with some additional resources. We wish to continue to use this program and maximize the use of our staff time to meet with property owners and educate them on the value of defensible space. Funding for additional staff time is needed by the fire District to enhance this program and complete structural assessments every two years and deliver educational materials to potential participants as the population continues to grow and change.

There are additional areas that abut City of West Richland property (specifically the sewer treatment plant) as well as many private homes that have never had a significant fire resulting in large buildup of fuel. The area also has extremely limited access and does pose a significant hazard if wildfire does gain access to the area. Efforts are needed to coordinate fuel reduction or defensible space around this area. This will be challenging, as there are wetlands in the area as well as being adjacent to the Yakima River and associated fish habitat.

Rural Water Supplies: Continue to seek and develop water supply systems in our rural areas for assistance in fire suppression. The District has worked with some of the vineyards to establish water supply points at their irrigation ponds, but these are not always a reliable source of water depending upon the time of year and required water use for the vineyards. The District has also worked with the Barker Ranch to identify water supply access points to be developed as the ranch makes improvements to the irrigation and wetland management program. These water supplies allow access to water supplies closer to the threat of wildland fires as identified by landowners, users and the District.

Apparatus Inventory

Table 10) Benton County Fire District #4 apparatus inventory.

Fed ID Number: 91-1317376								
Address	**Unit #**	**Year**	**Make**	**Tank Size**	**Type**	**GPM**	**Other Information**	**Available for Mob.**
Station 420: 2604 Bombing Range Road, West Richland, WA 99353	CH141 (UT145)	2013	Ford F-150 Raptor				Command	Yes
	UT141	2017	Chevrolet K2500				Command	Yes
	UT142	2017	Chevrolet Tahoe				Command	Yes
	UT144	2003	Ford Ranger				Command	Yes
	UT146	2014	Ford Explorer				Command	Yes
	DC141 (UT143)	2006	F-250				Command	Yes
	E1412	2001	KME	1000	Type 1 Engine	1250	Structure w/ Foam	Yes
	E1452	2005	F-450 4x4	400	Type 5 Engine	120	Wildland w/Foam	No
	E1461	1997	Ford Super Duty 4X4	300	Type 6 Engine	120	Wildland w/Foam	Yes
	E1431	1997	Freightliner / BME	560	Type 3 Engine	1000	Wildland/Structure w/Foam	Yes
	Tactical Tender 1412	2013	Pierce Hawk	2500	Type 1 Tender	500	Pump/Roll/Structure/CAFS	No
	Medic 1422	2016	Ford E-450 / Braun		Type 2 Medic		ALS Transport	Yes
	Medic 1423	2010	Ford E-450 / Braun		Type 2 Medic		ALS Transport	Yes
	Rehab 141	2006	F-250				Support	n/a
	Decon 143				Trailer		Support	n/a
Station 410: 1400 Harrington Road, West Richland, WA 99353	E1411	2001	KME	1000	Type 1 Engine	1250	Structure w/Foam	Yes
	Water Tender 1412	2015	Freightliner / Pierce	3000	Type 1 Tender	500	Pump/Roll	Yes
	E1451	2011	F-550 4x4	400	Type 5 Engine	120	Wildland w/Foam	No
	BS142	1986	IHC		Type 2 Cascade Air System			No
	Medic 1421	2014	Ford E-450		Type 2 Medic		ALS Transport	Yes
	Rehab 142	2000	Ford E-450				Rehab	n/a

Benton County Fire District #5

District Summary

Benton County Fire District #5 (BCFD#5) is primarily a wildland fire agency with some urban/suburban interface with neighboring agencies. BCFD#5 also responds to vehicle accident and also provides some non-ambulance EMS services. The district operates out of four main stations with approximately twenty volunteers. BCFD#5 personnel are on duty twenty-four hours a day, seven days a week. The district covers an area of approximately 400 square miles.

District Concerns

Residential Growth: BCFD#5 has not seen significant population growth. However, there is growth in the suburban areas on the outer district lines, with housing development expanding into the district.

Communications: BCFD#5 is part of a Bi-County dispatch center (SECOMM) that is responsible for dispatching all fire, ems and police, as well as one fire agency from a third county, Walla Walla County. SECOMM has a VHF simulcast and micro wave system utilized by fire agencies, and law enforcement agencies operate on an 800MHz radio system. The VHF radio system is out dated and will require a major overhaul within the next 2 to 5 years as parts are no longer available.

The merger to one dispatch center was recent. With the addition of Franklin County Fire agencies, Pasco Fire Department and Walla Walla Fire District #5, radio traffic has increased. It seems that the number of dispatch staff needs to be increased to handle the increased radio traffic and calls.

Other: BCFD#5 is reliant on neighboring fire agencies for structure fires as well as for ALS services. There is a need to have access to Water Tenders and Type 1 Engines.

Cooperative Agreements: BCFD#5 has mutual aid agreements with neighboring fire agencies. BCFD#5 will implement or renew needed mutual aid agreements.

District Needs

BCFD#5 is experienced, well versed and trained for wildland firefighting, however, better qualifications and experience is needed for structure fires, especially with the increase of housing in high wildfire risk areas. BCFD#5 is reliant on neighboring agencies for structure firefighting. BCFD#5 has a need for updated/appropriate equipment for structural firefighting and protection.

Benton County Fire District #6

District Summary

Benton County Fire District #6 (BCFD6) is located in South East Washington state approximately thirty miles South of the Tri-Cities (Kennewick, Richland and Pasco) area along the scenic Columbia River. Our department consists of: one paid Chief, three paid firefighters, sixteen active duty volunteers, and approximately 15 paid on call firefighter/EMT's, and two support volunteers. BCFD6 has eight personnel trained as EMT-Basic, two Advanced EMT's and two Paramedics. The career staff works 48/96 shift work. Due to the low resident population many of our volunteers live outside of the Fire District. Most are daytime responders and take up to 35 minutes to respond in the evenings. Only ten volunteers live within the District and cover a majority of the calls.

Our department protects 277 square miles of rural land. Our two ambulances service a response area encompassing approximately 490 square miles in two counties. Eighty percent of our total calls for service are medical related. Many were medical/trauma related. Most of those were motor vehicle accidents. Currently, BCFD6 has exceeded our average call volume, for the same time period, as we begin the busy winter MVA season.

The resident population of BCFD6 is approximately one thousand (1,000). However, due to the nature of the industries and abundant farming in our district, the population during the summer time period is much higher and varies throughout the year. Each year we see a drastic increase of traffic on our roadways and major Interstate highways. Although we are rural, our district contains several key facilities and locations that, if affected, could have wide reaching affects for the Western United States. Some of these key areas are: thirty (30) miles of US Fish and Wildlife scenic wildlife preserve along the Columbia River; the US Corps of Engineers McNary Dam; three Bonneville Power Administration high energy transmission lines; Williams Pipeline bulk storage facility containing 2.5 billion cubic feet of natural gas; four major Williams Pipeline high flow transmission lines serving Spokane, Seattle and the West coast; fifteen miles of Interstate 82; twelve miles of State Route 221; thirty miles of State route 14; and hundreds of square miles of cultivated agricultural property including the sixth largest winery in the world, Columbia Crest.

BCFD6 provides ALS/BLS ambulance coverage to two neighboring Fire Districts through an Automatic Aid Agreement (Klickitat County Fire District 10 and Benton County Fire District 5). Since we have only one Paramedic, we are unable to provide full ALS coverage and must revert to BLS coverage when the Paramedic is unavailable. Therefore, we must work closely with our neighboring ALS agencies as well. Mutual aid is received and given to the Tri-Cities area when advanced life support is needed through a Mutual Aid Agreement.

District Concerns

Benton County Fire Protection District 6 is a very rural area with huge commercial target hazards. It is the perfect storm for major infrastructure loss. In 2013 our district experienced a huge event at the Williams Pipeline bulk storage facility that resulted in a $100 million-dollar loss. Our limited budget combined with the State of Washington one percent maximum budget increase law has crippled our small department for many years. As our District valuation increases the tax amount per thousand decreases. Due to our rural location and limited population to draw volunteers, a series of community meetings were held so that the voting public had an opportunity to see, in our current state, we are unable to fight the most basic interior structure fires due to the lack of certified firefighters. BCFD6 also has six seasoned responders that are near retirement age. However, these few volunteers respond to a majority of the calls for service. These precious few members are the “backbone” of our organization and are vital to our continued operation. New volunteers have recently joined our ranks but will require several years of training to be able to take on medical and fire responsibilities.

Benton County Fire Protection District 6 does not enjoy a large donating population. Fundraisers in our economically depressed area do not produce the donations needed to purchase equipment. The tax base and a small amount of ambulance income are all that our Department has to operate on.

The remaining budget priorities are placed on personal protective equipment, maintenance, ensuring apparatus are safe, training firefighters and training EMT’s. Several fire stations owned by Benton County Fire District 6 are thirty-five years old and require major repair.

District Needs

The following statements describe the various needs of BCFD #6; some of these items should be considered for future Mitigation Action Items:

- BCFD6 needs weed abatement along the state, federal highways and railways throughout our fire district. The overgrowth and close proximity of combustible vegetation causes multiple large fires every year.
- Personnel need is another issue for BCFD6. The small community to draw from does not provide adequate responders for our area. With our rural location, this can be detrimental to the person in need if we do not have the responders to help.
- Firefighter and EMT training. Due to our rural location it is difficult to get outreach training for firefighter 1, wildland firefighter and Emergency Medical Technician.
- Fire apparatus. With the age of our fleet firefighting apparatus replacement is a concern.

Kennewick Fire Department

Department Summary

The City of Kennewick is fortunate to be situated in an area that offers spectacular views of the Horse Heaven Hills to the south, Rattle Snake Mountain to the west, the Columbia River to the north and the broad plains of the Columbia Basin and Blue Mountains to the east. These natural features are valued because it emphasizes the region's identity with our three rivers (Yakima, Snake and Columbia), the agricultural industry and the desert lying just outside our irrigated boundaries. These features and dry climate provide for wildfire activity throughout a good part of the year. The City of Kennewick Fire Department (KFD) is primarily an urban/suburban fire agency which employs 94 personnel and provides fire suppression, Emergency Medical Services (EMS), fire prevention, investigation and code enforcement, technical rescue, hazardous materials and incident management services to Kennewick citizens as well as to the surrounding community through strong mutual and automatic agreements.

Department Concerns

As stated above KFD is primarily an urban/suburban fire department that deals with all risk incidents. KFD areas of concern are:

Residential Growth: The population of Kennewick has increased significantly since its incorporation as a city in 1904. At the time of the 1910 census, the Kennewick population was 1,219 people. In 2018 the population is 81,850. Using data from the U.S. Census Bureau Kennewick is planning for a population of 112,044 by the year 2037; an increase of just over 30,000 residents over the next 20 years. This increase in population will increase calls for EMS service which is 80% of the responses that the department handles annually. The additional need for EMS service will have a direct effect on available resources to respond to wildland fires as most fire units are cross staffed with ambulances.

Wildland Urban Interface: The city is boarded to the south by open grass and saga lands. Prevailing winds from the southwest historically push large wildland fire into the city. On August 11th, 2018 one such fire called the Bofer Canyon Fire moved into the City of Kennewick with devastating results. The fire was a result of a road side start off of Highway 82 just south of the Kennewick Exit. Pushed by 30 mph winds the fire hit the Canyon Lakes housing development within minutes making a run to the east through several additional housing developments before being stopped at Olympia Street. The result was the total loss of five homes with four additional damaged homes and several outbuildings lost or damaged. Two citizens sustained minor injuries and the landscape was stripped of all vegetation creating a dust problem throughout the summer and fall months. Additionally, the city has several riparian areas that are wildfire interface problem areas. The city does not have the funding to provide for a fuels management program for the riparian areas identified as Zintel Canyon, Blackberry Canyon, the riparian area south of 27th & Cascade St., and riparian area 53rd and Washington St., all are Wildland Urban Interface zones.

Communications: KFD is part of a Bi-County dispatch center (SECOMM) that is responsible for dispatching all fire (both city and county) and police (both city and county). SECOMM has a rather complex and somewhat temperamental VHF simulcast and micro wave system utilized by fire agencies, while Law agencies operate on an 800MHz radio system. The VHF radio system is very out dated and will require a major overhaul within the next 2 to 5 years as parts are no longer available.

Cooperative Agreements: KFD is a signatory to Washington State Fire Mobilization Plan and has a cooperative agreement with the Department of Natural Resources. KFD has mutual aid and automatic aid agreements in place with agencies within Benton, Franklin and Walla Walla counties. As of 2018 KFD did not have a federal cooperative agreement in place which would allow for KFD resources to participate on USFS, USFW, BLM or other federal agencies incidents. A federal agreement should be developed for the 2019 fire season.

Residential Burning: Outdoor burning permissions within the City of Kennewick UGA (urban growth area) are determined based upon the Benton County burning regulations. The City of Kennewick does not allow any outdoor burning (other than blown tumbleweeds) within the UGA. The Benton Clean Air Agency is charged with enforcing burning regulations.

Other: The Kennewick Fire Department provides EMS and structural fire suppression assistance to its surrounding neighboring jurisdictions, while relying heavily on neighboring fire districts and department for assistance in wildfire suppression. KFD also, participates in Incident Management Team (IMT) activities for large wildfires occurring locally, state wide and nationally. As the experienced IMT personnel retire out recruiting and training personnel to fill those positions will be critical in the coming years.

Benton County and the City of Kennewick should adopt a regulation requiring “defensible space” for all existing and new construction within the WUI. This process will require a two-fold approach. First, public education through a collaborative partnership with the media, fire departments, and emergency management, and second development and adoption of county ordinances requiring the improvement and maintenance of defensible spaces.

The City of Kennewick should explore a fuels management program mainly within the identified WUI and riparian zones to reduce the risk of wildfire to the community while improving and maintaining ecosystem health.

Department Needs

Firewise-Wildland Urban Interface Defensible Space: An integrated and focused public education program dedicated to wildland fire prevention and protection needs to be developed and implemented throughout the county. This program should include consistent and enforceable burning regulations, information on defensible spaces, and outreach programs through the use of all facets of media, including social media.

Riparian Fuels Management Program: The riparian landscape is the interface between bodies of water such as rivers, streams, and lakes and upland ecosystems. The major riparian areas in Benton County lie along the Columbia and Yakima rivers; however, smaller riparian areas are present along many smaller streams, ponds, and irrigation ditches. Most riparian areas produce high densities of shrubs and grass with scattered deciduous trees due to the relative abundance of water. Upslope from the waterway, vegetation generally resorts back to the typical shrub-steppe or grass fuel types that dominate the county, and within the City of Kennewick abut to mostly residential property creating a wildfire interface problem. The City of Kennewick is in need of a fuels mitigation and vegetation management program within these areas. These riparian areas are full of hazardous fuels, live and dead vegetation that has accumulated and increases the likelihood of unusually large wildland fires. When fire encounters areas of heavy fuel loads (continuous brush, downed vegetation or small trees) it can burn these surface and ladder fuels and may quickly move from a ground fire into a crown fire.

Fuel treatments are intended to lower the risk of catastrophic wildfires by managing vegetation to modify/reduce hazardous fuels. The goal of fuel treatment projects is to modify fire behavior to reduce environmental damage and aid in suppressing wildfires. Benefits from fuel treatments include; prevent loss of lives, reduce fire suppression cost, reduce private property losses and protect natural resources (control of unwanted vegetation, including invasive species, improvement of rangeland for livestock grazing, improvement of fish and wildlife habitat, enhancement and protection of riparian areas and wetlands, and improvement of water quality) from devastating wildfire.

Funding for a strategic management and control of wildland vegetation is essential to the safety, health, recreational, and economic wellbeing of Kennewick's citizens.

Pre-Attack or Pre-Incident Planning: The City of Kennewick should begin to employ GIS technology to aid in wildfire pre-incident planning and in the development of pre-attack plans which include zone maps identifying key fire suppression actions. Additionally, dispatch deployment plans should be created to insure rapid deployment of the right type and number of resources to each zone to assist first responders before they arrive on scene and need to request resources.

Contingency Planning: Contingency plans identify high-risk neighborhoods and areas with the potential for large wildland incidents. These plans contain information that may be beneficial to incoming resources, including fuel types, water sources, staging areas and ICP locations.

A map of each high-risk neighborhood also is provided to give users an elevated view of the area and its potential threats.

Richland Fire and Emergency Services

Department Summary

Richland Fire and Emergency Services provide all fire, ambulance, and other emergency services to 54,989 citizens located in 35.72 square miles of Benton County in southeast Washington State. With robust mutual aid agreements, Richland provides and receives assistance during large incidents or times of overwhelming call volumes. Mutual aid partners with automatic aid agreements include Benton County Fire District #4, Hanford Fire Department, Benton County Fire District #1, Kennewick Fire Department, and Pasco Fire Department. In 2018, Richland Fire and Emergency Services responded to 6,764 calls for service. Richland currently carries a full-time staff of 63 employees, with 60 of those employees maintaining training and certifications for line firefighting. Response to emergency incidents is carried out from four stations located throughout the city. Each station is staffed 24 hours per day, year-round, with a minimum of three firefighters, including an officer and at least one paramedic. All line personnel trained to NWCG firefighter 2 or above. Each station houses a type 1 structural engine, an advanced life support ambulance, and a specialized apparatus such as wildland engine or aerial apparatus.

City of Richland is a rapidly growing community due in part to its close proximity to the Hanford nuclear reservation where many laboratories and energy related industries provide excellent job and professional growth opportunities. Richland also provides many recreational opportunities, being located at the convergence of the Columbia and Yakima rivers. Over 3 square miles of river are accessible within Richland's boundaries. As Richland continues to grow, homes in the wildland urban interface present additional challenges for fire prevention and suppression. Additionally, many high value laboratories and research facilities are located in north Richland close to Hanford, where there are significant wildland urban interface exposures.

Department Concerns

Richland Fire and Emergency Services has identified several issues which need to be addressed in the immediate future. These issues are serving an aging population, maximizing organizational efficiencies, and serving the growth of the community. Serving the growth of the community requires strengthening wildland urban interface response capabilities.

As Richland grows, more wildland urban interface hazards arise. Additionally, more individuals take part in recreational activities on our local waterways and hiking areas such as Badger Mountain, Amon Canyon, Bateman Island, and the Yakima delta. Improved access for emergency vehicles, in conjunction with identified egress routes from these areas, will help improve safety in the city as well as protect property in the event of wildfire. Plans are being worked on to achieve these goals, but there will likely be significant expense involved. As with any growth, additional facilities need to be considered, as well as staffing for the facilities. Plans are in place to build additional stations, as well as staff those stations, to ensure the high level of service Richland residents have come to expect. Funding for these additional facilities will be a significant hurdle.

West Benton Fire Rescue

Department Summary

WBFR provides fire, rescue and emergency medical services to an area of 176 square miles located in Western Benton County, including the City of Prosser and Community of Whitstran. This response area is comprised of urban, suburban, rural and wildland is inhabited by 13,300 permanent residents and is split down the middle by the Yakima River. WBFR provides fire protection to the area with 3 paid personnel, 2 seasonal employees and 25 volunteers, answering over 600 calls for service annually.

Department Concerns

Personnel: WBFRs response model relies heavily on Volunteer Firefighters, which make up 85% of our response force. Due to a societal decline in volunteerism and the ever-increasing requirements to be a firefighter, WBFR has found it difficult to increase the depth of the Volunteer ranks. In addition, it is difficult to expand specialized services such as technical rescue and hazardous materials response when so heavily reliant on Volunteer Firefighters.

Rural Property Development: WBFRs response area continues to see development of new single-family residential structures into the Intermix/Interface areas comprised of heavy grass/brush fuels. Many times, fires in the interface/intermix require an extensive amount of resources to provide structure protection as well as being actively engaged in fire suppression. This can cause a large drain on regionally available apparatus.

Communications: With the recent addition of Franklin County and Walla Walla Fire District 5 to our dispatching agency, radio traffic has been extremely busy. Though local repeaters and tactical frequencies used to command individual incidents are plentiful, both the availability of simulcast frequencies to communicate with the dispatcher AND the personnel at the dispatch center to listen to multiple frequencies is lacking.

Vegetation Management: Invasive plant species such as Kocia and Russian thistle, along with cheatgrass, make managing a 5-acre rural residential parcel difficult. Many rural property owners fail to control invasive species which leads to insufficient or non-existent defensible space.

The lack of a State Vegetation Management Program has allowed the cheatgrass and invasive species to grow right up the end edge of Interstate and State Highway road surfaces. Vegetation that has grown up to the edge of a roadway becomes critically dry in the summer months and is easily ignited by discarded smoking material, mechanical problems or traffic accidents and creates traffic hazards due to fire, smoke and responding fire apparatus in the roadway. WBFR protects thousands of acres of lands that abut under-maintained roadways and spend a considerate amount of time dealing with wildland fires started from roadside ignitions.

Burn Permits: WBFR does not issue burn permits. Burning is limited within the City Limits of Prosser, and surrounding UGA to tumbleweeds. In the rural areas of the response area, Benton County Clean Air Agency sets burning regulations and sets the daily burn decision regarding outdoor burning. Many times, people are unaware about the daily burn decision or the presence of a burn ban.

Fire Inspections: Prosser is home to a vibrant downtown core comprised of 100-year-old multi-story buildings that house restaurants, assembly occupancies, mercantile, offices and residential units. Fire and Life Safety Inspections came under the authority and responsibility of the City of Prosser in 2015. Proper fire and life safety inspections must be maintained to minimize the occurrences of devastating downtown fire losses.

Other: Relying primarily on Volunteer Firefighters, WBFR sometimes struggles to mount an effective initial response force to incidents, and a large/complex natural cover fire or structure always requires the assistance from neighboring agencies to mitigate. To augment day time response in during the summer months, WBFR hires 2 seasonal employees to complete station tasks and respond on incidents.

The two WBFR fire stations are not staffed around the clock, and calls that occur at night or over the weekend are staffed with personnel responding from home. WBFR must continue to identify ways to decrease “turnout time” to incidents, which includes identifying funding to house responders at the headquarters fires station.

WBFR has begun to identify and install fuel breaks around the WUI to the South of town with our heavy equipment. WBFR will continue to build private landowner relationships and identify areas where fuel breaks will have a positive impact.

Cooperative Agreements: WBFR is a signatory to the Tri-County Master Mutual Aid Agreement which includes all agencies in Benton, Franklin and Walla Walla Counties. Additionally, due to our proximity to Yakima County, WBFR has individual Agreements Yakima County Fire District 5, and with the Cities of Sunnyside, Grandview, Mabton, Toppenish and Yakima when additional apparatus is needed. WBFR also has cooperator agreements with USFWS, DNR and BLM.

Department Needs

- Benton County Building Department and the City of Prosser establishing and enforcing codes requiring defensible space around structures and a concerted effort made to form a County wide community education campaign.
- Additional personnel to staff WBFR with a crew around the clock to reduce turnout time.
- Washington State Department of Transportation reinstatement of a proper vegetation management program to address roadway ignition hazards.
- Identification and implementation of frequencies identified for emergency response and dispatch staffing to support a large multi-county dispatch operation.

Apparatus Inventory

Table 11) West Benton Fire Rescue apparatus inventory.

Fed ID #								
Address	**Unit #**	**Year**	**Make**	**Tank Size**	**Type**	**GPM**	**Other Information**	**Available for Mob.**
Station 310: 1200 Grant Ave	CH131	2017	Chevrolet Tahoe				Command	Yes
	CT131	2012	Ford F-250				Command	Yes
	CT132	2016	Ford F150				Command	Yes
	UT131	2009	Chevrolet Tahoe				Utility	Yes
	R1341	2005	Braun		Type 4 Rescue		Hvy Rescue	Yes
	E1311	1994	E-One	750	Type 1 Engine	1500	Structure w/ Foam	Yes
	E1313	1998	H&W	970	Type 1 Engine	1250	Structure w/ Foam	Yes
	T1311	2010	E-One	3000	Type 1 Tender	750	Tactical	Yes
	W1312	1986	Ford LTL9000	4500	Type 1 Tender	1000	Water Tender	Yes
	E1352	2000	Ford F450	450	Type 5 Engine	150	4x4 wildland	Yes
	E1351	2009	Ford F450	450	Type 5 Engine	150	4x4 wildland	Yes
	Transport131	1988	White/GMC		Transport		Tractor/Trailer	Yes
	Dozer 1321	1982	Case 1150C		Type 2 Dozer		With Disc	Yes
	ATV131		Polaris 400 4x4		ATV		Swamper	Yes
Station 320: 15802 Rothrock Rd	E1312	1998	H&W	970	Type 1 Engine	1250	Structure w/ Foam	Yes
	T1313	1989	International	2500	Type 1 Tender	250	Tactical Tender	Yes
	E1353	2004	Ford F450	450	Type 5 Engine	150	4x4 Wildland	Yes
	E1363	1988	Chevrolet 3500	250	Type 6 Engine	150	4x4 Wildland	Yes

Washington Department of Natural Resources

District Summary: The Washington Department of Natural Resources (DNR) is the largest on-call fire department in the State with 1,200 permanent and temporary employees that fight fire on more than 12 million acres of private and state-owned forest lands. The DNR's fire protection and safety equipment requirements help local fire districts respond to wildfires. The DNR also works with the National Weather Service to provide the fire weather forecasts and fire precaution levels that firefighters, landowners, and forest industry rely on.

The Washington DNR does not have resources directly assigned to Benton County. The DNR's Northwest Region has 8-10 Type 5 and 6 initial attack engines staffed and available during the fire season in addition to air resources. These resources as well as others statewide are available to Benton County as they are available.

****NOTE: Washington DNR does not respond to structure fires.****

Bureau of Land Management

Spokane District Mission Statement: The mission of the Spokane District is to share our unique capability and interest in sustaining the full diversity of natural and cultural landscapes across Washington State and invite their discovery and use. This includes protecting the natural resources, such as water for fish and wildlife; preserving environmental and cultural values on the lands they manage; providing for multiple uses including some commercial activities; and enhancing opportunities for safe and enjoyable outdoor recreation. The Spokane District also assesses energy and mineral resources and works to ensure that their development is in the best interest of the public. Another major responsibility is to ensure consideration of Tribal interests and administration the Department of Interior's trust responsibilities for American Indian Reservation communities.

District Summary: Up through the 1970's, BLM's policy was to divest ownership of all federal public (BLM) lands in the state of Washington. But in 1980, at the height of the Sage Brush Rebellion (a social movement to give control over federal lands to the states and local authorities), Washington voted to have the public lands remain under federal ownership and management. In the 1980 general election, the state put a measure on the ballot asking voters if the state constitution should "be amended to provide that the state no longer disclaim all rights to unappropriated federal public lands." Approximately 60% of the people and the majority in every county voted no, signaling to BLM that there was strong support for continued federal management of the public lands in the state. Today the Spokane District BLM manages just over 11,000 acres in Benton County for multiple uses, providing wildfire protection, suppression, support, and training for the BLM managed lands and other federal/state/county agencies.

The Spokane District Fire Management Program currently consists of two type six wildland engines (300 gallons) with two full time Engine Captains, four engine crew members, one ten-person hand crew, one Fuels Technician, Seasonal Dispatcher, Assistant Fire Management Officer (AFMO), and a Fire Management Officer (FMO). The hand crew and one engine are stationed in Spokane at the District office and the other in Wenatchee at the field office. There are approximately 16 other specialist (staff) from across the district that assist the Fire Management Program in wildland and/or prescribed fire efforts. With the District's scattered ownership pattern, the engines are usually on scene after initial attack forces have arrived. Our engines and personnel are available for off District and out of state fire assignments that aide in support, training, and experience.

Fire Protection Issues

The following sections provide a brief overview of the many difficult issues currently challenging Benton County in providing wildland fire safety to citizens. These issues were discussed at length both during the committee process and at the public meetings.

Address Signage

The ability to quickly locate a physical address is critical in providing services in any type of emergency response. Accurate road address and address signage is fundamental to ensuring the safety and security of Benton County residents. Currently, there are numerous areas throughout the county lacking road signs, address markers, or both. Updating signage throughout the county will increase the likelihood that first responders will be able to quickly locate and read posted signs in emergency situations.

Coordination with State and Federal Agencies

Efforts are being created to improve communication between local fire departments and the federal agencies through agreements and sharing communication plans. This presents a problem when there is confusion on who has initial attack responsibilities on federal lands and what restrictions are imposed by the jurisdictional agency responsible for fire protection.

Urban and Suburban Growth

One challenge Benton County faces is the large number of houses in the urban/rural fringe. Since the 1970s, a segment of Washington's growing population has expanded further into traditional rural or resource lands. The “interface” between urban and suburban areas and the resource lands created by this expansion has produced a significant increase in threats to life and property from fires. Benton County has a low number of Firewise Communities; therefore, there are many property owners within the interface that are not aware of the problems and threats they face. Furthermore, human activities increase the incidence of fire ignition and potential damage.

Rural Fire Protection

People moving from urban areas to the more rural parts of Benton County, frequently have high expectations for structural fire protection services. Often, new residents do not realize that the services provided are not the same as in an urban area. The diversity and amount of equipment and the number of personnel can be substantially limited in rural areas. Fire protection may rely more on the landowner’s personal initiative to take measures to protect his or her property. Furthermore, subdivisions on steep slopes and the greater number of homes exceeding 3,000 square feet are also factors challenging fire service organizations. In the future, public education and awareness may play a greater role in rural or interface areas. Great improvements in fire protection techniques are being made to adapt to large, rapidly spreading fires that threaten large numbers of homes in interface areas.

Debris Burning

Local burning of yard debris is highly regulated in Benton County. Permit burns in Benton County are based on the DNR cycle, while burn bans are a locally-based decision determined by fuel moistures (see

Fire District Summaries for more information on burning). Some people still burn outside of the designated time frame, and escaped debris fires impose a very high fire risk to neighboring properties and residents. It is likely that regulating this type of burning will always be a challenge for local authorities and fire departments; however, improved public education regarding the county's burning regulations and permit system as well as potential risk factors would be beneficial.

Pre-planning in High Risk Areas

Although conducting home, community, and road defensible space projects is a very effective way to reduce the fire risk to communities in Benton County, recommended projects cannot all occur immediately, and many will take several years to complete. Thus, developing pre-planning guidelines specifying which and how local fire agencies and departments will respond to specific areas is very beneficial. These response plans should include assessments of the structures, topography, fuels, available evacuation routes, available resources, response times, communications, water resource availability, and any other factors specific to an area. All of these plans should be available to the local fire departments as well as dispatch personnel.

Conservation Reserve Program Fields

Since the introduction of the CRP by the federal government, many formerly crop producing fields have been allowed to return to native grasses. CRP fields are creating a new fire concern all over the west. As thick grasses are allowed to grow naturally year after year, dense mats of dead plant material begin to buildup. Due to the availability of a continuous fuel bed, fires in CRP fields tend to burn very intensely with large flame lengths that often jump roads or other barriers, particularly under the influence of wind. Many landowners and fire personnel are researching allowable management techniques to deal with this increasing problem.

Currently, large blocks of land as well as scattered parcels in Benton County are enrolled in the CRP program. Hundreds of acres of continuous higher fuel concentrations as well as limited access to these areas have significantly increased the potential wildfire risk in these areas. Many CRP landowners are willing to conduct hazardous fuel reduction treatments to lessen the fire risk; however, they are often limited by the regulations of the CRP program.

Due to the difficulties involved with conducting fuel reduction projects on CRP land as well as the enormity of the task in Benton County, the Community Wildfire Protection Plan steering committee has recommended disking fuel breaks adjacent to CRP land wherever possible. The goal is to lower the intensity of a wind-driven CRP fire before it threatens homes and other resources.

Volunteer Firefighter Recruitment and Retention

The rural fire departments in Benton County are predominantly dependent on volunteer firefighters. Each district spends a considerable amount of time and resources training and equipping each volunteer, with the hope that they will continue to volunteer their services to the department for at least several years. One problem that all volunteer-based departments encounter is the diminishing number of new recruits. As populations continue to rise and more and more people build homes in high fire risk areas, the number of capable volunteers has gone down. In particular, many departments have difficulty maintaining volunteers available during regular work day hours (8am to 5pm).

One of the goals of this CWPP is to assist local fire departments and districts with the recruitment of new volunteers and retention of trained firefighters. This is a very difficult task, particularly in small, rural communities that have a limited pool; however, providing departments with funding for training, safety equipment, advertising, and possibly incentive programs will help draw more local citizens into the fire organizations.

Communication

There are several communication issues being addressed in Benton County. Many of the emergency responders have identified areas of poor reception for both radios and cell phones. The lack of communication between responders as well as with central dispatch significantly impairs responders' ability to effectively and efficiently do their job as well as lessens their safety. The conversion to a narrow band communication system exacerbated these issues and will require numerous additional repeaters to be installed. Additionally, the radio system will soon require replacement of the microwave.

For emergency situations, Benton County currently uses CodeRed to keep citizens informed. CodeRed is an opt-in notification program that is free for citizens.

Communication is a central issue for the planning committee; thus, numerous recommendations targeting the improvement of communications infrastructure, equipment, and pre-planning have been made.

Water Resources

Nearly every fire district involved in this planning process indicated the need to develop additional water resources in several rural areas. Developing water supply resources such as cisterns, dry hydrants, drafting sites, and/or dipping locations ahead of an incident is considered a force multiplier and can be critical for successful suppression of fires. Pre-developed water resources can be strategically located to cut refilling turnaround times in half or more, which saves valuable time for both structural and wildland fire suppression efforts.

Invasive Species

Fire behavior and fire regimes have been altered due to the proliferation of cheatgrass (*Bromus tectorum*) and other invasive species. Cheatgrass has a very fine structure, tends to accumulate litter, and dries completely in early summer, thus becoming a highly flammable, often continuous fuel.[21]

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[21] USDA online database. http://www.fs.fed.us/database/feis/plants/graminoid/brotec/all.html#REFERENCES Accessed December, 2013.

Public Wildfire Awareness

As the potential fire risk in the wildland urban interface continues to increase, it is clear that fire service organizations cannot be solely responsible for protection of lives, structures, infrastructure, ecosystems, and all of the intrinsic values that go along with living in rural areas. Public awareness of the wildland fire risks as well as homeowner accountability for the risk on their own property is paramount to protection of all the resources in the wildland urban interface.

The continued development of mechanisms and partnerships to increase public awareness regarding wildfire risks and promoting "do it yourself" mitigation actions is a primary goal of the planning committee as well as many of the individual organizations participating on the committee.

Current Wildfire Mitigation Activities

Many of the county's fire departments and agencies are actively working on public education and homeowner responsibility by visiting neighborhoods and schools to explain fire hazards to citizens. Often, they hand deliver informative brochures and encourage homeowners to have their driveways clearly marked with their addresses to ensure more rapid and accurate response to calls and better access.

The City of Richland Fire Department has contacted homeowners around the Leslie Canyon Area, to educate them about the fire hazard and actions they can take to make their properties more resistant to fire. Some of these residents have completed work needed. Residents in Country Ridge were also contacted and have done work as well. The City of Kennewick is working with residents in the Zintel Canyon area to discuss similar measures. BCFD#1 has made contact with residents in the Triple Vista and Clodfelter areas and the Badger and Dallas Road areas to discuss similar measures.

Firewise

"Over the past century, America's population has nearly tripled, with much of the growth flowing into traditionally natural areas. These natural, unprotected settings are attracting more residents every year. This trend has created an extremely complex landscape that has come to be known as the wildland urban interface: a set of conditions under which a wildland fire reaches beyond trees, brush, and other natural fuels to ignite homes and their immediate surroundings. Consequently, in nearly all areas of the country, the wildland urban interface can provide conditions favorable for the spread of wildfires and ongoing threats to homes and people. Many individuals move into these landscapes with urban expectations. They may not recognize wildfire hazards or might assume that the fire department will be able to save their home if a wildfire ignites. However, when an extreme wildfire spreads, it can simultaneously expose dozens — sometimes hundreds — of homes to potential ignition. In cases such as this, firefighters do not have the resources to defend every home. Homeowners who take proactive steps to reduce their homes' vulnerability have a far greater chance of having their homes withstand a wildfire. The nation's federal and state land management agencies and local fire departments have joined together to empower homeowners with the knowledge and tools to protect their homes through the National Firewise Communities Program. Firewise Communities is designed to encourage local solutions for wildfire safety by involving firefighters, homeowners, community leaders, planners, developers, and others in efforts to design, build, and maintain homes and properties that are safely compatible with the natural environment. The best Firewise approach involves a series of practical steps that help individuals and community groups work together to protect themselves and their properties from the hazard of wildfire. Using at least one element of a Firewise program and adding other elements over time will reduce a homeowner's and a community's vulnerability to fire in the wildland/urban interface. Wildland fires are a natural process. Making your home compatible with nature can help save your home and, ultimately, your entire community during a wildfire."[22]

Fire Adapted Communities (FAC)

"Fire Adapted Communities are neighborhoods located in wildfire-prone areas that can survive wildfire with little or no assistance from firefighters. During a wildfire, FACs reduce the potential for loss of human life and injury, minimize damage to homes and infrastructure and reduce firefighting costs. This program offers information, promotional materials and articles that can be customized for your area. This program also offers videos and a display system that is available for use at community events, meetings, etc."[23]

Firebreaks

Fire breaks have been constructed in some areas, such as Rattlesnake Mountain and the Richland Airport. There are fire breaks throughout the county that are maintained on an as-needed basis.

Staff Rides

Some agencies participate in Staff Rides, like to Rattlesnake Mountain, which involve taking agency members to known areas of past fires and reviewing such wildfire factors as terrain and successful tactics, in preparation for future incidents in the same areas.

Public Wildfire Awareness

Some agencies currently post information on social media to teach homeowners about defensible space concepts and strategies.

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[22] http://www.firewise.org/Information/Who-is-this-or/Homeowners/~/media/Firewise/Files/Pdfs/Booklets%20and%20Brochures/BrochureCommunitiesCompatibleNature.pdf. Accessed June, 2012.

[23] Living with Fire website available at: http://www.livingwithfire.info/fire-adapted-communities. Accessed May, 2014.

Drought

The term 'drought' is applied to a period in which an unusual scarcity of rain causes a serious hydrological imbalance: water-supply reservoirs empty, wells dry up, and crop damage ensues. The severity of the drought is gauged by the degree of moisture deficiency, its duration, and the size of the area affected. If the drought is brief, it is known as a dry spell, or partial drought. A partial drought is usually defined as more than 14 days without appreciable precipitation, whereas a drought may last for years.

Definitions

Washington has a statutory definition of drought, consisting of two parts:

1. An area has to be experiencing or projected to experience a water supply that is below 75 percent of normal.
2. Water users within those areas will likely incur undue hardships as a result of the shortage.

Background Information

Drought is a normal, recurrent feature of climate. It occurs in virtually all climate zones, but its characteristics vary significantly from one region to another. Drought is a temporary occurrence; it differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate. A drought is therefore different from a dry climate.

Droughts tend to be more severe in some areas than in others. Catastrophic droughts generally occur at latitudes of about 15°-20°, in areas bordering the permanently arid regions of the world. In North America, archaeological studies of Native Americans and statistics derived from long term agricultural records show that six or seven centuries ago whole areas of the Southwest were abandoned by the indigenous agriculturists because of repeated droughts and were never reoccupied. The statistics indicate that roughly every 22 years—with a precision of three to four years—a major drought occurs in the United States, most seriously affecting the Prairie and midwestern states.

A drought directly or indirectly affects all people and all areas of the state. A drought can result in farmers not being able to plant crops or the failure of the planted crops. Table 12 shows how drought is classified by severity and which impacts/consequences can be expected at different levels of severity. This results in loss of work for farm workers and those in related food processing jobs. Other water or electricity-dependent industries commonly shut down all or a portion of their facilities, resulting in further layoffs. A drought can spell disaster for recreational companies that use water (e.g., swimming pools, water parks, and river rafting companies) and for landscape and nursery businesses because people will not invest in new plants if water is not available to sustain them. Additionally, with much of Washington's energy coming from hydroelectric plants, a drought can mean more expensive electricity from other resources than dams and probably higher electric bills.

Historical Drought Events

The State's most severe drought episode occurred in 1977, when many of the current records for low precipitation, snow accumulation (e.g. snowpack), and stream flow totals were set. The more recent 2001 drought turned out to be the second-worst drought year in state-recorded history. By mid-March 2001, most of Washington was suffering a water supply deficit. Federal, state and local officials worried that low river flows would disrupt state energy production. Dwindling water supplies put various threatened and endangered fish species at risk. The state also experienced severe economic strain on its agricultural, municipal and industrial sectors due to the drought. In 2015, 44% of Washington was declared a drought emergency area, including Benton County. By May of 2015 one fifth of the state's rivers and streams were at record lows. By August 85% of the state was categorized as "extreme drought", also including Benton County.

In the last century, there have been a number of drought episodes in eastern Washington, including several that have lasted for more than a single season, such as the dry periods between 1928-32 and 1992-94. The primary effects of these droughts have been economic – affecting agriculture and the population in general due to energy curtailments. The worst national drought in 50 years affected at least 35 states during the summer of 1988. In some areas the lack of rainfall dated back to 1984. In 1988, rainfall totals over the mid-west, Northern Plains and the Rockies were 50 percent to 85 percent below normal. Crops and livestock died, and some areas were affected by desertification. Forest fires began over the Northwest and by autumn, 4,100,000 acres had been destroyed.

Table 12) Drought severity index from U.S. Drought Monitor Weekly Drought Map (noaa.gov).

Description	Possible Impacts
Abnormally Dry	Going into drought: short-term dryness slows growth of crops/pastures. Coming out of drought: some lingering water deficits; crops/pastures not fully recovered.
Moderate Drought	Some damage to crops/pastures; streams, reservoirs, or wells are low with some water shortages developing or imminent; voluntary water-use restrictions requested.
Severe Drought	Crop/pasture losses are likely; water shortages are common and water restrictions are imposed.
Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions.
Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies.

Severe Weather

Severe storms are a serious hazard that can and do affect the Pacific Northwest on a regular basis. Due to Washington's complex landscape and influence from the Pacific Ocean, severe storms have varying degrees of impact on different portions of the state. Although Washington sees relatively few damaging storms in comparison with the rest of the nation, severe weather still poses a significant hazard to both state and local communities.

Definitions and Background Information

High Winds: Sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration, not caused by thunderstorms. In Washington State, extreme sustained wind velocities can be expected to reach 50 mph at least once in two years; 60 to 70 mph once in 50 years; and 80 mph once in 100 years. The National Climatic Data Center (NCDC) has recorded 82 high or strong wind events with wind speeds greater than 30 knots since 1950. The 2014 Washington State Enhanced Hazard Mitigation Plan identified Benton County as being vulnerable to severe high wind events.

Severe Thunderstorm: A thunderstorm that produces a tornado, winds of at least 58 mph (50 knots), and/or hail at least 1 inch in diameter. A thunderstorm with wind equal to or greater than 40 mph (35 knots) and/or hail at least ½ inches in diameter is defined as approaching severe. Thunderstorms with lightning, heavy rain, hail, and high winds are frequent occurrences in Benton County and its neighboring counties from late April through September. The spring storms are generally the result of local convection. They develop fairly quickly, dissipate rapidly, and generally cause small amounts of localized damage, if any. The NCDC has recorded 48 Thunderstorm Wind events in Benton County since 1950.

Tornado: A violently rotating column of air, usually pendant to a cumulonimbus (type of cloud), with circulation reaching the ground. It nearly always starts as a funnel cloud and may be accompanied by a loud rotating noise. On a local scale, it is the most destructive of all atmospheric phenomena. Since 1956, only four tornadoes have been recorded in Benton County, the most recent occurred in 2015. None of these tornadoes were large enough to receive a Fujita tornado intensity rating.

Heavy Snow: This generally means: a snowfall accumulating to 4" or more in depth in 12 hours or less or a snowfall accumulating to 6" or more in depth in 24 hours or less. The NCDC has recorded 14 heavy snows events in Benton County since 1950.

Lightning: A visible electrical discharge produced by a thunderstorm. The discharge may occur within or between clouds, between the cloud and air, between a cloud and the ground or between the ground and a cloud. Lightning strikes are fairly common during summer storms and are known to start fires and damage property, such as what happened in August of 2009 when lightning strikes started the Dry Creek Complex fire.

Hail: Showery precipitation in the form of irregular pellets or balls of ice more than 5 mm in diameter, falling from a cumulonimbus cloud. The NCDC has recorded 13 hail events in Benton County since 1950.

None of these events caused significant property damage or included widespread occurrence of hailstones larger than 1 inch in diameter.

Winter storm: A storm with significant snowfall, ice, and/or freezing rain; the quantity of precipitation varies by elevation. Heavy snowfall is 4 inches or more in a 12-hour period, or 6 or more inches in a 24-hour period in non-mountainous areas; and 12 inches or more in a 12-hour period or 18 inches or more in a 24-hour period in mountainous areas. The NCDC has recorded 4 winter storm events in Benton County since 1950.

Historical Weather Events

From 1956 to 2017, 152 Presidential Disaster declarations were made for Washington State, 43 of which were related to severe weather. Of these 43 events, 12 directly impacted Benton County.[24]

Table 13) Presidential Disaster declarations made for Benton County between 1956 and 2017.

FEMA Disaster #	Year	Extent	Incident Title
137	1962	Statewide	SEVERE STORMS
185	1964	Benton County	HEAVY RAINS & FLOODING
414	1974	Benton County	SEVERE STORMS, SNOWMELT & FLOODING
492	1975	Benton County	SEVERE STORMS & FLOODING
545	1977	Benton County	SEVERE STORMS, MUDSLIDES, & FLOODING
852	1990	Benton County	SEVERE STORMS & FLOODING
1100	1996	Benton County	HIGH WINDS, SEVERE STORMS AND FLOODING
1159	1997	Benton County	SEVERE WINTER STORMS, LAND & MUDS SLIDES, FLOODING
3037	1977	Benton County	DROUGHT
1817	2009	Benton County	SEVERE WINTER STORM, LANDSLIDES, MUDSLIDES, AND FLOODING
1825	2009	Benton County	SEVERE WINTER STORM AND RECORD AND NEAR RECORD SNOW
4309	2017	Benton County	SEVERE WINTER STORMS, FLOODING

[24]FEMA Data Visualization: Disaster Declarations for States and Counties. Accessed 1/23/18 https://www.fema.gov/data-visualization-disaster-declarations-states-and-counties:

Earthquake

Much of the information below was excerpted or derived from past Benton County Hazard Mitigation Plans or from the Washington Military Department's Washington State Enhanced Hazard Mitigation Plan (EHMP).

Background Information

More than 1,000 earthquakes occur in the Washington State annually. Washington has a record of at least 20 damaging earthquakes during the past 125 years. Large earthquakes in 1946, 1949, and 1965 killed 15 people and caused more than $200 million (1984 dollars) in property damage. Most of these earthquakes occurred in western Washington but several, including the 1872 Lake Chelan earthquake which is one of the largest earthquakes on record for the State of Washington, occurred east of the Cascade crest. Because of the potential for another earthquake with a magnitude similar to that of the Lake Chelan quake, researchers are currently attempting to map and understand the seismic potential of the fault systems in eastern and central Washington. One geologic feature that is of particular concern in central Washington is the Wallula Fault Zone which runs through Benton County. Some researchers believe that the fault could produce a 7.5 magnitude earthquake which could cause substantial surface cracking, soil liquefaction, and damage to infrastructure in local communities.

In addition to locating and mapping fault lines in Washington, researchers are also attempting to predict when earthquakes will occur. Earthquake histories spanning thousands of years from Japan, China, Turkey, and Iran show regional patterns of large earthquake reoccurrence on the order of hundreds or thousands of years. Unfortunately, Washington's short historical record (starting about 1833) is inadequate to sample its earthquake record. Using a branch of geology called paleoseismology to extend the historical earthquake record, geologists have found evidence of large, prehistoric earthquakes in areas with no documentation of large historic events, suggesting that most of the state may be at risk (Walsh *et al.* 2006).

Definitions

Cascadia Subduction Zone Earthquakes: the result of geologic processes producing stresses in the earth. In the Pacific Northwest, oceanic crust is being pushed beneath the North American continent along a major boundary parallel to the coast of Washington and Oregon. The boundary called the "Cascadia Subduction Zone" lies about 50 miles offshore and extends from the middle of Vancouver Island in British Columbia past Washington and Oregon to northern California. The interaction of these two "plates" produces three primary types of earthquakes:

- **Deep or Benioff Zone Earthquakes:** These earthquakes occur within the subducting Juan de Fuca plate at depths of 15 to 60 miles, although the largest events typically occur at depths of about 25 to 40 miles. They may produce events with magnitudes exceeding 9.0.
- **Subduction Zone (Interplate) Earthquakes:** These earthquakes occur along the interface between tectonic plates. Scientists have found evidence of great-magnitude earthquakes along the Cascadia Subduction Zone. These earthquakes are very powerful, with a magnitude of 8 to 9 or greater; they have occurred at intervals ranging from as few as about 100 years to as long as

1,100 years. Subduction zone earthquakes are particularly dangerous in that they produce strong ground motions and in nearly all cases, damaging tsunamis.

- **Shallow or crustal Earthquakes:** These earthquakes occur in the earth's crust within the upper part of the North American plate. Crustal earthquakes are shallow earthquakes, typically within the upper 5 or 10 miles of the earth's surface and some ruptures may reach the surface.

Olympic-Wallowa Lineament (OWL): An approximately 500-km-long topographic feature of the landscape oblique to the Cascadia plate boundary, extending from Vancouver Island, British Columbia, to Walla Walla, Washington[25]. The OWL is a zone that features numerous fault lines that may be able to produce earthquakes.

Yakima Fold-and-Thrust Belt: The Yakima Fold-and-Thrust Belt is a major fault line that is a part of the OWL and incorporates many of the ridges in Benton County; it extends from the Blue Mountains in the east to the western Washington Faults to the west. The folds in the basalt are interpreted as being forced up by compressional faults in rigid crust beneath the basalt; these faults may be earthquake sources[26]. Compressional forces in the Earth's crust have created the ridges that are prominent in the Columbia river basin.

Wallula Fault Zone: An integral feature of the Olympic-Wallowa Lineament and the Yakima Fold and Thrust Belt, it is a prominent northwest-striking fault zone that extends from near Milton-Freewater, OR to near Kennewick, WA.

Ground Shaking: the motion felt on the earth's surface caused by seismic waves generated by the earthquake. It is the primary cause of earthquake damage. The strength of ground shaking (strong motion) depends on the magnitude of the earthquake, the type of fault, and distance from the epicenter (where the earthquake originates). Ground shaking generally decreases with distance from the earthquake source (attenuation), but locally can be much higher than adjacent areas, due to amplification (an increase in strength of shaking for some range of frequencies).

Amplification: occurs where earthquake waves pass from bedrock into softer geologic materials such as sediments. Buildings on poorly consolidated and thick soils will typically see more damage than buildings on consolidated soils and bedrock.

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[25] B. L. Sherrod, R. J. Blakely, J. P. Lasher, A. Lamb, S. A. Mahan, F. F. Foit and E. A. Barnett
Active faulting on the Wallula fault zone within the Olympic-Wallowa Lineament, Washington State, USA
Geological Society of America Bulletin (May 2016) 128 (11-12): 1636-1659

[26] Yeats, Robert S. "Living With Earthquakes In The Pacific Northwest." *Pressbooks*, Oregon State University Press, https://openoregonstate.pressbooks.pub/earthquakes/. Accessed 30 May 2018.

Liquefaction: occurs when water-saturated sands, silts, or (less commonly) gravels are shaken so violently that the grains rearrange and the sediment loses strength, begins to flow out as sand boils (also called sand blows or volcanoes), or causes lateral spreading of overlying layers.

Historical Earthquake Events

Washington is situated at a convergent continental margin, the collisional boundary between two tectonic plates (Figure 13). The Cascadia subduction zone, which is the convergent boundary between the North America plate and the Juan de Fuca plate, lies offshore, stretching from northernmost California to southernmost British Columbia. The two plates are converging at a rate of about 3-4 centimeters per year (about 2 inches per year); in addition, the northward-moving Pacific plate is pushing the Juan de Fuca plate north, causing complex seismic strain to accumulate. Earthquakes are caused by the abrupt release of this slowly accumulated strain.

Intraplate, or Benioff zone, earthquakes occur within the subducting Juan de Fuca plate at depths of 15 to 60 miles, although the largest events typically occur at depths of about 25 to 40 miles. The largest recorded event was a magnitude 7.1 on the Richter scale, the Olympia quake in 1949. Other significant Benioff zone events include the magnitude 6.8 Nisqually earthquake of 2001, the magnitude 5.8 Satsop earthquake in 1999, and the magnitude 6.5 Seattle-Tacoma earthquake in 1965. Strong shaking lasted about 20 seconds in the 1949 Olympia earthquake and about 15 to 20 seconds during the 2001 Nisqually earthquake. Since 1900, there have been five earthquakes in the Puget Sound basin with measured or estimated magnitude of 6.0 or larger, and one of magnitude 7. The approximate rate for earthquakes similar to the 1965 magnitude 6.5 Seattle-Tacoma event and the 2001 Nisqually event is once every 35 years. The approximate reoccurrence rate for earthquakes similar to the 1949 magnitude 7.1 Olympia earthquake is once every 110 years.

Subduction zone, or interplate, earthquakes occur along the interface between tectonic plates. Scientists have found evidence of great magnitude earthquakes along the Cascadia Subduction Zone. These earthquakes were very powerful (magnitude 8 to 9 or greater) and occurred about every 400 to 600 years. This interval, however, has been irregular, as short as 100 years and as long as 1,100 years. The last of these great earthquakes struck Washington in 1700.

Shallow crustal earthquakes occur within about 20 miles of the surface. Recent examples occurred near Bremerton in 1997, near Duvall in 1996, off Maury Island in 1995, near Deming in 1990, near North Bend in 1945, just north of Portland in 1962, and at Elk Lake on the St. Helens seismic zone (a fault zone running north-northwest through Mount St. Helens) in 1981. These earthquakes ranged in magnitude from 5 to 5.5. Scientists believe that the state’s largest crustal earthquake, the 1872 quake near Lake Chelan, was shallow and may be the state’s most widely felt earthquake. The 1936 magnitude 6.1 quake near Walla Walla, another significant Eastern Washington earthquake, was also shallow. Recurrence rates for earthquakes on surface faults are unknown; however, four magnitude 7.0 or greater events occurred during the past 1,100 years, including two since 1918 on Vancouver Island.

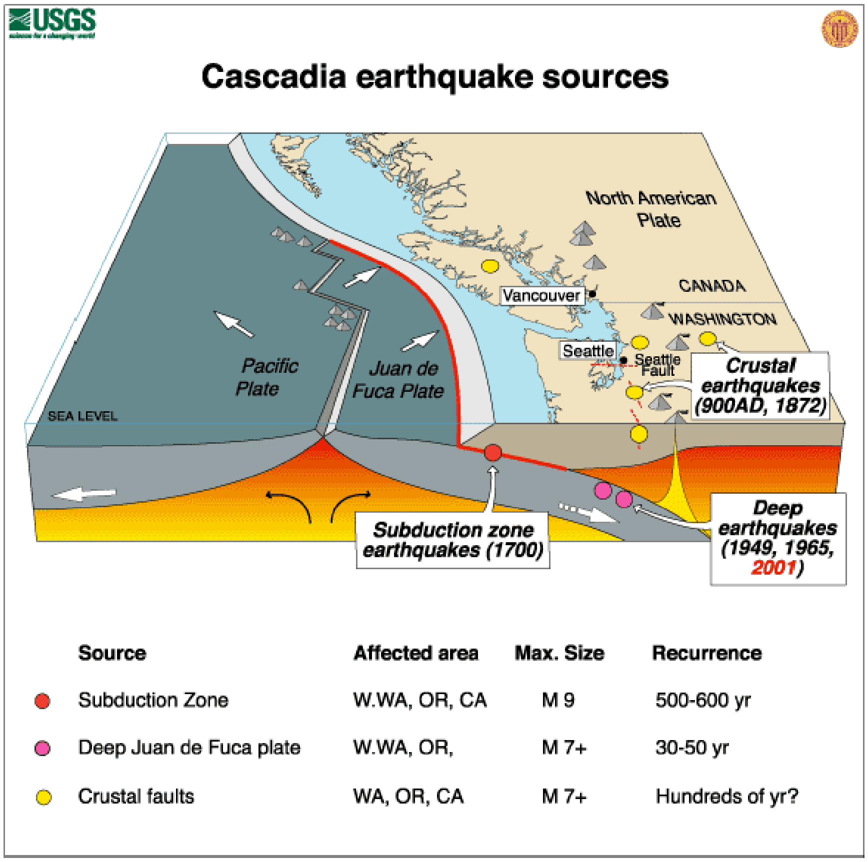

Figure 13) Diagram of tectonic plate subduction zone along the Pacific Coast.

Surface faults can also produce multiple earthquakes in rapid succession called swarms. Residents of Spokane strongly felt a swarm of earthquakes in 2001; the largest earthquake in the swarm had a magnitude of 4.0. The Spokane earthquakes were very shallow, with most events located within a few miles of the surface. The events occurred near a suspected fault informally called the Latah Fault; however, the relation between the fault and the swarm is uncertain. Geologists have mapped the Spokane area, but none confirmed the presence of major faults that might be capable of producing earthquakes. State geologists continue to investigate the geology and earthquake risk near Spokane.

Recently, residents of Benton County experienced swarms of smaller earthquakes that occurred north of Richland at Wooded Island in 2009 and southeast of Prosser in 2000. The largest earthquake to occur in the Wooded Island swarm had a magnitude of 3.0, and collectively, the swarm was accompanied by 35 mm of surface deformation was detected with satellite interferometry (InSAR)[27].

[27] Blakely, Richard J., Brian L. Sherrod, Craig S. Weaver, Alan C. Rohay, and Ray E. Wells. "Tectonic setting of the Wooded Island earthquake swarm, eastern Washington." *Bulletin of the Seismological Society of America*, vol. 102, no. 4, https://pubs.er.usgs.gov/publication/70042555. Accessed 30 May 2018.

Elsewhere in Eastern Washington, geologists have uncovered evidence of a number of surface faults; however, they have not yet determined how active the faults are, nor determined the extent of the risk these faults pose to the public. A few examples of major faults and fault systems in Eastern Washington that could produce damaging earthquakes in the Columbia River Basin include Toppenish Ridge (which appears to have been the source of two earthquakes with magnitudes of 6.5 to 7.3 in the past 10,000 years (EMD 2004)), the Yakima Fold-and-Thrust belt (Figure 14 shows a cross section of the Yakima Fold-and-Thrust belt and the relationship between some of the prominent ridges in the Columbia River Basin and the location of fault lines.), and the Wallula fault zone. As technology evolves, geologists will continue to gain a better understanding of how Eastern Washington fault systems work and their potential to produce earthquakes.

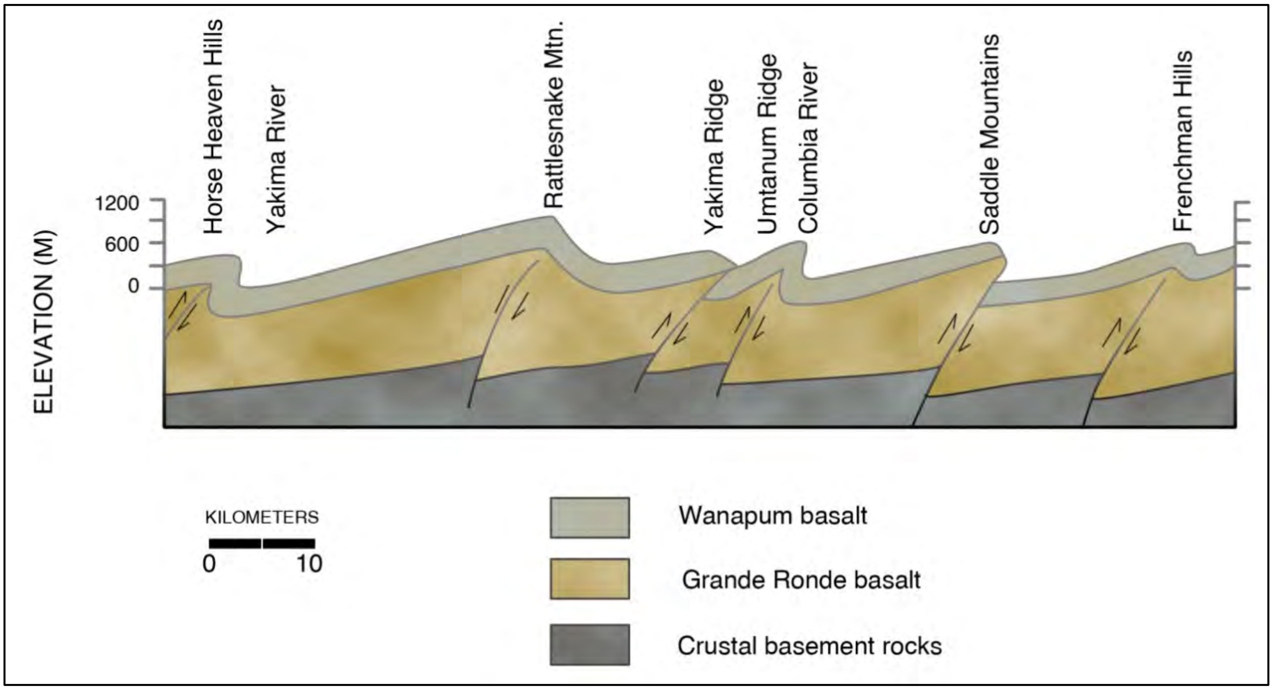

Figure 14) Geologic cross section across Yakima Fold Belt west of Hanford Reservation. South is to the left (taken from *Living With Earthquakes In The Pacific Northwest*).

Seismic activity is a frequent occurrence in the Pacific Northwest as an extensive network of fault lines runs throughout the region. While tectonic plate subduction zones can produce large, devastating earthquakes along the Pacific coast, smaller faults found in the eastern part of the region tend to produce small to moderate earthquakes (Figure 15 shows the epicenters of all Washington earthquakes that occurred between 1872 and 2011). Most earthquakes that occur in eastern Washington are gentle enough that they go unnoticed by affected populations.

Between 1969 and 2018, almost 4,200 earthquakes occurred within or just outside of the Benton County boundary with the largest concentrations of earthquakes having occurred in the northwest corner of the county and in the vicinity of Wooded Island in the Columbia River (Figure 16; due to the limitations of the area-selection feature of the Pacific Northwest Seismic Network mapping tool, areas outside of Benton County were included in the historical earthquake mapping exercise and analysis).

Magnitude 0.9 earthquakes are the mode of the dataset and represent approximately 8.9% of all earthquakes that occurred in the area selected for analysis. Only about 0.4% of earthquakes had a magnitude greater than 3.0 with the highest magnitude earthquake reaching 3.9 (Table 14). Figure 17 shows the distribution of earthquakes that have occurred in the analysis-area; almost 85% of the earthquakes in the dataset were magnitude 0.3 to 1.7.

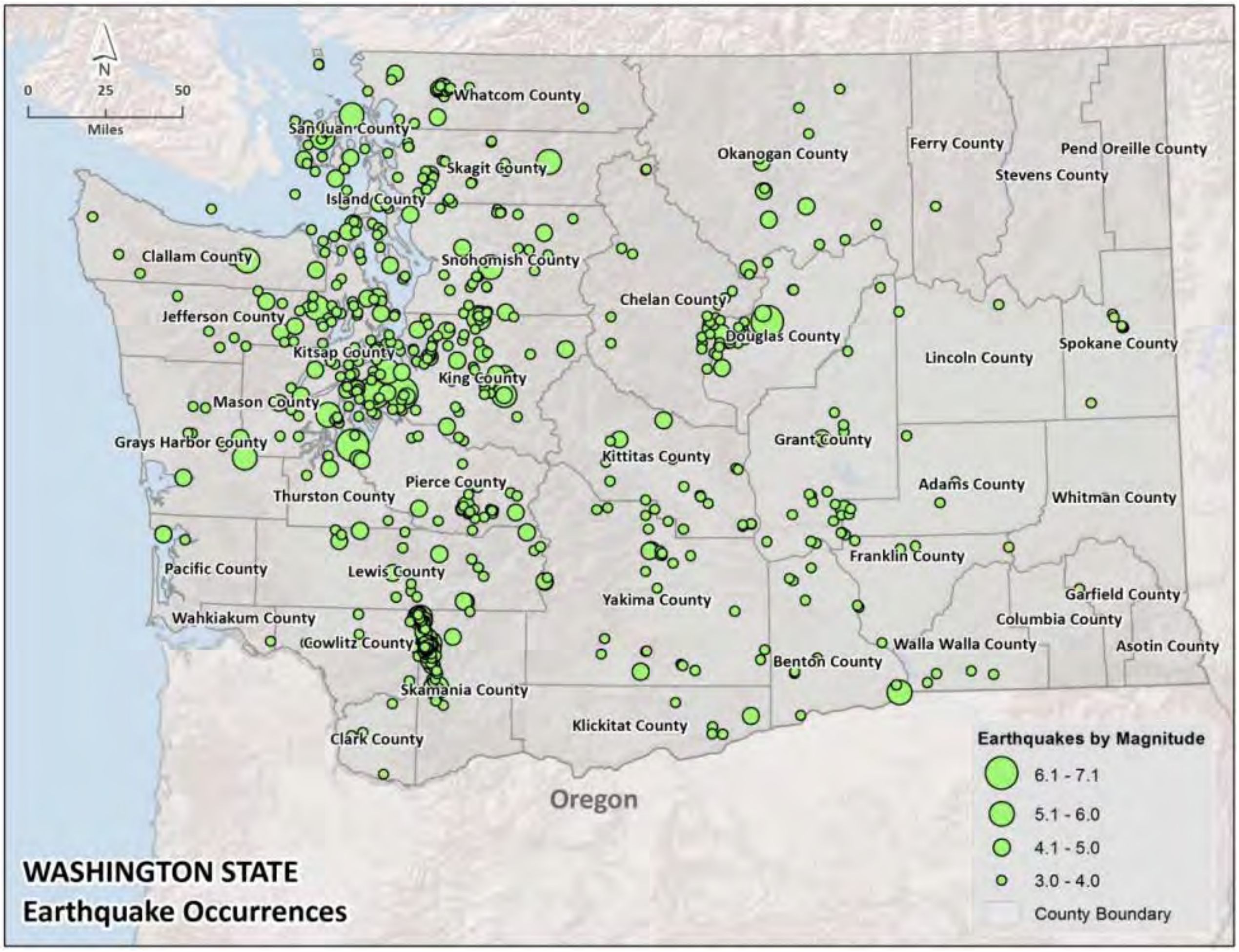

Figure 15) Historic Earthquake Epicenters with Magnitudes of 3.0 or Greater (1872 -2011) (Washington State Department of Natural Resources).

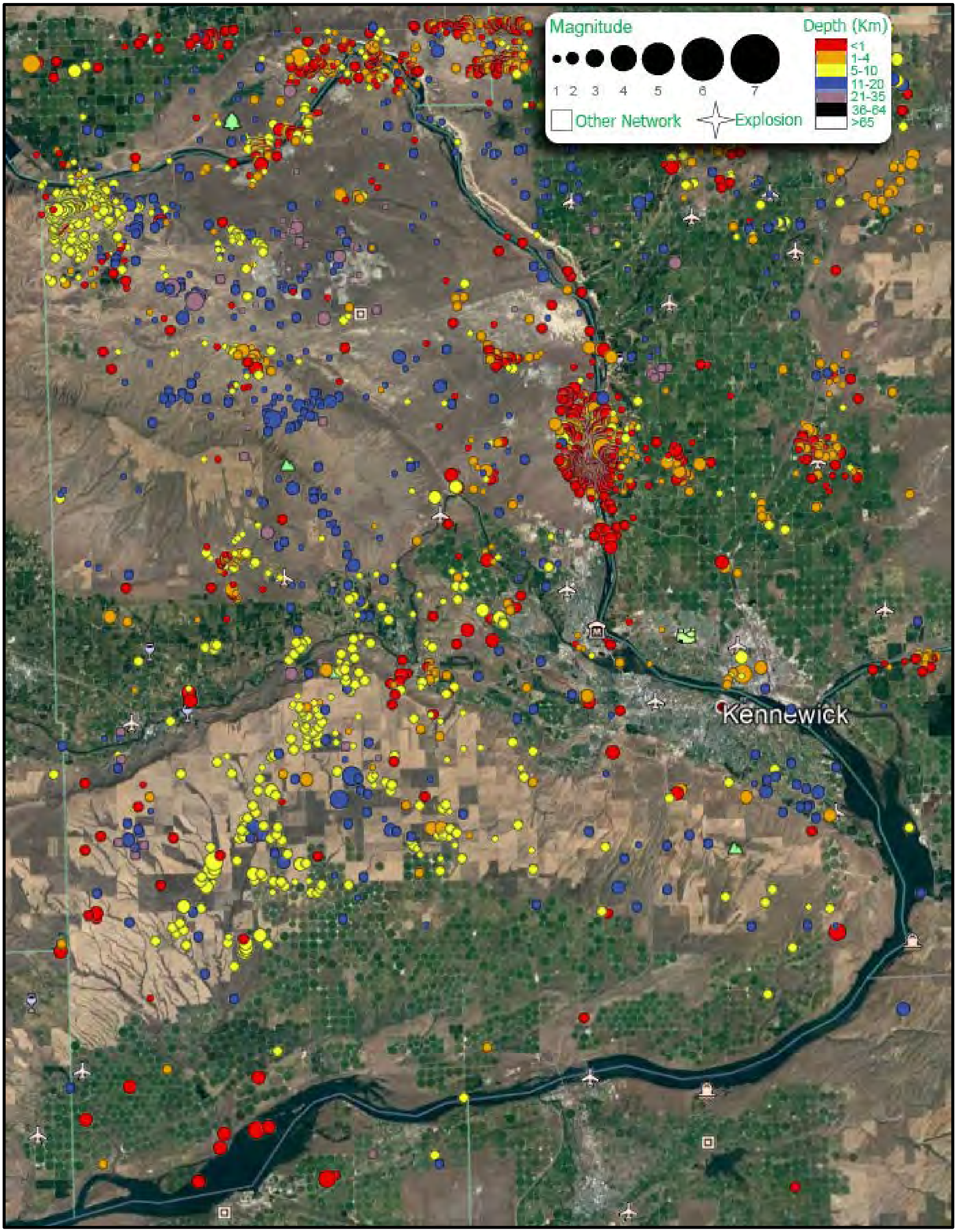

Figure 16) Historic earthquakes on record in and in proximity to Benton County, WA. Map was created using the Pacific Northwest Seismic Network mapping tool and Google Earth.

Table 14) Count of earthquakes by magnitude that occurred in proximity to or within Benton County, WA from 1969 to 2018. Table was created using data from the Pacific Northwest Seismic Network.

Magnitude	Count	Magnitude	Count	Magnitude	Count
-0.9	1	0.7	318	2.2	38
-0.8	2	0.8	314	2.3	35
-0.6	1	0.9	373	2.4	11
-0.5	4	1.0	294	2.5	13
-0.4	6	1.1	293	2.6	15
-0.3	16	1.2	249	2.7	10
-0.2	10	1.3	262	2.8	8
-0.1	25	1.4	201	2.9	5
0.0	23	1.5	164	3.1	4
0.1	40	1.6	142	3.2	3
0.2	71	1.7	102	3.3	4
0.3	109	1.8	98	3.4	3
0.4	171	1.9	74	3.7	1
0.5	242	2.0	58	3.8	2
0.6	317	2.1	48	3.9	1
Total Number of Earthquakes: 4,181					

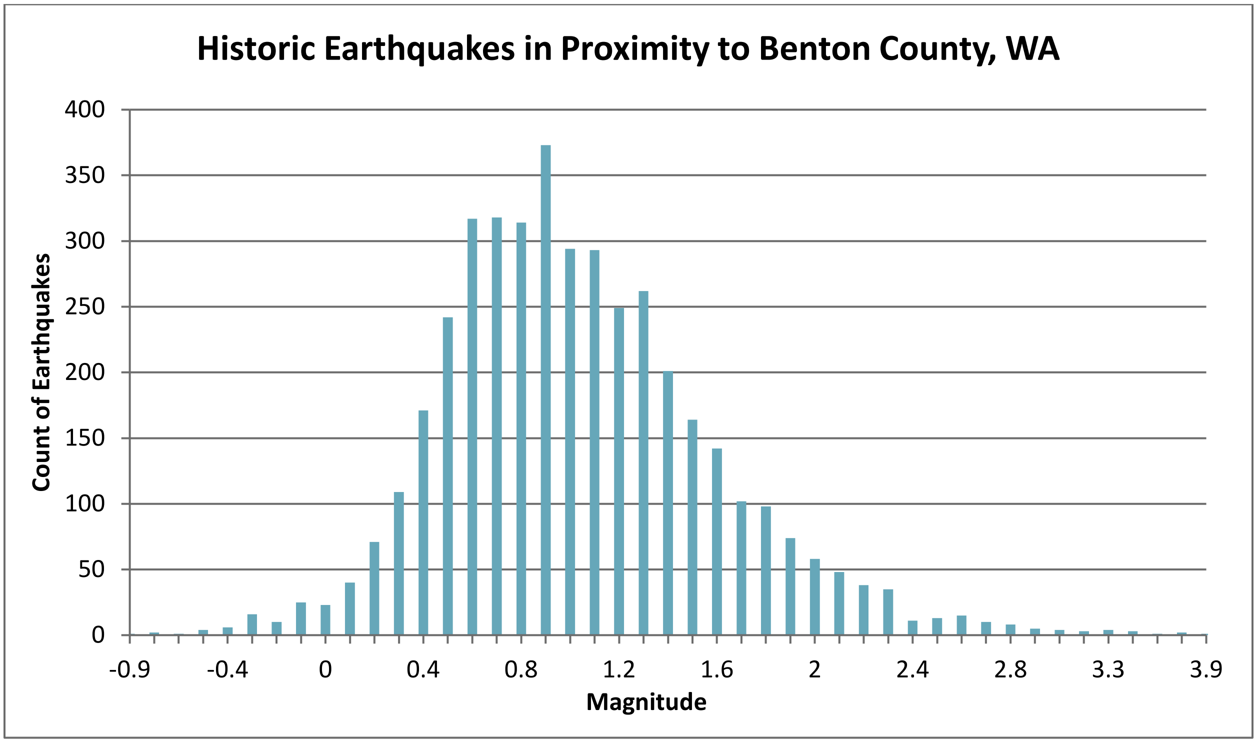

Figure 17) Count of earthquakes by magnitude that occurred in proximity to or within Benton County, WA from 1969 to 2018. Figure was created using data from the Pacific Northwest Seismic Network.

Landslide

Much of the information below was excerpted or derived from past Benton County Hazard Mitigation Plans or from the Washington Military Department's Washington State Enhanced Hazard Mitigation Plan (EHMP).

Landslide is a general term for a wide variety of down slope movements of earthen materials that result in the perceptible downward and outward movement of soil, rock, and vegetation under the influence of gravity. Some landslides are rapid, occurring in seconds, whereas others may take hours, weeks, or even longer to develop. Although landslides usually occur on steep slopes, they can also occur in areas of low relief. Movement can occur through falls, topples, slides, and flows.

Definitions

The following are common classifications of landslides as defined by Varnes in 1978, taking into account modifications made by Cruden and Varnes in 1996.[28,29]

Fall: A fall starts with the detachment of soil or rock from a steep slope along a surface on which little or no shear displacement takes place. The material then descends mainly through the air by falling, bouncing, or rolling.

Topple: Toppling is the forward rotation out of the slope of a mass of soil or rock about a point or axis below the center of gravity of the displaced mass. Toppling is sometimes driven by gravity exerted by material upslope of the displaced mass and sometimes by water or ice in cracks in the mass.

Slide: A slide is a downslope movement of soil or rock mass occurring dominantly on the surface of rupture or on relatively thin zones of intense shear strain.

Flow: A **flow** is a spatially continuous movement in which surfaces of shear are short-lived, closely spaced, and usually not preserved. The distribution of velocities in the displacing mass resembles that in a viscous liquid. The lower boundary of displaced mass may be a surface along which appreciable differential movement has taken place or a thick zone of distributed shear.

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[28] Varnes, D. J. 1978. Slope movement types and processes. In: Special Report 176: Landslides: Analysis and Control (Eds: Schuster, R. L. & Krizek, R. J.). Transportation and Road Research Board, National Academy of Science, Washington D. C., 11-33.

[29] Cruden,D.M., Varnes, D.J., 1996, Landslide Types and Processes, Special Report , Transportation Research Board, National Academy of Sciences, 247:36-75

Background Information

Landslides can occur naturally or be triggered by human-related activities. Naturally-occurring landslides can occur on any terrain, given the right condition of soil, moisture content, and the slope's angle. They are caused from an inherent weakness or instability in the rock or soil combined with one or more triggering events, such as heavy rain, rapid snow melt, flooding, earthquakes, vibrations, and other natural causes. Other natural triggers include the removal of lateral support through the erosive power of streams, glaciers, waves, and longshore and tidal currents; through weathering, wetting, drying, and freeze-thaw cycles in surficial materials; or through land subsidence or faulting that creates new slopes.

Washington State has six landslide provinces, each with its own characteristics; Benton County is part of the Columbia Basin province. Landslides in this province include slope failures in bedrock along the soil interbeds and in the overlying catastrophic flood sediments and loess deposits. Bedrock slope failures are most common in the form of very large deep-seated translational landslides, deep-seated slumps or earth flows; a triggering mechanism appears to be over-steepening of a slope or removal of the toe of a slope by streams or the catastrophic glacial floods. These landslides usually move along sediment interbeds within the Columbia River Basalts. Major landslide problems occurred during the relocation of transportation routes required by the filling of the reservoir behind the John Day Dam and in the highly erosive and weak loessal soils of southeastern Washington. Rockfall occurs in the oversteepened rock slopes left behind by the erosion of the catastrophic floods along SR 730 and 14.

Irrigation in the Columbia Basin compounds landslide problems. For example, irrigation near Pasco has increased drainage and landslide problems ten-fold since 1957. Reactivations of relict and dormant deep-seated landslide complexes have occurred in the bluffs along the Columbia River upstream of Richland.

Stream and riverbank erosion, road building or other excavation can remove the toe or lateral slope and exacerbate landslides. Seismic or volcanic activity often triggers landslides as well. Urban and rural living with excavations, roads, drainage ways, landscape watering, and agricultural irrigation may also disturb the solidity of landforms, triggering landslides. In general, any land use changes that affects drainage patterns or that increase erosion or change ground-water levels can augment the potential for landslide activity.

Land stability cannot be absolutely predicted with current technology. The best design and construction measures are still vulnerable to slope failure. The amount of protection, usually correlated to cost, is proportional to the level of risk reduction. Debris and vegetation management is integral to prevent landslide damages. Corrective measures help but can often leave the property vulnerable to risk.

The following characteristics may be indicative of a landside hazard area:

- Bluff retreat caused by sloughing of bluff sediments, resulting in a vertical bluff face with little vegetation
- Pre-existing landside area
- Tension or ground cracks along or near the edge of the top of a bluff
- Structural damage caused by settling and cracking of building foundations and separation of steps from the main structure
- Toppling, bowed or jack-sawed trees
- Gullying and surface erosion
- Mid-slope ground water seepage from a bluff face

By studying the effects of landslides in slide prone areas we can plan for the future. More needs to be done to educate the public and to prevent development in vulnerable areas. WAC 365-190-080 states that geologically hazardous areas pose a threat to the health and safety of citizens when incompatible development is sited in areas of significant hazard. Some hazards can be mitigated by engineering, design, or construction so that risks are acceptable. When technology cannot reduce the risk to acceptable levels, building in hazardous areas should be avoided.[30]

Historical Landslide Events

Significant landslide events (those resulting in disasters) are rare, but several have been recorded in the State, including the 2014 Oso mudslide that killed 43 people and destroyed 49 homes or other structures. Major landslide events had a significant impact on transportation, communities, and natural resources in 1977, 1979, 1986, 1989, 1997, 1998, 2006 (x2), 2007 (x2), 2009, and 2014. Greater detail on each landslide event can be found in the Washington Military Department's Washington State Enhanced Hazard Mitigation Plan.

Landslides commonly occur on slopes and in areas where they have taken place before. Historically, most areas of Washington State have experienced landslides. Areas that have been most active in the recent past includes several stretches of the Interstate 5 corridor, the U.S. 101 Highway corridor along the Pacific Coast from Astoria, Oregon to Olympia, in the Cascades, Olympics, and Blue Mountains, the Puget Sound coastal bluffs, the Columbia River Gorge, the banks of Lake Roosevelt, and the Prosser to Benton City section of Interstate 82. The Prosser landslide is included in the Washington DNR list of significant deep-seated landslides to occur between 1984 and 2014. The Prosser landslide occurred in 1986/1987 during the construction of I-82; it is the only "significant" landslide to occur in Benton County.

[30] Canning, Douglas J. "*Geologically Hazardous Areas"*. Shorelands and Environmental Assistance Program. Washington Department of Ecology. Olympia, Washington.

Volcano

Much of the information below was excerpted or derived from past Benton County HMPs or from the Washington Military Department's Washington State Enhanced Hazard Mitigation Plan (EHMP).

Washington State has five major volcanoes – composite volcanoes – in the Cascade Range. These are, from north to south, Mount Baker, Glacier Peak, Mount Rainier, Mount St. Helens, and Mount Adams.

Definitions

Volcano: A vent in the earth's crust through which magma, rock fragments, gases, and ash are ejected from the earth's interior. Over time, accumulation of these erupted products on the earth's surface creates a volcanic mountain.

Composite Volcano: A steep-sided, often symmetrical cone constructed of alternating layers of lava flows, ash, and other volcanic debris. Composite volcanoes tend to erupt explosively and pose considerable danger to nearby life and property.

Background Information

An explosive eruption from a composite volcano blasts solid and molten rock fragments (tephra) and volcanic gases into the air with tremendous force. The largest rock fragments (bombs) usually fall back to the ground within 2 miles of the vent. Small fragments (less than about 0.1 inch across) of volcanic glass, minerals, and rock (ash) rise high into the air, forming a huge, billowing eruption column.

Eruption columns can grow rapidly and reach more than 12 miles above a volcano in less than 30 minutes, forming an eruption cloud. The volcanic ash in the cloud can pose a serious hazard to aviation. Ash related engine failures have led to restriction on travel through ash clouds. Following the eruption of Eyjafjallajökull in 2010, which disrupted one of the busiest airways in the world, over 100,000 flights were cancelled, leading to billions in economic losses.[31] During the 56 years between 1953 and 2009 there were 94 occasions when aircraft encountered ash, with 79 of those incidents caused some degree of engine damage and 26 resulted in significant engine damage.[32]

Large eruption clouds can extend hundreds of miles downwind, resulting in ash fall over enormous areas; the wind carries the smallest ash particles the farthest. Ash from the May 18, 1980 eruption of Mount St. Helens, WA fell over an area of 22,000 square miles in the Western United States. The impacts in Benton County were primarily from the ash fallout. In Eastern Washington, crop losses were estimated to be $100 million and some dairy farmers had to dump their milk. Transportation was disrupted and some motorists were stranded.

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[31] Morton, M.C., 2017. "Of airplanes and ash clouds: What we've learned since Eyjafjallajökull." Earth. Available online at: https://www.earthmagazine.org/article/airplanes-and-ash-clouds-what-weve-learned-eyjafjallaj%C3%B6kull

[32] Guffanti, M., et al., 2010. "Encounters of Aircraft with Volcanic Ash Clouds: A Compilation of Known Incidents, 1953—2009." USGS Data Series 545, ver. 1.0, 12 p., Available online at: http://pubs.usgs.gov/ds/545

Volcanoes emit gases during eruptions. Even when a volcano is not erupting, cracks in the ground allow gases to reach the surface through small openings called fumaroles. More than ninety percent of all gas emitted by volcanoes is water vapor (steam), most of which is heated ground water. Other common volcanic gases are carbon dioxide, sulfur dioxide, hydrogen sulfide, hydrogen, and fluorine. Sulfur dioxide gas can react with water droplets in the atmosphere to create acid rain, which causes corrosion and harms vegetation. Carbon dioxide is heavier than air and can be trapped in low areas in concentrations that are deadly to people and animals. Fluorine, which in high concentrations is toxic, can be adsorbed onto volcanic ash particles that later fall to the ground. The fluorine on the particles can poison livestock grazing on ash-coated grass and also contaminate domestic water supplies.[33]

While there are numerous volcanos of concern in the U.S. (Table 15), the volcanoes of the Cascade Range, which stretches from northern California into British Columbia, have produced more than 100 eruptions, most of them explosive, in just the past few thousand years. However, individual Cascade volcanoes can lie dormant for many centuries between eruptions, and the great risk posed by volcanic activity in the region is therefore not always apparent. When Cascade volcanoes do erupt, high-speed avalanches of hot ash and rock (pyroclastic flows), lava flows, and landslides can devastate areas 10 or more miles away; and huge mudflows of volcanic ash and debris, called lahars, can inundate valleys more than 50 miles downstream. Falling ash from explosive eruptions can disrupt human activities hundreds of miles downwind, and drifting clouds of fine ash can cause severe damage to jet aircraft even thousands of miles away. Erupting Cascade volcanoes are more prone than other U.S. volcanoes to explosive volcanic activity, resulting in pyroclastic flows. These are hot, often incandescent mixtures of volcanic fragments and gases that sweep along close to the ground at speeds up to 450 mph.

Table 15) List of active volcanos of Highest Priority and High Priority within the U.S., Source: USGS.

Region	Highest Priority	High Priority
Alaska	Akutan, Amak, Amukta, Bogoslof, Cleveland, Fourpeaked, Kasatochi, Kiska, Makushin, Recheshnoi, Redoubt, Seguam, Vsevidof, Yantarni, Yunaska	Black Peak, Chignagak, Churchill, Dana, Douglas, Dutton, Edgecumbe, Hayes, Kaguyak, Kupreanof, Spurr, Wrangell
Washington	Glacier Peak, Mount Baker, Mount Ranier, Mount St. Helens	Mount Adams
Oregon	Crater Lake, Mount Hood, Newberry, Three Sisters	
California	Lassen Volcanic Center, Mount Shasta	Clear Lake, Mono-Inyo Craters, Mono Lake Volcanic Field, Medicine Lake
Wyoming		Yellowstone

[33] Myers, Bobbie, et al. "What are Volcano Hazards?" U.S. Geological Survey. Vancouver, Washington. July 2004.

Because the population of the Pacific Northwest is rapidly expanding, the volcanoes of the Cascade Range in Washington, Oregon, and northern California are some of the most dangerous in the United States. Although Cascade volcanoes do not often erupt (on average, about two erupt each century), they can be dangerous because of their violently explosive behavior, their permanent snow and ice cover that can fuel large volcanic debris flows (lahars), and their proximity to various critical infrastructure, air routes, and populated areas.[34]

Historical Volcano Events

The Pacific Coast lies along the Ring of Fire which has produced 22 of the 25 largest volcanic eruptions over the last roughly 11,000 years[35]. The USGS studies and monitors many of the active volcanos in Washington State. Studies have shown that Glacier Peak has erupted an estimated 5 times in the last 13,000 years, likewise. Figure 18 highlights the activity of each volcano along the Cascade Mountains for the past 4000 years. While not a common occurrence eruption from the Cascade Volcanos occur, on average, two every century.

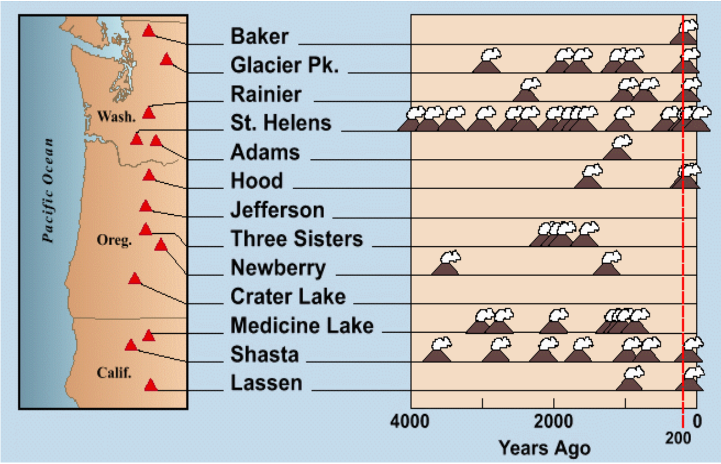

Figure 18) History of volcanic activity in the Pacific Northwest

The Cascade Range has more than a dozen potentially active volcanoes. Cascade volcanoes tend to erupt explosively, and on average two eruptions occur per century—the most recent were at Mount St. Helens, Washington (1980–86 and 2004–8), and Lassen Peak, California (1914–17). On May 18, 1980, after 2 months of earthquakes and minor eruptions, Mount St. Helens, Washington, exploded in one of the most devastating volcanic eruptions of the 20th century. Although less than 0.1 cubic mile of molten rock (magma) was erupted, 57 people died, and damage exceeded $1 billion. Fortunately, most people in the area were able to evacuate safely before the eruption because public officials had been alerted to the danger by U.S. Geological Survey (USGS) and other scientists. To help protect the Pacific Northwest's rapidly expanding population, USGS scientists at the Cascades Volcano Observatory in Vancouver, Washington, monitor and assess the hazards posed by the region's volcanoes.[36]

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[34] Dzurisim, Dan, et al. "Living with Volcanic Risk in the Cascades." U.S. Geological Survey – Reducing the Risk from Volcano Hazards. USGS. Vancouver, Washington. 1997.

[35] Oppenheimer, Clive. 2011. Eruptions that Shook the World. University of Cambridge.

[36] Dzurisim, Dan, et al. "Living with Volcanic Risk in the Cascades." U.S. Geological Survey – Reducing the Risk from Volcano Hazards. USGS. Vancouver, Washington. 1997.

Chapter: 4 Community Profiles and Risk Assessments

The purpose of this chapter is to link the unique qualities, features, and characteristics of each jurisdiction to local and regional natural hazards. Each community profile includes relevant information about demographics, infrastructure, commerce, industry, natural resources, and geography and identifies any community-components that are of particular interest, especially as they relate to natural hazards. Following the community profile is a risk and vulnerability assessment that summarizes the probability of a given natural hazard event affecting a jurisdiction, the potential impacts that a natural hazard event could have on a jurisdiction, and which community-components are at risk.

Jurisdictional Risk and Vulnerability Rating

The Benton County Comprehensive Emergency Management Plan assigns a rating to the "Probability and Risk" associated with each of the seven profiled hazards.

This rating system was reviewed by the committee and is included in the 2018 update, along with additional analysis on the history of hazard events, probability of future events, potential hazard impacts, resource values that are at risk, and input from the community.

The terms "High", "Moderate", and "Low" are used to rate each hazard for "Probability", "Vulnerability" and "Risk" in Benton County. A definition for each category is listed below. The Risk rating is a combination of Probability and Vulnerability associated with the hazard.

Probability: The probability of an occurrence happening in Benton County, sometimes without the regard to hazard history.

High	Probability of occurrence at least one chance in the next 1 to 10 years
Moderate	Probability of occurrence at least one chance in the next 10 to 25 years
Low	Probability of occurrence at least once chance in the next 25 to 50 years

Vulnerability: The potential effect a hazard could have on the percentage of people and property within an area in Benton County.

High	25% or higher of population and property being affected by the hazard
Moderate	5% to 10% of population and property being affected by the hazard
Low	Less than 5% of population and property affected by the hazard

Risk: Risk is an estimate of the combination of Probability of occurrence and Vulnerability.

High	Strong potential for a disaster of major proportions occurring in the next 1 to 10 years
Moderate	Moderate potential for a disaster of less than major proportions occurring in the next 10 to 25 years
Low	Little potential for a disaster occurring during the next 25 to 50 years

Benton County Profile

Location

Benton County is located in south-central Washington in the middle of the Columbia Basin. The Columbia River forms the county's northern, eastern, and southern boundaries, forming an arc some 120 miles long. Benton County is bordered to the west by Yakima and Klickitat counties, to the north by Grant County, to the east by Franklin and Walla Walla counties, and to the south by two Oregon counties, Umatilla and Morrow. Benton County covers an area of 1,722 square miles. The highest elevation in the County is 3,629 feet, located in the Rattlesnake Mountains north of Prosser. The lowest elevation is 265 feet, found near Plymouth along the north bank of the Columbia River. The Yakima River flows from west to east through the middle of the County. The Yakima, Snake, and Walla Walla rivers join the Columbia River within 30 miles of each other along Benton County's eastern border near Sacajawea State Park.

Incorporated cities and towns in Benton County include Benton City, Kennewick, Prosser, Richland, and West Richland. Most of the unincorporated areas of the County are rural areas with low-density agriculture-based land use. However, there are also several distinct unincorporated communities, including Paterson, Plymouth, Finley, and Whitstran. Benton County was created in 1905 from the eastern portions of Yakima and Klickitat Counties. Prosser is the County seat.

Of the county's five incorporated communities, Prosser, Benton City, and West Richland are located adjacent to the Yakima River, Richland is at the confluence of the Yakima and the Columbia Rivers, and Kennewick borders the Columbia River downstream of Richland. Richland and Kennewick, together with Pasco (across the Columbia River in Franklin County) are all located on the banks of Lake Wallula, created after the construction of the McNary Dam. These cities are collectively referred to as the Tri-Cities due to their interlocking economic dependence and their geographic proximity to each other. The unincorporated community of Finley lies to the southeast along the Columbia River, just outside of Kennewick. Elevations for all of the communities are in the 300 to 700 feet above sea level range. The two unincorporated communities of Plymouth and Paterson border the Columbia River at the county's southern border below McNary Dam. Elevations of Plymouth and Paterson are 300 and 400 feet, respectively.

The Columbia River was historically an important fishery and its associated lowlands used as wintering ground by several Native American tribes including the Umatilla, Wallowa, Wanapum, Nez Perce, and Yakama tribes. Permanent settlement of the region accelerated in the 1890s when infrastructure was completed that allowed irrigation of the arid shrub-steppe lands in the area. This, along with the completion of the Dalles-Celilo Canal in 1915, which first connected the Tri Cities to the Pacific Ocean, turned Benton County into an important agricultural center. In 1942 the U.S. Army Corps of Engineers, Manhattan District selected the northern part of the county as the location of the Hanford Nuclear

Site[37]; a key facility for the development of nuclear weapons during World War II. In the 1950's, the Washington Public Power Supply System (WPPSS) was created to ensure that the rising demand for energy in the northwest would be met through the construction of multiple energy-producing facilities. Located within the Hanford Site, the Columbia Generating Station was constructed in 1970 as a part of WPPSS[38]; it is currently operated by Energy Northwest. These nuclear and energy production projects had significant impacts on the economic development of Benton County due to the increasing workforce in the northwest.

Benton County is currently one of the top ten agricultural counties in Washington, based on the total value of all agricultural products (crop and livestock). The area produces carrots, onions, potatoes, wheat, barley, oats, apples, grapes, and cherries. In addition to crop production, there is a significant food-processing industry in the Tri-Cities. Area plants produce French fries, grape juice, baby carrot sticks, and other foods. Winter wheat is the dominant crop cover. Washington State University Irrigated Agriculture Research and Extension Center, one of the world's largest irrigated experiment stations, is located in Benton County approximately four miles north of Prosser. In recent years the wine industry has become a rapidly growing segment of the agriculture industry, with many new wineries opening. The state's largest winery, Columbia Crest, is located at Paterson.

The Tri-Cities area of Benton County is a major transportation hub for the Pacific and Inland Northwest. The Tri-Cities are served by Interstate Highway 82, which connects the Tri-Cities directly to the three nearby transcontinental Interstate Highways, I-84, I-90 and I-5. Several Federal Highways and multiple State Highways service the area. Additionally, Tri-Cities offers mainline rail freight service by both Burlington Northern Santa Fe and Union Pacific Railroads and is the only major metropolitan and major manufacturing area between the Cascade and Rocky Mountains offering this level of service by these two major national rail carriers. The Columbia-Snake River System connects the region to the Pacific Ocean and allows the transport of commodities to locations throughout the world. Barge service is available through the Port of Benton.

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[37]Gibson, Elizabeth. "Benton County - Thumbnail History." History Link, 9 Mar. 2004, www.historylink.org/File/5671. Accessed 31 May 2018.

[38]Wilma, David. "Washington Public Power Supply System." History Link, 10 July 2003, www.historylink.org/File/5482. Accessed 31 May 2018.

Climate

Benton County is located in the central part of the Columbia Basin, which has a landform surrounded by mountain ranges that have a pronounced effect on the region's climate. The following are characteristics of the climate as summarized in Benton County's Comprehensive Plan (1998; source National Weather Service):

Geomorphology and Weather

- The Cascade Range to the west obstructs easterly flows of moist air into the basin.
- The Rocky Mountain Range and ranges in southern British Columbia protect the basin from the more severe winter storms.
- Occasionally an outbreak of severely cold weather will penetrate into the basin for damaging spring or fall freezes.
- The County experiences strong seasonal winds associated with rapidly moving weather systems

Sunshine and Growing Season

- The growing season is approximately 185 days from mid-April to mid-October.
- The percent of possible sunshine each month is 20-30 percent in winter, 50-60 percent in spring, and 80-85 percent in mid-summer.
- The number of clear days each month increases from about 5 in winter to 20 in summer.

Temperature

- Dry with mild winters and warm sunny summers, cool summer nights.
- Summer temperatures in the warmest summer months can exceed 90˚F from 26 to 77 days with nights dropping to 50˚F, day time temperatures can exceed 103˚F for about four days in two out of ten summers.
- Winter afternoon temperatures range from 35˚ to 45˚F with night time readings at 20˚ to 30˚F, minimum temperatures can be 60˚F or lower on four nights in two out of ten winters, afternoons remain below freezing on about one third of all January days.
- The region can experience sustained low temperatures. In 1949-50, night time winter temperatures were less than 0˚F on 18 nights, minus 15˚F or lower on seven nights, and minus 23˚F on one night (sustained cold temperatures were also experienced January-February 1996).
- Warm winters do occur - in 1957-58, the lowest temperature was 19˚F.
- Number of days with maximum temperatures below freezing ranges from 2 to 46.

Moisture and Precipitation

- Mean annual precipitation is from 5 to 10 inches, with from 10 to 15 inches in discrete areas on the Horse Heaven and Rattlesnake hills.
- Approximately 70 percent of precipitation occurs between November and April averaging one inch per month as either rain or snow in mid-winter months.
- There can be 3 to 6 weeks at a time in mid-summer with no measurable precipitation.

Storms and Weather Events

- Thunderstorms typically occur on 10 to 15 days between March and October, usually accompanied by light rainfall, but hail and heavy showers can occur.
- Winter season snowfall has ranged from less than ½ inch (1957-58) to 44 inches (1915- 16), accumulations have ranged from 4 inches to 21 inches (February 1916).
- Snow cover can melt rapidly as a result of rain or warm Chinook winds.
- Severe winter and spring flooding of the lower Yakima River can occur as a result of snowmelt and/or river icing conditions, such as occurred in December 1995 and February 1996.

Soils and Geology

The soils in Benton County are generally suitable for both agriculture and structural development, with localized areas of constraint relating to slope, geo-hydrology or pockets of sandy soils and fines. Soils are very susceptible to wind and water erosion once stripped of their natural cover. However, in undisturbed condition the indigenous shrub steppe and bunch grass vegetative cover is adapted to hold basin soils in place. When stripped of natural cover, prevention of erosion requires the application of deliberate and aggressive management techniques (Benton County Comprehensive Plan).

Generally, with some notable localized exceptions, the addition of water and fertilizer to soils anywhere in Benton County will result in productive agriculture. The principal exceptions are on steep erosive slopes, in pockets of very sandy soils, or where near surface basalt formations are accompanied by thin soils and poor hydrologic conditions.

Benton County is located in the central Columbia Plateau where two of the most catastrophic geologic events in earth history took place: enormous outpourings of basaltic lava flows 17.5 to 6 million years ago and giant glacial outburst floods up to 12 thousand years ago. These and related events produced the local landscape, where the Earth's youngest basalt plateau was swept by the largest documented floods in geologic history.

The northern and eastern parts of the County are part of the Pasco Basin and the southern part of the County is part of the Umatilla Basin. These basins are two of several regional structural and topographic, sediment-filled basins within the Columbia Plateau. The County is underlain by the Miocene-age Columbia River Basalt Group, a thick sequence of flood basalts that covers more than 63,000 square miles of eastern Washington, western Idaho, and northeastern Oregon. The sediments overlying the basalts include the Pliocene Ringold Formation (interlayered deposits of sand, silt, clay and gravel exposed in the White Bluffs along the Columbia River), glaciofluvial deposits of the Pleistocene Hanford formation (unconsolidated gravel, sand and silt deposits), and Holocene surficial deposits composed of windblown silt and sand and gravelly alluvium along the rivers.

The basalt sequence is over 10,000 ft thick within the downwarped Pasco Basin. Sedimentary interbeds of the Ellensburg Formation separate basalt flows and flow units especially in the upper part of the basalt sequence. Folding and faulting of the basalts under north-south compression was contemporaneous with the eruption of the basalt flows. This deformation produced the anticlinal ridges of the Yakima Fold Belt (e.g., Rattlesnake Mountain, Horse Heaven Hills and others). The fold ridges are characterized by gently dipping southern limbs and steeply dipping northern limbs that are cut by thrust or high-angle reverse faults that trend parallel to the ridges.

Deformation of these folds continued from the Miocene to the Pleistocene, and perhaps into the present. Geologic evidence of young faulting has been found on Gable Mountain at the Hanford Site and near Wallula Gap along the Rattlesnake-Wallula alignment (RAW) (Reidel and others, 1994). As of the update of this plan, the OWL, RAW, Yakima Fold and Thrust Belt, and the Wallula fault zone are recognized as some of the major faults and fault systems in eastern Washington. These faults and fault systems will be included in the evaluation of seismic hazards for Benton County.

Land Ownership

The data used in this section was taken from the 2010 BLM land ownership database. Local government property (i.e. county) is likely included in the Private ownership category. The majority of ownership, approximately 67%, within Benton County is private (Table 16). Federal ownerships account for 27% of the land base with the Hanford Site encompassing the largest portion with over 194,000 acres and the U.S. Fish & Wildlife Service and Bureau of Land Management accounting for the remaining 105,470 acres. Less than 6% of Benton County is owned by the state. Figure 19 shows the distribution of land ownership in Benton County.

Land use in Benton County is predominately for agricultural purposes. According to the 2012 Census of Agriculture, approximately 703,505 acres of privately-owned land is classified as agricultural which is just over 94% of all private land and just over 63% of the total area of Benton County. Of the 703,505 acres classified as agriculture about 74% is cropland and 16% is pastureland.

Table 16) Land ownership in Benton County, WA

Entity	Acres	Percent Coverage
BLM	11,020	1%
COE	54	<1%
Federal (DOD)	194,450	17%
FWS	98,220	9%
Private	746,948	67%
State	45,782	4%
State Fish & WL	5,812	1%
State Parks	612	<1%
Water	10,329	1%
Total	**1,113,227**	**100%**

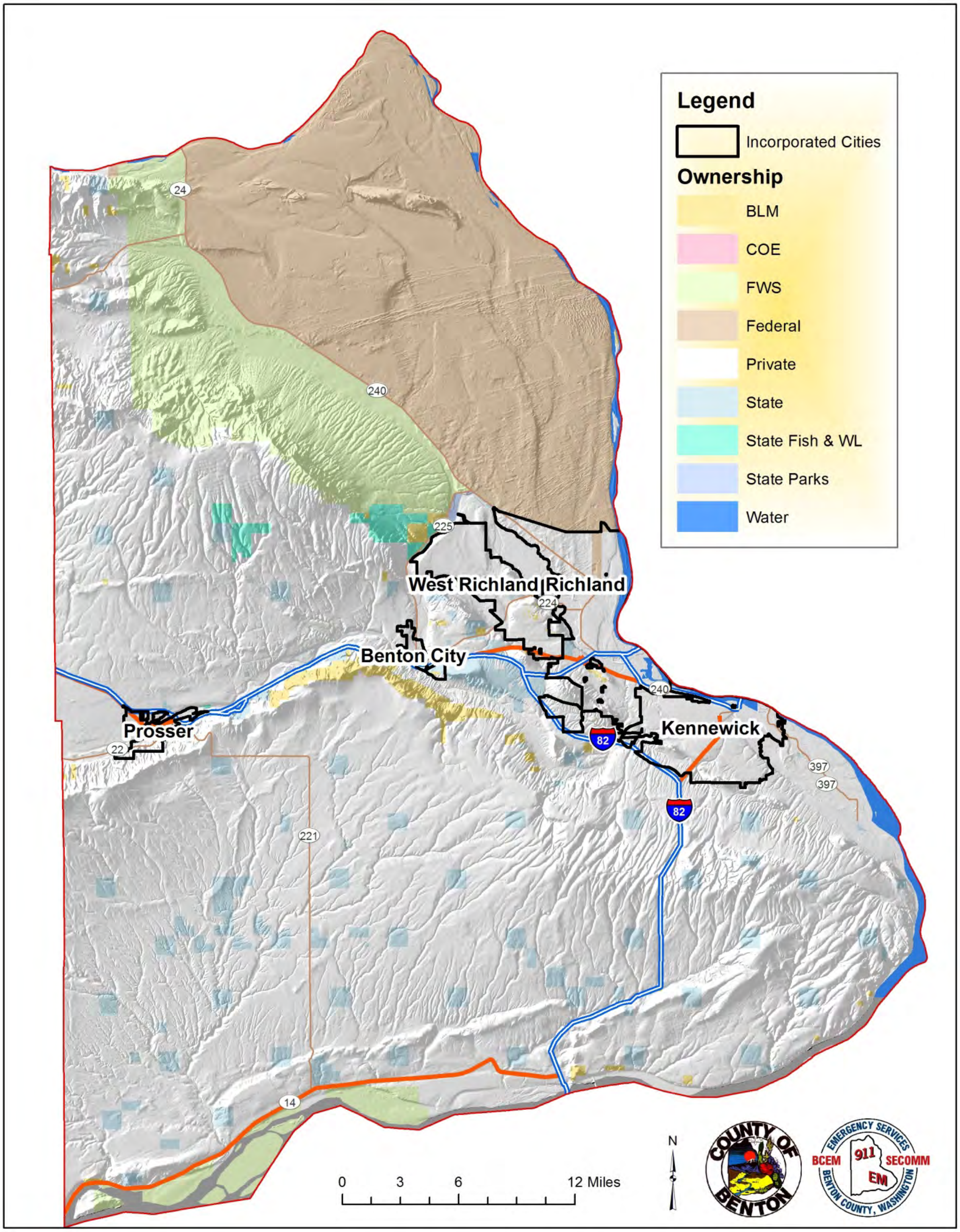


Figure 19) Land ownership in Benton County, WA.

Population and Demographics

Benton County was created by the Washington State Legislature on March 8, 1905. The county government consists of an elected County Commission, consisting of three full time County Commissioners. The Commissioners are elected to four-year terms in a general election. Each commissioner represents a district determined by population boundaries. Other elected county officials include: Assessor, Auditor, Clerk, Coroner, Prosecuting Attorney, Treasurer, Sheriff, and Superior Court and District Court judges.

The U.S. Census Bureau, Census of 2010 reported Benton County's population at 175,171 – a 23 percent increase since 2000 (Table 17). The 2018 population was estimated to be 197,420. The median age was 35.6, with approximately 72.8 percent of the county population 18 years and over. Approximately 82.4 percent of the population is White and 18.7 percent Hispanic or Latino. The Census reports there are 27,726 residents (17.9 percent) who speak a language other than English at home, including 6.4 percent (8,391 people 5 years and over) who speak English less than "very well." Spanish is the language other than English most often spoken at home by 20,551 residents (13.3 percent). Of those speaking Spanish at home, 10,234, or 5.8 percent of Benton County's population, speak English less than "very well."

Table 17) Historical and estimated current populations for communities in Benton County, WA from 1960 to2016.

	1960	1970	1980	1990	2000	2010	2018*
Benton County	62,070	67,540	109,440	112,560	142,475	175,171	197,420
Benton City	1,210	1,070	1,980	1,806	2,624	3,038	3,405
Kennewick	14,244	15,212	32,397	42,155	54,693	73,917	81,850
Prosser	2,763	2,954	3,896	4,476	4,838	5,714	6,125
Richland	23,548	26,290	33,587	32,315	38,708	48,054	55,320
West Richland	1,347	1,107	2,935	3,962	8,385	11,181	15,320
***2018 population estimated based on 2010 census**							

Capabilities Assessment

Mitigation capabilities are existing authorities, policies, programs, and resources that reduce hazard impacts or that could be used to implement hazard mitigation activities. Detailed Capabilities Assessments for Benton County can be found in Appendix B.

Development Trends

The Following is excerpted from Chapters 3.7 and 3.8 in the 2018 Benton County Comprehensive Plan:

Population growth in Benton County from 2011 to 2016 grew at a rate reflective of the slow growth in the nation's economy, the improved national economy of 2017 has provided a rebound in growth reminiscent of the growth in 2009. Figure 3-2 reflects the population trend in the last 10 years in Benton County.

The latest population projections from OFM, using the "high" series estimates, indicate that Benton County can expect a population increase of 86,609 over the next 20 years. This will result in a year 2037 population of 280,109, which is an increase of 45 percent over the current population of 193,500. The County will review the future growth trends and adjust population projections if necessary.

Approximately 18 percent of the total County population, or 35,085 people (OFM 2017), reside in the unincorporated area of Benton County. The 20-year OFM projection also indicates the unincorporated County population will grow to 53,220 persons in 2037. This will add 18,135 additional people in the next 20 years who are projected to seek housing in unincorporated areas of the County between now and the year 2037. This growth represents a 52 percent increase over the current rural population. Table 18 indicates the population estimates in Benton County and the unincorporated areas of the County.

Table 18) 20-year population estimates for Benton County, WA (OFM 2017).

Year	Population in Unincorporated Benton County	Total Population in Benton County
2017	35,085	193,500
2037 Projection	53,220	280,109
20 Year Increase	**18,135**	**86,609**

At an estimated 2.7 residents per household, the increased population in unincorporated Benton County would require approximately 6,716 new homes in the next 20 years. This growth will be accommodated mostly in the Urban lands of the UGAs, Rural Transition areas, and Rural Remote areas. Some growth will also take place in the Rural Community Centers and Rural Resource areas.

There are currently 78,952 acres designated for the rural residential uses within the four rural land use designations of Benton County (outside of Hanford and the agricultural areas).

A land capacity analysis on vacant and existing units in the Rural Transition land (1 du/acre) and Rural Remote land (1 du/5 acre) indicates adequate land supply to accommodate future housing demand. However, additional growth is also anticipated to occur in the Rural Community Centers and Urban areas. Table 19 indicates potential allocation of future population in these two land use categories:

Table 19) Potential allocation of future population per land use category

Land Use	New Units
Urban	134
Rural Transition	1,142
Rural Remote	5,652
Rural Community Centers	34
Total	**6,961**

1) Does not include UGAs.

2) Lot size is determined by minimum lot size requirements; i.e., how many units are allowed per given acreage.

Benton County Hazard Annex

Flood Profile

Local Event History

In recent history, the most damaging floods in Benton County have been associated with the Yakima River. Benton County is the downstream end-point for the Yakima River drainage, which contains 6,155 sq. miles, or four million acres. The areas along the lower Yakima in Benton County especially vulnerable to relatively frequent flooding extend from Benton City downstream through West Richland to the delta where the Yakima empties into the Columbia River. This area is characterized by low lying river bottom lands and ancient river channels which are historically the river's natural floodway and floodplain. Since 1970, Benton County has been included within the area of five nationally declared flood disasters, all associated with the Yakima River. The history of flooding in Benton County is summarized in Table 20.

Table 20) History of flood events that affected Benton County. Measurements were taken at Kiona.

Date	Flow (cfs)	Stage (ft)	Return Period (Yrs)	Comments
23-Dec-33	67000	21.57	167	Largest flood of record. Resulted in construction of extensive federal levee system in Yakima County.
17-Nov-06	66000	20.12	159	
11-Feb-96	49400	20.98	67	Benton County declared a federal disaster area (Note: crest may have reached up to 21.5 ft)
18-Jan-74	39700	18.56	36	Benton County declared a federal disaster area.
18-Nov-1896	38000	16.07	34	
30-May-48	37900	17.2	33	
13-Dec-21	35,800 at Parker			
17-Apr-04	32000	15.05	18	
26-Nov-09	30600	14.8	16	
23-Mar-10	29200	14.53	14	
6-Dec-75	28300	16.52	13	
28-Dec-80	27600	16.27	12	
4-Dec-77	27000	16.11	11	Benton County declared a federal disaster area.
3-Mar-01	26400	14	10	
14-Jun-03	26400	14	10	
2-Dec-95	26300	15.87	9	Benton County declared a federal disaster area.
10-Jan-09	25400	15.55		Benton County declared a federal disaster area.
16-Jun-16	24,800 at Parker			
17-Feb-1898	23100	13.27	7	
27-Nov-90	22600	14.36	7	Benton County declared a federal disaster area.
1-Feb-65	22400	13.76	6	
22-Feb-82	22200	14.42	6	
5-Jun-13	20900	13.1	5	

13-Feb-51	20900	12.99	5	
23-Jan-19	20,600 at Parker			
15-Mar-72	20200	13.57	5	
22-May-56	20100	12.73	5	
18-Feb-17	7340	7.85		Flooding was a result of snow melt. Benton County declared a federal disaster area.

Probability of Future Occurrence

Although floods can happen at any time during the year, there are typical seasonal patterns for flooding in Washington State, based on the variety of natural processes that cause floods:

- Heavy rainfall on wet or frozen ground, before a snow pack has accumulated, typically cause fall and early winter floods.
- Rainfall combined with melting of the low-elevation snow pack typically cause winter and early spring floods. Of particular concern is the so-called Pineapple Express, a warm and wet flow of subtropical air originating near Hawaii which can produce multi-day storms with copious rain and very high freezing levels.
- Late spring floods in Eastern Washington result primarily from melting of the snow pack.
- Thunderstorms typically cause flash floods during the summer in Eastern Washington; on rare occasions, thunderstorms embedded in winter-like rainstorms cause flash floods in Western Washington.

The 2001 draft of the CFHMP identified several areas in Benton County that are more prone to flooding than other areas:

1. Major flood damage is typically caused by high-magnitude winter floods. Eighteen of the 24 largest Yakima River floods were winter floods.
2. Flood related damages have been concentrated in the low-lying areas between Benton City and the Richland-West Richland area.
3. Flooding problems in the Horse Heaven Hills are relatively infrequent but can cause significant wide spread damage to county roads when flash floods occur.
4. Flood problems that have occurred repeatedly include the following:
    a. Inundation of property and homes along Byron Road near the river west of Prosser and excessive erosion of the road.
    b. Inundation of property and roads south of Babs Avenue in Benton City and low-lying areas north (downstream) of town.
    c. Inundation of roads, homes and property, farmland and grazing pastures in the Richland-West Richland area, extending from the Twin Bridges south to Sunset Memorial Gardens and W. E. Johnson Park.

The Columbia River features an extensive network of dams and dikes that regulate and control the flow of water. Since the Columbia River crosses international boarders, water level and water flow are determined and agreed upon by the United States and Canada. Given the control mechanisms and international cooperative agreements in place, flooding events on the Columbia River are rare but can and have occurred. In May of 2018, the volume of water moving downstream from Canada exceeded the capacity of dames below Benton County which resulted in flooding along the riverfront areas in Richland and Kennewick.

In the event of a heavy rain event or rapid snow melt, flash flooding can occur in canyons and gullies. Zintel Canyon, located in Kennewick, presented a flash flood risk to nearby communities until the Zintel Canyon Dam was constructed to mitigate flash flood hazards.

Based on the above information, the likelihood of occurrence of a major flood hazard on the Yakima River within the five-year planning cycle is **HIGH**. The likelihood of occurrence of a major flood hazard on the Columbia River or of a major flash flood within the five-year planning cycle is **LOW**, with the exception of the Columbia Park area in Kennewick, which has a **MEDIUM** likelihood of occurrence of a flood hazard.

Impacts of Flooding

The National Flood Insurance Program defines flood as, "A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties (at least one of which is the policyholder's property) from:

- Overflow of inland or tidal waters; or
- Unusual and rapid accumulation or runoff of surface waters from any source; or
- Mudflow (liquid and flowing mud moving across surface); or
- Collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above."

Floods cause loss of life and damage to structures, crops, land, flood control structures, transportation infrastructure (roads and bridges) and utilities. Floods also cause erosion and landslides (including mudslides or mudflows) and can transport debris and toxic products that cause secondary damage. Flood damage in Washington State exceeds damage by all other natural hazards. There have been 32 Presidential Major Disaster Declarations for floods in Washington State from 1956 through July 2012. Every county has received a Presidential Disaster Declaration for flooding. While not every flood creates enough damage to merit a declaration, most are severe enough to warrant intervention by local, state or federal authorities.

Flooding of the Columbia River, although considered of low likelihood of occurrence, could inundate some transportation routes (road and railroad) and low-lying areas of Finley. Disruptions to the transportation system could negatively affect the local economy.

Development Trends

As both population and demand for development are projected to increase for Benton County, it should be expected that Benton County will have more infrastructure at risk during a flood event. Land use planning and adherence to building codes in flood sensitive areas should help reduce the amount of infrastructure at risk during a flood event.

Values of Resources at Risk

A qualitative risk analysis was conducted based on local knowledge of past flood events, the likelihood of future flooding, and the types, quantity, and relative value of development (and potential damage) within the floodplain (Figure 20).

Benton County has 641 structures, 26 of which are government owned structures, in flood zones totaling over $98 million (Table 21 and Table 22). As all structures fall within either A, AE, or AH flood zones, there is a 1% chance that they be subjected to flood conditions annually and a 26% chance that they will be subjected to flood conditions over the life of a 30-year mortgage (Table 23). For structures that fall within A flood zones, no analysis has been performed to determine flood depths or base flood elevations. Structures that fall into flood zone AH will likely experience a flood depth of 1 to 3 feet.

At present, there are limited flood control protection devices in operation or planned in the lower Yakima River. Levees exist on both banks of the Yakima River at its mouth. Additionally, a levee has been constructed on the south bank from the Van Giesen Street Bridge downstream for approximately one mile. The likely trend is for the frequency and magnitude of floods within the lower reaches of the Yakima River to increase as the upper water shed continues to urbanize and its natural storage capacity is diminished. Flooding in the Yakima River valley could cause property and infrastructure damage, evacuation of residents, and contamination of wells.

Table 21) Total number and total value of appraised structures in designated flood zones in Benton County, WA (includes only unincorporated structures).

Flood Zone	Appraised Structures	Value of Appraised Structures
A	144	$ 20,136,800.00
AE	343	$ 58,928,100.00
AH	154	$ 19,422,790.00
Total	**641**	**$ 98,487,690.00**

Table 22) Total number and total value of appraised Government structures in designated flood zones in Benton County, WA (includes only unincorporated government structures).

Flood Zones	Appraised Gov't Struct.	Value of Appraised Gov't Struct.
A	23	$ 3,995,800.00
AE	3	$ 268,680.00
Total	**26**	**$ 4,264,480.00**

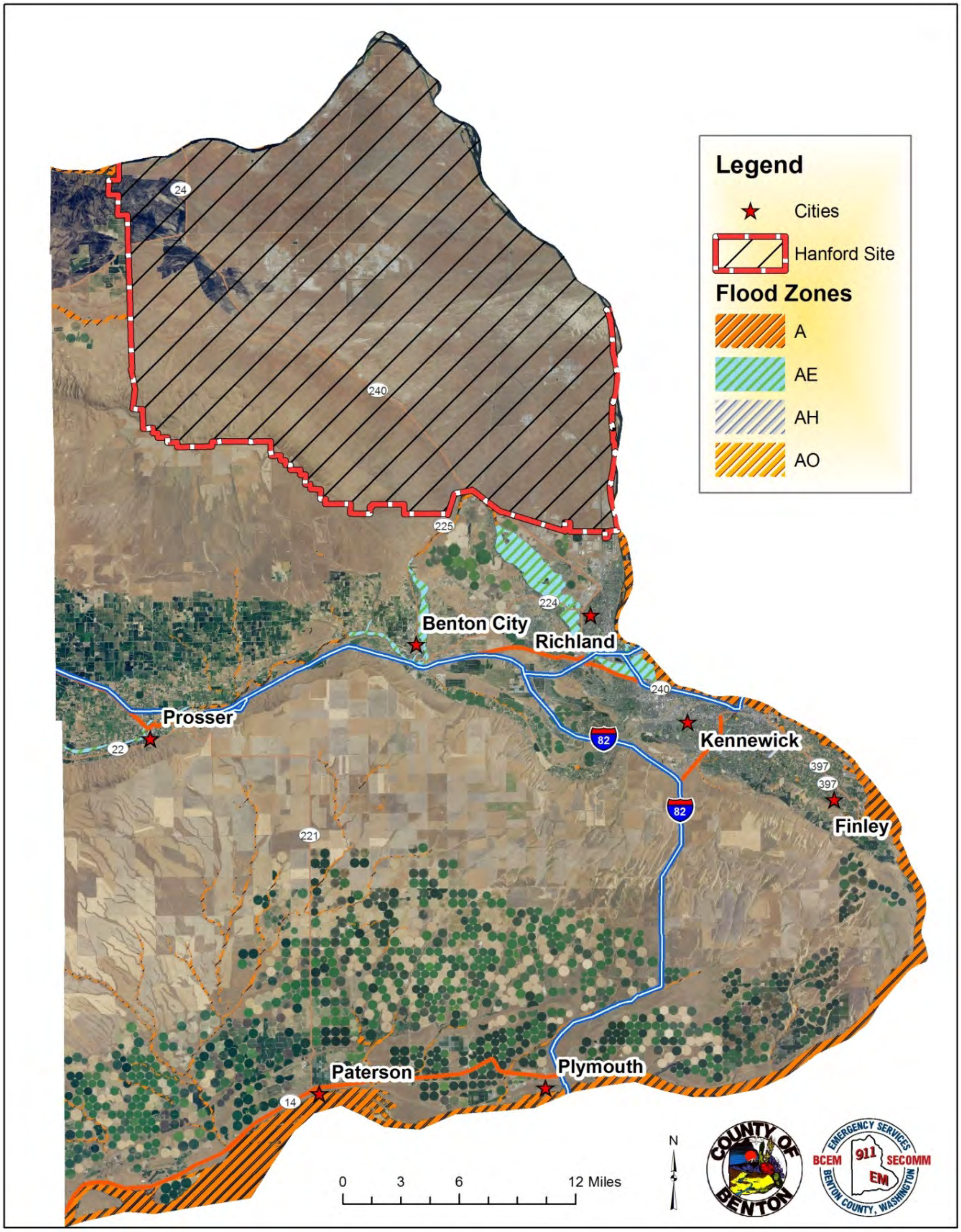


Figure 20) National Flood Insurance Program flood zone map of Benton County, WA.

Table 23) National Flood Insurance Program (NFIP) flood zone categories and descriptions.

ZONE	DESCRIPTION
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.

Drought Profile

Much of the information below was excerpted or derived from past Benton County Hazard Mitigation Plans or from the Washington Military Department's Washington State Enhanced Hazard Mitigation Plan (EHMP).

Local Event History

Through analysis of 100-year drought data (1895-1995), the EHMP reports that most of Washington State was in severe or extreme drought at least 5% of the time during that period. Benton County experienced severe or extreme drought 20-30% of the time during that 100 years. During the severe drought event that occurred in 2005, the Governor of Washington requested agricultural disaster designations from the U.S. Secretary of Agriculture because of significant crop damage from drought. Benton County was one of the 15 counties that were included in the disaster request.

Probability of Future Occurrence

Using historical information, it is reasonable to expect that at least some parts of Benton County will experience drought conditions in roughly 25 of the next 100 years resulting in a **MODERATE** probability rating. This does not specify when or how severe the drought conditions will be, nor does it fully incorporate any future effects of possible climate change.

Drought is difficult to predict for Benton County but there are resources that attempt to forecast droughts, seasonal drought conditions, and climatic patterns. The National Integrated Drought Information System (NIDIS) is one interagency program, sponsored by the National Oceanic Atmospheric Administration (NOAA), that is mandated to "…coordinate and integrate drought research, building upon existing federal, tribal, state, and local partnerships in support of creating a national drought early warning information system."[39]

NIDIS is a central hub for various types of information relating to drought. Some resources NIDIS utilizes include the United States Drought Monitor and NOAA's U.S. Seasonal Drought Outlook. Another resource is the National Interagency Fire Center's Significant Wildland Fire Potential Outlook, which examines national wildland fire risks. The U.S. Seasonal Drought Outlook expresses drought tendency over a given period. This outlook depicts large-scale trends by examining short and long-range forecasts, and current and expected conditions.

[39] "Drought.gov". National Integrated Drought Information System. www.drought.gov.

Impacts of Drought

Drought can have a widespread impact on the environment and the economy, depending upon its severity, although it typically does not result in loss of life or damage to real property, as do other natural disasters. The National Drought Mitigation Center at the University of Nebraska-Lincoln uses three categories to describe likely drought impacts:

- Agricultural – Drought threatens crops that rely on natural precipitation.
- Water supply – Drought threatens supplies of water for irrigated crops and for communities.
- Fire hazard – Drought increases the threat of wildfires from dry conditions in forest and rangelands.

Impacts of severe drought pose little direct threat to infrastructure, buildings, and human lives, but secondary effects may be felt due to losses in income and jobs, and disruptions in commerce. A drought can result in farmers not being able to plant crops or the failure of the planted crops. This results in loss of work for farm workers and those in related food processing jobs. Other water or electricity-dependent industries commonly shut down all or a portion of their facilities, resulting in further layoffs. A drought can spell disaster for recreational companies that use water (e.g., swimming pools, water parks, and river rafting companies), for landscape and nursery businesses because people will not invest in new plants if water is not available to sustain them, and dwindling water supplies put various threatened and endangered fish species at risk as well.

Drought threatens the supply of electricity in the state of Washington. Hydroelectric power plants generated nearly three-quarters of the electricity produced in Washington State in 2000. When supplies of locally generated hydropower shrink because of drought, utilities seek other sources of electricity, which can drive up prices even as supply is reduced. Unlike most disasters, droughts occur slowly but may last a long time. On average, the nationwide annual economic impacts of drought – between $6 billion and $8 billion annually in the United States – are greater than the impacts of any other natural hazard.

Drought also affects groundwater sources, but generally not as quickly as surface water supplies, although groundwater supplies generally take longer to recover. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry; shallow wells are more susceptible than deep wells. About 16,000 drinking water systems in Washington State get water from the ground; these systems serve about 5.2 million people. Drought also impacts the irrigation district curtailments in Benton County. People begin to use potable water for irrigation purposes when they are restricted from using their primary source resulting in the involvement of law enforcement to uphold the ordinance. Limiting irrigation also increases fire risk in Benton County.

The state's EHMP identifies Benton County as one of nine counties most at-risk and vulnerable to drought. This is based on Benton County meeting specific criteria, such as a history of drought conditions, an economy heavily-reliant on agriculture, significant acreage of irrigated farmland, and above average population growth for the state.

Development Trends

As both population and demand for development are projected to increase for Benton County, an increase in water usage in Benton County should be expected as well. With increased pressure on water sources, it is likely that Benton County will become more sensitive to drought conditions and will likely have to implement water conservation practices sooner during a period of drought. Increased fire risk associated with drought conditions may also make additional development vulnerable to wildfire.

Value of Resources at Risk

At the time of the 2012 USDA Census of Agriculture, or Ag Census, there were 1,509 farms in Benton County, totaling 703,505 acres of land. This is up 11% from the 2007 Ag Census, but the market value of products sold during that five-year period rose much more significantly. The 2007 Ag Census reported the market value of products sold at $525,918,000 while in 2012 it was reported at $923,163,000 – a 76% increase. Farmland was designated for the following uses in 2012: 73.8% of all farmland was used as cropland, 16.3% was pastureland, while 9.9% was designated as “other uses”.

In 2012 Benton County ranked third in the state of Washington in total market value of agricultural products sold and ranked number 38th nationally out of 3,077 counties. Among individual commodities, Benton County was second in the state of Washington in revenue from “vegetables, melons, potatoes, and sweet potatoes,” (valued at more than $257 million, ranking 12th nationally) and fourth in revenue from “fruits, tree nuts, and berries” (valued at more than $324 million, ranking 18th nationally).

The 2012 Ag Census reported Benton County ranked second in the state in acres used for both potatoes and “vegetables harvested” at 33,697 acres and 83,081 acres respectively. Benton County is also a national leader in those categories, fifth in potato acreage and seventh in vegetable acreage.

People could pay more for water if utilities increase their rates. With much of Washington’s energy coming from hydroelectric plants, a drought can mean more expensive electricity from other resources than dams and probably higher electric bills. Social and environmental impacts are also significant, although it is difficult to put a precise cost on these impacts.

Wildfire Profile

For a complete analysis of the wildfire hazard in Benton County, refer to the Wildfire Hazards section in Chapter 3. The information in that section is a complete excerpt of chapter 4 of the Benton County Community Wildfire Protection Plan which is why it is presented in the same section of this plan.

Local Event History

Benton County experiences a routine cycle of wildfires. Attempts are made to minimize impacts on the community. However, in doing so, many resources are required at high cost. Recently, Benton County Fire District #1 had a fire that totaled $137,000 in suppression costs and the fire caused $2 million dollars in damage. ***Table 3 in the wildfire section of chapter 3 shows wildland fires 300 acres in size or larger that occurred in Benton County since 1981.*** The largest wildfire was the 24 Command fire that occurred in 2000 and burned upwards of 192,000 acres. The following is a summary of the fire from the 24 Command Fire Burned Area Emergency Rehabilitation Plan by the U.S. Fish and Wildlife Service and the U.S. Department of Energy:

> The 24 Command Fire (also known as the Two Forks Fire and the SR 24 MP 36 Fire) began at about 1330 hours on Tuesday, June 27, 2000, as the result of a fatal motor vehicle accident on State Route (SR) 24, about 2 miles west of the intersection with SR 240. The lands in the vicinity are managed as the Arid Lands Ecology Reserve (ALE) and the Hanford Reach National Monument by the US Fish and Wildlife Service, under permit from the US Department of Energy. Driven by high winds and temperatures and low humidity, the fire quickly spread over the next two days and consumed 163,884 acres of Federal, state, and private lands. The fire also burned 11 residences and a number of other structures in and around Benton City. Burned acreage included: US Fish and Wildlife Service - 78,732 acres; Department of Energy-Hanford Site - 60,254 acres; private lands - 20,225 acres; State - 3,633 acres; Bureau of Land Management - 980 acres; and McGee Ranch and Riverlands.

Probability of Future Occurrence

Benton County's dry climate and vast grassland areas makes it very susceptible to large wildfires. While wildland, wildland urban-interface (WUI), and roadside and vehicle-related fires do occur in Benton County on a regular basis during the warm summer months, these fires are typically very small and are usually contained and extinguished with existing personnel and equipment. However, large fires have occurred in the recent past and the WUI situation continues to become more complex as the county's population grows.

Those persons living in interface areas are most vulnerable to wildland or WUI fires. Within Benton County, approximately 60% of the land is classified as Fire Regime Group IV meaning that a longer fire return interval is expected for most of the county, but it will likely burn with severity. Additionally, the existing cover type for just over 43% of the county is classified as grasses and forbs. Covered with light, flashy fuels and having a higher proportion of invasive species, these areas are particularly vulnerable to wildland or WUI fires. The potential for large wildland fires in Benton County can be termed as **MODERATE** but over short periods of hot, dry weather the potential can quickly change to **HIGH**. Risk assessments should be accomplished using the national standard NFPA-299 for standardization of the risk potential. Irrigated farmlands, improved fire spotting techniques, better equipment, and trained personnel are major factors in the relatively small average number of wildland fires that have occurred in the county annually.

On average, Benton County receives 7.75 inches of precipitation annually, but the dry climate of the Columbia River Basin and the frequent occurrence of strong, dry winds can cause fuels to cure quickly and become more prone to ignition. Additionally, high summer temperatures coupled with seasonal low rainfall amounts can result in summer drought conditions. These conditions are reached more often than the public perceives which can place Benton County at higher risk for human-caused wildfire. However, the likelihood of a large, catastrophic fire can be reduced through the implementation of fuel treatments and fuel breaks, habitat restoration projects, and public education and outreach related to safe recreational practices and residential fire mitigation programs such as Firewise.

Impacts of Wildfire Events

Should a wildland fire or WUI fire occur, the impacts of the fire would vary greatly with the size and location of the fire, the weather, and time of year. While it is unlikely that a major wildland or WUI fire would seriously impact Benton County as a whole, large wildfires are possible, and have occurred recently, due to continuous light, flashy fuels that are found throughout the county.

Immediate impacts to Benton County could potentially include loss of homes and property, loss of life, closed roads or extensive traffic-backups, displaced citizens who were evacuated or cannot access their homes, poor visibility from smoke, public confusion and concern, disrupted utilities or other municipal services, high volume of 911 emergency response calls, etc. Longer-term impacts could include limited or restricted vehicle access to at-risk areas, high volumes of emergency response vehicles, increased presence of emergency personnel, lingering concern or worry from the public, heavy smoke / prolonged smoke exposure, etc.

In the event of a large wildland or wildland-urban interface fire, additional resources could be requested through activation of the Tri-County Fire Mutual Aid Agreement, Southeastern Washington Regional Fire Mobilization Plan and/or the Washington State Fire Mobilization Plan in addition to other state and federal fire resources.

While there have always been people that have built homes in undeveloped areas, the number of people that are doing so has increased significantly in recent years as community populations and demand for development increases. As secluded lots with natural features have become more popular and communities expand, both individual homeowners and neighborhoods have encroached on natural, undeveloped areas that have higher risk of wildfire occurrence. These interface areas are becoming more numerous in Benton County and put both lives and property at increased wildfire risk.

Should a large wildland or WUI fire occur in Benton County, the effects of such an event would not be limited to just the loss of valuable rangeland, wildlife habitat, and recreational areas. The loss of large amounts of vegetation on steep slopes of watersheds would increase the risk of landslides and mudslides during the winter months and the depositing of large amounts of mud and debris in streams, rivers, and irrigation channels could threaten valuable fish habitat and watershed usage for many years.

In addition, the loss of crops and grazing land could significantly impact the agricultural industry in Benton County for a few years or more.

If a significant portion of the business area has been affected, the loss to the community can be overwhelming. Reduction of payrolls, infrastructure and long-term layoffs during recovery from a large fire could have a serious impact on the buying power of a large sector of the population. A long-term business closure could also have a large impact to the community's tax base.

Refer to the wildfire section in chapter 3 for information about specific fire protection issues in Benton County.

Development Trends

As population and demand for development increase, Benton County will likely become more vulnerable to wildland fire due to the desire to live in and resulting expansion of the wildland-urban interface.

Refer to the wildfire section in chapter 3 for information about the wildland urban interface in Benton County and the specific risks associated with additional expansion.

Value of Resources at Risk

At risk resources vary greatly depending on the location of the wildfire and the values of these resources can be far reaching and difficult to quantify.

The agricultural sector of the economy carries extensive values that a wildfire would put at immediate risk if the incident was in proximity to agricultural lands or facilities. Personal property, especially in the wildland-urban interface, consists of a wide range of values that would be at risk during a wildfire event. Response to any wildfire, especially a major one, would likely put stress on many support industries, critical infrastructure, and emergency response personnel and facilities within the county.

Refer to the wildfire section in chapter 3 for relative threat level mapping information for Benton County and specifics about high-value resources at risk.

Severe Weather Profile

Much of the information below was excerpted or derived from past Benton County Hazard Mitigation Plan's or from the Washington Military Department's Washington State Enhanced Hazard Mitigation Plan (EHMP).

Local Event History

Severe storms, especially severe wind storms are common in Benton County during the spring and fall months and all areas of Benton County are vulnerable to the impacts of severe storms. Severe wind storms that occur in the Columbia River Basin routinely have wind speeds that can reach 60 mph but some storms, including winter storms, are capable of even greater wind speeds:

- During a five-day windstorm event in January 1972, wind speeds (gusts) up to 150 mph were recorded on Rattlesnake Mountain. In Toppenish (Yakima County), the windstorm leveled buildings, tore off roofs, and overturned trailers. It is estimated that the storm caused $250,000 in damages (1972 dollars) in Benton County alone.
- In a January 1990 windstorm, wind gusts up to 81 mph were recorded causing an estimated $3,000,000 in damages.
- On October 3rd, 1990, due to blowing dust, two chain-reaction accidents occurred on I-82, in Benton County, south of Kennewick, involving 26 vehicles. One person was killed and at least a dozen were injured. Again, in August of 2014, due to blowing dust, another accident involving more than 50 cars occurred in the same area, on I-82 near Locust Grove. At least 26 people had minor injuries.
- In the winter of 1996-1997, Benton County experienced a massive storm that brought heavy snow accumulation, high winds and rain and led to a FEMA Disaster Declaration.
- Severe windstorms were also experienced in December 1995 and December 2001, causing damage to roofs, trees, and other property.
- In 2006 a windstorm affected all 39 counties in Washington, causing $50 million in damage statewide.
- On May 19, 2006 a storm formed from convection in southern Morrow County in the late afternoon and eventually dissipated in Franklin County in the early evening. There was little lightning, if any. This storm included 90+ mph winds, localized medium hail, and localized heavy rains. Several homes in Kennewick were damaged when the runoff overflowed the gutters and flowed through garages flooding lower floors with one to three feet of water. The high winds caused significant damage to pulp wood groves in Morrow and Franklin counties.
- On August 20, 2009 a storm formed near the Oregon-Washington border in southern Benton County and traveled north beyond Grant County. There was little precipitation and a significant amount of lightning. The storm ignited fires from southwest Benton County across the Hanford Site and into counties farther north. There was no advanced warning of the approaching storm; it produced numerous lightning strikes and ignited many fires. Two of the Benton County fires burned together to form the Dry Creek Complex, resulting in the mobilization of a Washington State Type 2 Incident Management Team and a multi-day response
- On 05/21/2015, there was a tornado in Benton County that caused $20,000 in damage.
- In February 2017 a severe storm produced heavy snow and rain that resulted in flooding and eventually led to a FEMA Major Disaster Declaration.

- In June of 2017 a severe storm produced more than 300 lighting strikes in the area with winds exceeding 68 mph. Lightning struck a house in Richland resulting in a house fire.

Probability of Future Occurrence

The probability of Benton County experiencing a severe weather event on an annual basis is very high. On record, there have been 43 thunderstorm and high wind events that were reported in Benton County, Washington between January 1st, 1950 and May 31st, 2003. In addition, there were four dust storms, three funnel cloud sightings, and one tornado in 1956.

Wind events in Benton County are often associated with winter storms during winter months and thunderstorms during the warmer months but can also occur without additional storm influences. The most damaging wind events, those with high winds speeds and long durations, typically occur over the winter months which is when most wind events are expected to occur. Strong winds generated by thunderstorms and microbursts are the second most common type of strong winds in Benton County. These storms have produced recorded sustained winds of 64 mph with wind gusts as high as 67 mph during the months of April, May, June, July, and August. Thunderstorm and microburst winds are relatively short-lived but can still cause significant localized damage.

A major winter storm hazard event has been determined to have a **MODERATE** likelihood of occurrence in Benton County. Storms with severe winds, such as ice storms and dust storms, occur on an infrequent basis and are considered to pose a **LOW** risk.

Tornadoes are relatively rare, but the conditions for a funnel cloud to form are reported in Benton County several times each year. Nevertheless, based on the historical record of tornadoes in this area, the probability of a small tornado occurring in Benton County is **LOW**. The probability of a higher magnitude tornado occurring in this area is **VERY LOW**.

Impacts of Severe Weather Events

When a strong windstorm strikes a community, it leaves behind a distinctive trail. Trees toppled over on buildings and cars, downed power lines crisscrossing the roads, and widespread power outages are a few of the signs that a windstorm has struck. After such an event, it can take communities days, weeks, or longer to return to normal activities. In addition to costly structural damages, windstorms can cause injury or even death.

Windstorms have the ability to cause damage over 100 miles from the center of storm activity. Isolated wind phenomena in the mountainous regions have more localized effects. Winds impacting walls, doors, windows, and roofs, may cause structural components to fail. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift and suction forces that act to pull building components and surfaces outward. The effects of winds are magnified in the upper levels of multi-story structures. As positive and negative forces impact the building's protective envelope (doors, windows, and walls), the result can be roof or building component failures and considerable structural damage.

Winter storms are deceptive killers. Many of the deaths that occur are indirectly related to the actual storm, including deaths resulting from traffic accidents on icy roads, heart attacks while shoveling snow, and hypothermia from prolonged exposure to the cold. Property is at risk due to flooding and landslides resulting from heavy snow melt. Trees, power lines, telephone lines, and television and radio antennas can be impacted by ice, wind, snow, and falling trees and limbs. Saturated soil can cause trees to lose their ability to stand and fall on houses, cars, utilities, and other property. Similarly, if streets are icy, it is difficult for emergency personnel to travel and may pose a secondary threat to life if police, fire, and medical personnel cannot respond to calls. Common winter storm hazards are as follows:

- **Roads and Bridge:** Snow and ice events resulting in icy road conditions can lead to major traffic accidents. Roads blocked by fallen trees during a windstorm may have tragic consequences for people who need access to emergency services. The ability to travel after a natural hazard event is a priority issue for residents, organizations, and providers of essential services such as hospitals and utilities.
- **Power Lines:** Historically, falling trees can be a major cause of power outages resulting in interruption of services and damaged property. In addition, falling trees can bring electric power lines down, creating the possibility of lethal electric shock. Snow and ice can also damage utility lines and cause prolonged power outages. Rising population growth and new infrastructure in the City creates a higher probability for damage to occur from severe winter storms as more life and property are exposed to risk.
- **Water Lines:** The most frequent water system problem related to cold weather is a break in cast iron mainlines. Breaks frequently occur during severe freeze events, as well as during extreme cooling periods during the months of October, November, and December. Another common problem during severe freeze events is the failure of commercial and residential water lines. Inadequately insulated potable water and fire sprinkler pipes can rupture and cause extensive damage to property.

Vulnerability to severe storm hazards is a function of location, type of human activity, use, and frequency of storm events. The effects of severe storms on people and structures can be lessened by total avoidance of flood hazard areas or by restricting, prohibiting, or imposing conditions on hazard zone activity. Local governments can reduce flooding, landslides and wind effects through land-use policies and regulations. Individuals can reduce their exposure to hazards by educating themselves on the past history of a site and by making inquiries to planning and engineering departments of local governments. In addition, it is highly advised to consult the professional services of an engineering geologist, geotechnical engineer, or a civil engineer, who can properly evaluate a site, built or un-built.

Development Trends

Despite a steady increase in population and fluctuating demand for development, the vulnerability of Benton County to severe storms has not changed. Adherence to building codes and community preparedness will help to minimize the impact of a severe storm on Benton County.

Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Benton County. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Additionally, due to the lack of significant topographic features, the wind tends to blow much of the snow accumulation away.

Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on Benton County residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. More rural parts of the County are sometimes better prepared to deal with power outages for a few days due to the frequent occurrence of such events; however, prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food.

Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Benton County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow-covered roads. In the event of severe weather, all households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

Thunderstorms do occur within Washington affecting all counties, but usually are localized events. Their impacts are fairly limited and do not significantly affect the communities enough to declare a disaster. The loss potential from flash flooding caused by severe thunderstorms can be significant in Benton County. Particularly as winds in excess of 20 mph tend to blow debris into irrigation canals which can cause overtopping and damage. In order to mitigate the risk of flooding, the irrigation district deploys vegetation clearing crews to canals when winds exceed 20 mph.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structure and other personal property as well as to the extensive agricultural development in Benton County. Potential losses to agriculture can be disastrous. They can also be very localized; thus, individual farmers can have significant losses, but the event may not drastically affect the economy of the County. Furthermore, crop damage from hail will also be different depending on the time of year and the type of crop. Most farmers carry insurance on their crops to help mitigate the potential financial loss resulting from a localized hail storm. Federal and state aid is available for County's with declared hail disasters resulting in significant loss to local farmers as well as the regional economy. Homeowners in Benton County rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

Earthquake Profile

Much of the information below was excerpted or derived from past Benton County Hazard Mitigation Plans or from the Washington Military Department's Washington State Enhanced Hazard Mitigation Plan (EHMP).

Local Event History

Because of its location near the collision boundary of two major tectonic plates, Washington State is particularly vulnerable to a variety of earthquakes. FEMA has determined that Washington State ranks second (behind only California) among states most susceptible to damaging earthquakes in terms of economic loss. FEMA notes that a majority of the state is at risk to strong shaking (on a scale of minimal to strong) with shaking magnitude generally decreasing from west to east.

The Washington coast and the greater Puget Sound Basin are most at risk although damaging earthquakes have occurred east of the Cascades. The Puget Sound basin had damaging earthquakes in 1909, 1939, 1946, 1949, 1965, and 2001. Eastern Washington had large earthquakes in 1872 near Lake Chelan and in 1936 near Walla Walla. The 1872 earthquake near Lake Chelan was the states most widely felt shallow earthquake. The magnitude for this event has been estimated at 7.4. The 1936 magnitude 6.1 earthquake near Walla Walla was also a shallow event. Because of their remote locations damage was light from these two quakes. Ground shaking from historic earthquakes in Washington and the western U.S. has been noted in Benton County, and has resulted in only minor damage in several events.

The EHMP examines two significant earthquake events near Benton County that have occurred since 1872:

Lake Chelan Earthquake– December 14, 1872

Likely originating northeast of Chelan, WA, the magnitude 6.8 (est.) Chelan Earthquake was felt from British Columbia to Oregon and from the Pacific Ocean to Montana. At the time there were few man-made structures in the epicenter area near Lake Chelan so most of the regional impacts were ground affects. Observed after the earthquake were huge landslides, massive fissures in the ground, and a 27-foot high geyser. Extensive landslides occurred in the slide-prone shorelines of the Columbia River. One massive slide, at Ribbon Cliff between Entiat and Winesap, blocked the Columbia River for several hours. In addition to the Columbia River shoreline, landslides also occurred throughout the Cascade Mountains.

As of 2014 geologists had begun the process of interpreting a large amount of evidence that they suspect will indicate the exact location of the epicenter of the 1872 earthquake. As of the update of this plan, the study is still in progress, but some researchers believe the epicenter is located in Spencer Canyon, near Orondo, WA but this is yet to be confirmed. Determining the exact location of the epicenter is important as the fault is capable of producing another large earthquake in the future. Knowing where an earthquake may occur will help researchers predict the potential impacts it could have on nearby communities and help them prepare.

Milton-Freewater Earthquake – July 15, 1936

The earthquake, magnitude 6.1, occurred at 11:05 a.m. The epicenter was about 5 miles south-southeast of Walla Walla. It was widely felt through Oregon, Washington and northern Idaho, with the greatest shaking occurring in northeast Oregon. Property damage was estimated at $100,000 (in 1936 dollars) in, what was at the time, a sparsely populated area.

In recent years, geologists have attempted to find the exact location of the epicenter of the Milton-Freewater earthquake. As of the update of this plan, geologists are attempting to determine exactly which fault was the source of the quake as it could either have occurred on the RAW or on the Hite fault. The location of the epicenter has implications for impacts of any future earthquakes occurring along the same fault and the way that communities prepare for such event. The results are expected to be available in the near future.

Probability of Future Occurrence

Communities in western Washington, particularly those in the Puget Sound Basin and along the Pacific coast, are most at risk from earthquakes. Some counties in eastern Washington, including Benton County, are also vulnerable. While most earthquakes occur in western Washington, earthquake hazards are significant east of the Cascades to approximately the Columbia River.

Because of the infrequency of such devastating events, there is a **LOW** probability for a potentially damaging earthquake to occur that would result in many people being injured or killed and damaging private property, government infrastructure and the local economy. However, there is a **HIGH** risk to the citizens, infrastructure, and economy of Benton County should such an earthquake occur.

It is impossible to forecast earthquakes given our existing technology, but scientists can estimate general probability based on historic occurrences and location among other factors. The size of a fault segment, the stiffness of rocks, and the amount of accumulated strain energy combine to control the magnitude and timing of earthquakes. Fault segments most likely to break can be identified where faults and plate motions are well known. Geologists have uncovered evidence of a number of surface faults in eastern Washington; however, they have not yet determined how active the faults are, nor determined the extent of the risk they pose to communities. One fault, Toppenish Ridge (located west of Benton County), appears to have been the source of two earthquakes with magnitudes of 6.5 to 7.3 in the past 10,000 years. A number of faults within Benton County have been mapped and potential seismic activity has been modeled (Figure 21).

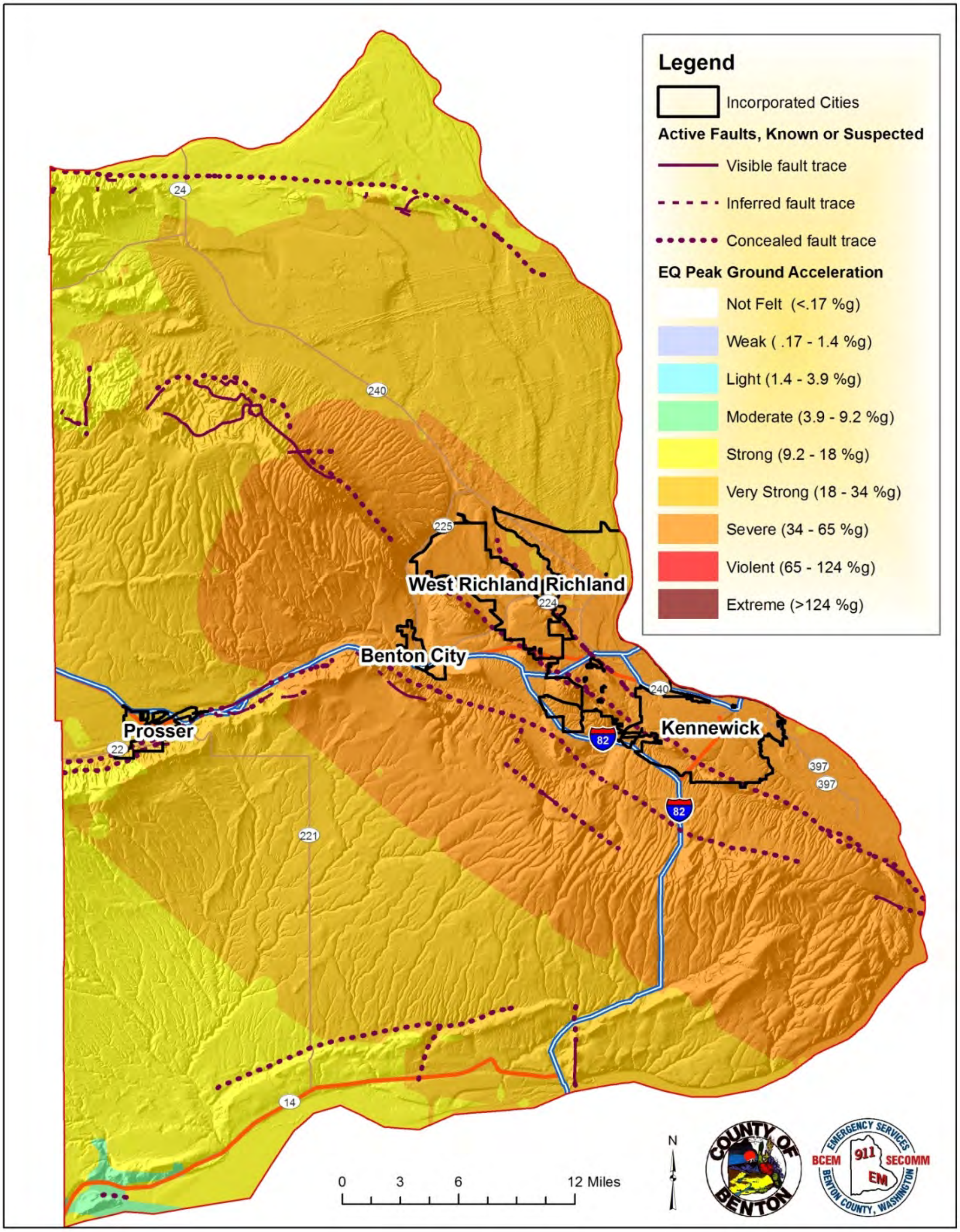


Figure 21) Peak ground acceleration for earthquakes occurring in the vicinity of Benton County.

Faults and fault systems in the Pacific Northwest are complex and are currently being studied. Even with the number of studies that have been conducted to date, additional research will be required before scientists are able to forecast when any particular fault in Washington State will break. The following studies, in addition to those mentioned previously on the Lake Chelan and Milton-Freewater earthquakes, have been conducted recently, or are still underway, and have provided critical information about faults and fault systems in Eastern Washington:

- **In-text Citation: Sherrod et al. (2016)**
- *Active faulting on the Wallula fault zone within the Olympic-Wallowa Lineament, Washington State, USA*
    - B. L. Sherrod, R. J. Blakely, J. P. Lasher, A. Lamb, S. A. Mahan, F. F. Foit and E. A. Barnett
    - Geological Society of America Bulletin (May 2016) 128 (11-12): 1636-1659
    - The authors of the study mapped past earthquakes that occurred in the Wallula Fault zone. The structure and past earthquake activity of the Wallula fault zone are important because of nearby infrastructure which includes communities within the Columbia River basin.
- **In-text Citation: Blakely et al. (2012)**
- *Tectonic setting of the Wooded Island earthquake swarm, eastern Washington*
    - Richard J. Blakely, Brian L. Sherrod, Craig S. Weaver, Alan C. Rohay, and Ray E. Wells
    - Bulletin of the Seismological Society of America 2012
    - "…a swarm of ~1500 shallow (~1 km deep) earthquakes…occurred in 2009 on the Hanford site, Washington. Epicenters were concentrated in a 2 km^2 area near Wooded Island in the Columbia River. The largest earthquake (M 3.0) had first motions consistent with slip on a northwest-striking reverse fault. The swarm was accompanied by 35 mm of vertical surface deformation (as) seen in satellite interferometry (InSAR)."
- **In-text Citation: Blakely et al. (2011)**
- *Connecting the Yakima fold and thrust belt to active faults in the Puget Lowland, Washington*
    - Richard J. Blakely, Brian L. Sherrod, Craig S. Weaver, Ray E. Wells, Alan C. Rohay, Elizabeth A. Barnett, Nichole E. Knepprath
    - Journal of Geophysical Research: Solid Earth
    - "We postulate possible tectonic connections between the YFTB in eastern Washington and active faults of the Puget Lowland. We suggest that faults and folds of Umtanum Ridge extend northwestward through the Cascade Range and merge with the Southern Whidbey Island and Seattle faults near Snoqualmie Pass 35 km east of Seattle. Recent earthquakes ($M_W \leq 5.3$) suggest that this confluence of faults may be seismically active today."

The findings of these studies have implications for nearby communities including those located in Benton County. They will be referenced in subsequent sections as critical infrastructure within Benton County and the seismic hazards associated with nearby faults are further detailed. For additional information, the studies can be found online (some may require a fee for access to the publication).

Impacts of Earthquakes

Earthquakes cause damage by strong ground shaking and by the secondary effects of ground failures, tsunamis, and seiches. The strength of ground shaking generally decreases with distance from the earthquake source. Shaking can be much higher when soft soils amplify earthquake waves. West Seattle and downtown Olympia are examples where amplification repeatedly has occurred, and ground shaking was much stronger than in other nearby areas. Ground failures caused by earthquakes include fault rupture, ground cracking, lateral spreading, slumps, landslides, rock falls, liquefaction, localized uplift and subsidence. Faults often do not rupture through to the surface. Unstable or unconsolidated soil is most at risk. Any of these failures will affect structures above or below them. Large and disastrous landslides can often result from an earthquake. Soil liquefaction describes a phenomenon whereby a saturated soil substantially loses strength and stiffness in response to an applied stress like an earthquake's ground shaking, causing it to behave like a liquid. Liquefaction can cause building foundations to fail and low-density structures such as underground fuel tanks and pilings to float.

The Nisqually Earthquake that took place on February 28, 2001 near Seattle caused extensive damage to communities along the Pacific coast. Depending on the location of the epicenter and the magnitude of an earthquake, Benton County may be able to expect some of the same types of damage that occurred in coastal communities after the Nisqually earthquake. A summary of the damage is as follows:

- Two studies by the University of Washington funded by the National Science Foundation estimated the quake caused $1.5 billion in damages to nearly 300,000 households and that 20% of small businesses in the region affected by the quake had a direct physical loss and 60% experienced productivity disruptions.
- Structures damaged included office buildings, residences, schools, hospitals, airport facilities and churches -many damaged structures were closed for various lengths of time following the earthquake.
- Structural damage was primarily concentrated in older, unreinforced masonry buildings built before 1950, with some damage reported to wood-frame structures and reinforced concrete structures.
- In general, new buildings and buildings that had recently been seismically upgraded typically displayed good structural performance, but many still sustained non-structural damage.
- The capital building in Olympia was severely damaged. The dome of the 74-year-old building sustained a deep crack in its limestone exterior and damage to supporting columns. There was non-structural damage which occurred throughout the building.
- Lifeline systems generally performed well during the event.
- Water utilities reported minor structural damages; a number of wells in Eastern Washington reportedly went dry.
- A gas-line leak caused a fire and explosion when two maintenance workers were resetting an earthquake valve at a correctional facility near Olympia.
- Seattle City Light reported 17,000 customer power outages, and Puget Sound Energy reported 200,000 customers without power, but power was restored to most customers within a day.
- The volume of calls placed immediately after the earthquake overloaded landline and wireless communication systems.

- Seattle-Tacoma International Airport closed immediately because its control tower was disabled. King County Airport (Boeing Field) suffered serious cracking and gaps on the runway due to soil liquefaction and lateral spreading.
- While the area's overall road network remained functional, many highways, roads, and bridges were damaged. Several state routes and local roadways closed due to slumping and pavement fractures. Two local bridges closed due to significant damage.
- The state's dams fared well during the earthquake. Dams controlled or regulated by the Federal Energy Regulatory Commission, the Bureau of Reclamation, or the U.S. Army Corps of Engineers, were not damaged.

Damage to residential structures came in a variety of forms, from severe mudslide destruction of entire homes to breakage of replaceable personal property. The study indicates that structural damage to roofs, walls and foundations accounted for nearly two-thirds of losses, followed by chimney damage, and damages to nonstructural elements and household contents. Anecdotal evidence suggests that the impacts of the Nisqually earthquake extended to Benton County as two wells at the north end of the county were reported to have been damaged.

There are a number of faults located within Benton County that have the potential to produce damaging earthquakes. Figure 21 shows the locations of different faults within Benton County as well as peak ground acceleration for the fault that passes through Kennewick and West Richland and extends under further northwest along a line that includes Thompson Hill, Badger Mountain, Red Mountain, and Rattlesnake Mountain. The fault, which is a part of the Wallula fault zone, could potentially produce a 7.5 magnitude earthquake but it is more likely to be close to 5.5 (Sherrod et al 2016). In the event that the fault does produce an earthquake, peak ground acceleration in the Kennewick/Richland area could be severe while the rest of the county could experience strong to very strong ground shaking. A scenario based on a 7.5 magnitude earthquake produced by this fault is included in the Washington Earthquake Risk Assessment that was done for each jurisdiction. It is referred to as the Rattlesnake Wallula Fault scenario in the analyses.

The epicenter is not indicated in Figure 21, but the Wooded Island earthquake swarm of that occurred in 2009 produced multiple earthquakes at the Hanford Site. The largest quake recorded a magnitude of 3.0 Blakely et al. 2012). The fault that produced the Wooded Island swarm could produce future earthquakes. The potential peak ground acceleration for said fault is unknown but the intensity of future earthquakes has implications for the Hanford Site in particular due to its proximity to Wooded Island.

Additional research has also revealed connectivity between faults in the Puget Lowland area and the Yakima Fold and Thrust Belt (Blakely et al. 2011). This finding suggests that seismic activity on the west coast of Washington could have implications for eastern Washington and potential seismic activity from faults found east of the Cascade Mountain range.

Critical Infrastructure in Benton County

The number of buildings and critical infrastructure near an earthquake epicenter is a major factor in determining the severity of the impacts from the earthquake. Benton County contains critical infrastructure that could theoretically be damaged by an earthquake event, thus causing further disaster or detrimental impacts. Road overpasses, bridges, rail lines, high-volume traffic areas, fuel storage facilities, fuel pipelines, natural gas pipelines, and river transportation systems are some of the elements of infrastructure within Benton County that might be affected during an earthquake event. Additionally, damage to medical facilities, schools, businesses, and other high-occupation infrastructure could escalate threats to human life and have negative impacts on the local economy.

Through advancements in satellite and laser imagery, researchers now have a better understanding of fault systems in Washington State and the hazards that they present. Considering that most major transportation, water, and energy-related infrastructure was designed and built when central Washington was thought to be at little to no risk of an earthquake, new information collected by researches is raising concern about the ability of older infrastructure to withstand severe ground shaking from earthquakes with "local" epicenters. Particularly quakes from the fault that produced the Wooded Island swarm as well as the Wallula fault zone. The stability of key infrastructure within Benton County has recently been and will continue to be evaluated for potential earthquake scenarios:

Bridges: In the event of an earthquake, bridges could potentially be damaged. Should a bridge become unpassable, first responders may not be able to respond to emergency situations in a timely manner and citizens may have escape routes cutoff. According to the local Washington State Department of Transportation manager, the primary bridges have been built to resist the effects of earthquakes. Also, all overpasses located along the I-182/US 12 and US 395 corridors are maintained by the state. The bridges listed below are state-maintained bridges in Benton County:

Cable Bridge (US 397)	Blue Bridge (US 395)
Interstate 182 Bridge	Benton City – Kiona Bridge (SR 225)
Vernita Bridge (SR 24)	Pasco-Kennewick/Finley railroad bridge

Dams: There is only one major dam located in Benton County. The McNary Dam is located on the Columbia River near Umatilla, OR and is owned by the U.S. Army Corps of Engineers so there are regulatory requirements for inspections and emergency planning. According to USACE response management officials, a loss of the McNary pool would pose some economic impact to Benton County.

Dam failure up the Columbia and Snake Rivers (for example, Grand Coulee and Dworshak, respectively) during an earthquake could cause significant damage in Benton County. In an effort to evaluate dams on the Columbia River, the Seismic Hazard Assessment for Mid-Columbia Dams report prepared by The US Army Corps of Engineers analyzes the impacts an earthquake may have on Columbia River dams. As mentioned previously, major dams on the Columbia River were constructed before earthquakes were considered to be a significant hazard in central Washington. Columbia River Dams are currently being assessed and some may be retrofitted with updates intended to increase structural stability during an earthquake.

The Hanford Site[40]**:** Currently being stored at the Hanford Site is 56 million gallons of radioactive waste from cold war era nuclear weapons production. Still in progress is a multi-billion dollar effort to clean-up all radioactive material at The Hanford Site. This includes dismantling and disposing building materials that were exposed to radioactive material and the disposal of radioactive material itself. Considering the quantity of nuclear waste still present at the Hanford Site and that the clean-up effort is a multi-decadal project, prolonged exposure to potential earthquakes is a concern. Additionally, most of the original structures on the Hanford Site, including the underground storage tanks that currently hold liquid nuclear waste, were constructed during World War II before earthquakes were considered to be a significant hazard in Central Washington. In light of new research about faults in central Washington, the Hanford Sitewide Probabilistic Seismic Hazard Analysis, prepared by Pacific Northwest National Laboratory, was conducted from 2012 to 2014 in an effort to summarize earthquake hazards at the Hanford Site.

Energy Northwest Columbia Generating Station[41]**:** The Columbia Generating Station is a nuclear power plant that was constructed within the Hanford Site. There are several reports, including the Columbia Generating Station Seismic Hazard and Screening report, that analyze the Columbia Generating Station's susceptibility to earthquakes and NRC Commissioner Allison M. Macfarlane has stated that "The NRC continues to conclude that CGS has been designed, built, and operated to safely withstand earthquakes likely to occur in its region."

Developmental Trends

Both population and demand for development are projected to increase for Benton County. With additional development and infrastructure, Benton County will become more vulnerable to Earthquake hazards. However, land use planning, adherence to and development of building codes, seismically sound engineering, and community preparedness will help to minimize the impact of an earthquake on Benton County.

Value of Resources at Risk

Benton County is likely to experience ground shaking from future earthquakes in the Pacific Northwest and western U.S. as it has in the past. A local shallow crustal earthquake (e.g. on the RAW or Horse Heaven Hills faults) similar to the July 15, 1936 Milton-Freewater earthquake (M=5.75) may even result in local ground failures. Forecasting the amount of damage that could occur during an earthquake and estimating potential losses in dollars is difficult as water, sewer, and natural gas pipelines, roads, power lines and infrastructure, buildings, and private property are all located within the county and are all vulnerable to earthquakes. However, there are a number of models that attempt to model and quantify

[40] http://www.tri-cityherald.com/news/local/hanford/article203465329.html

[41] https://www.energy-northwest.com/ourenergyprojects/Columbia/Documents/Columbia%20 Generating%20Station%20Seismic%20Safety%20Fact%20Sheet.pdf

damage from different earthquake scenarios. According to the Washington Earthquake Risk Assessment, earthquakes resulting from fault movement in or near Benton County could cause approximately $14 to $360 million in damages in unincorporated areas (Table 24). Of the 743 structures that were included in the different analyses, up to 1,069 structures were lost in the Rattlesnake Wallula Fault scenario totaling more than $359 million.

Table 24) Washington Earthquake Risk Assessment HAZUS Earthquake scenarios for unincorporated areas of Benton County, WA. Total number of structures and total value of structures used in the analyses are included below the table.

Benton County (unincorporated areas) Earthquake Scenarios	Total Loss Value (Building and Contents)	Total Loss Ratio (Building and Contents)
M7.4 Saddle Mountain Fault	$14,066,440	0.2%
M7.4 Rattlesnake Wallula Fault	$359,661,031	5.9%
M7.1 Horse Heaven Hills Fault	$259,935,341	4.3%
HAZUS Analysis (Earthquake Loss Ratio >= 10%)	**Number of Structures**	**Percent of Total Structures**
Hazus Earthquake Summary	743	4.1%
Total number of structures identified in analyses:		18,114
Total value of all structures and structure content:		$6,089,395,221

Landslide Profile

Much of the information below was excerpted or derived from past Benton County Hazard Mitigation Plans or from the Washington Military Department's Washington State Enhanced Hazard Mitigation Plan (EHMP).

Local Event History

Washington has a long history of landslides. Widespread landslides have historically occurred during large storm events (1983, 1996, 1997, 2007, and 2009) and earthquakes (1949, 1965 and 2001). Landslides can also move without large events and without warning, such as the Aldercrest-Banyon landslide in Cowlitz County, the Carlyon Beach/Hunters Point landslide in Thurston County, and the Nile Landslide in Yakima County. Landslides can also be caused by volcanoes, such as the debris avalanche of the Mt. St. Helens eruption of 1980 and subsequent lahars (volcanic debris flows).

In 1982 in Benton County, the construction of Interstate-82 between Prosser and Benton City at mile marker 92 reactivated a historical landslide causing between $10 and $15 million in damages. Figure 22 shows the locations of known historic landslides. Most have occurred along the steep slopes of Interstate 82 and along the Columbia River west of Paterson, WA.

Probability of Future Occurrence

Within the Columbia River Basin, a series of ancient seeping lava flows and subsequent flooding events from Lake Missoula (a prehistoric glacial lake) left behind soil deposits in the Columbia Basin that are highly susceptible to erosion. These loose, failure-prone soils are further capped by wind-blown sands, silts, and clays (known as loess). Consequently, landslides are a concern in the Columbia Basin as they can be triggered naturally by the process of erosion or by human activities such as the excavation of a toe slope. Irrigation in the Columbia Basin compounds the provinces landslide problems. For example, irrigation near Pasco has increased drainage and landslide problems ten-fold since 1957. Reactivations of relict and dormant deep-seated landslide complexes have occurred in the bluffs along the Columbia River upstream of Richland. Areas specific to Benton County that have been most active in the recent past include the Columbia River Gorge and the Prosser to Benton City section of Interstate 82 (yellow areas on Figure 22).

Benton County is vulnerable to landslide hazards under the proper conditions, especially in the steeper slope areas (red areas on Landslide Risk map; Figure 22). Several factors, such as rainfall levels, vegetation cover, soil depth and geology, affect the stability of slopes which, in general, become potentially less stable as slope-steepness increases. This is becoming more of a concern as it relates to new construction in the county. In response to market conditions, competition among competing land uses, and as higher income households target view lots on slopes and ridges, new residential developments in Benton County are increasingly occupying the more geologically complex terrain. These are the areas that present problems associated with slope instability and erosion, especially those in excess of 15 percent slope as identified by The Benton County Planning Department.

Based on historical evidence, there is a **MODERATE** probability of a destructive landslide occurring in Benton County. Because of the infrequency of landslide events occurring in populated areas of Benton

County, there is a **LOW** risk associated with this hazard during the majority of the year with the risk increasing to **MODERATE** during the times when irrigation systems are up and operating; typically mid-March through the end of October.

Impacts of Landslides

Landslides are downhill movements of rock, debris, or soil mass that vary in size depending on the geology and the initial cause of the slide. Because they can happen suddenly and without warning, landslides can injure or kill, destroy structures such as homes, businesses, and public buildings, interrupt infrastructure such as transportation or utilities. Landslides can even impact the environment by disturbing or covering aquatic or other habitat or directly killing plants and animals.

Natural processes can cause landslides or re-activate historical landslide sites. The removal or undercutting of shoreline-supporting material along bodies of water by currents and waves produces countless small slides each year. Seismic tremors can trigger landslides on slopes historically known to have landslide movement. Earthquakes can also cause additional failure (lateral spreading) that can occur on gentle slopes. Landslides are particularly common along stream banks. The incidence of landslides and their impacts on people can be exacerbated by human activities. Grading for road construction and development can increase slope steepness. Grading and construction can decrease the stability of a hill slope by adding weight to the top of the slope, removing support at the base of the slope, and increasing water content. Other human activities effecting landslides include: excavation, irrigation, drainage and groundwater alterations, and changes in vegetation. Locations at risk from landslides include areas with one or more of the following conditions:

- On or close to steep hills
- Steep road-cuts or excavations
- Existing landslides or places of known historic landslides (such sites often have evidence of past movement such as tilted trees, cracks in the ground, and irregular-surfaced ground)
- Steep areas where surface runoff is channeled, such as below culverts, V-shaped valleys, canyon bottoms, and steep stream channels
- Fan-shaped areas of sediment and boulder accumulation at the outlets of canyons.

Due to the unique problems inherent in development in steeply sloping areas, special care must be exercised in the planning and development of such areas. Benton County’s Comprehensive Plan Land Use Map identifies lower rural densities for steeply sloping areas and the Critical Areas Protection Ordinance applies performance standards to development within these areas. While not prohibiting development, the ordinance does require that the nature and severity of the hazard be identified and that the siting, design and engineering for development directly respond to the identified hazards, so that long term structural integrity can be reasonably assured (Benton County Comprehensive Plan).

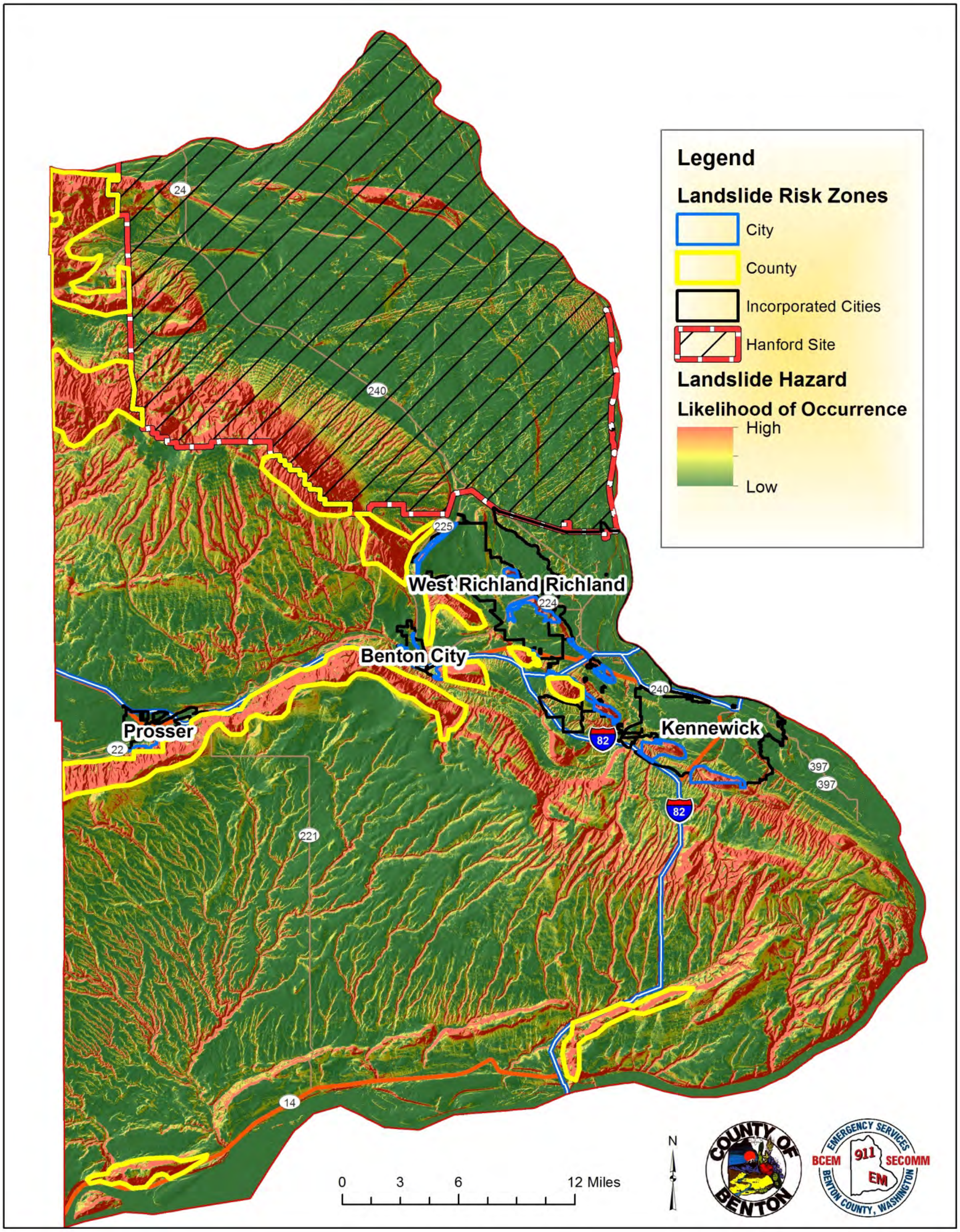


Figure 22) Landslide risk areas and historic landslides for Benton County, WA.

Developmental Trends

With a steady increase in population and overall increase in demand for development, the vulnerability of Benton County to landslides has changed. New housing developments are more frequently placed on sloped terrain that poses a risk of landslides. In particular, homes constructed on the toe slope of the Horse Heaven Hills and those constructed on the shoulder and toes slopes of the fault ridges (Badger Mountain for example) are considered to be at high risk. Refer to the Landslide sections for each jurisdiction for more information. Land use planning, adherence to building codes, and community preparedness will help to minimize the impact of a landslide on Benton County.

Value of Resources at Risk

Resources most at risk in a land movement event include infrastructure, economy, and personal and municipal property. These values vary significantly throughout the county. Most of the value associated with these resources is located in and near the cities of Richland and Kennewick as they are the hubs for commerce, industry, and transportation, and because they combine to make up the largest residential area.

Benton County has 2931 structures in designated high-risk landslide zones. These structures have an appraised value totaling just under $698 million (Table 25). Of these structures, around 26% are in unincorporated areas of Benton County. The majority (98%) of structures in high risk landslide zones are classified as residential.

Table 25) Number and value of appraised structures in designated high-risk landslide zones in Benton County, WA. This table includes both municipal jurisdictions and unincorporated areas of Benton County as well as structure use classifications.

Jurisdiction and Building Type	Number of Appraised Structures	Value of Appraised Structures
Unincorporated	**777**	**$141,875,560.00**
Agricultural	1	$970.00
Commercial	10	$551,450.00
Industrial	2	$238,470.00
Residential	764	$141,084,670.00
Benton City	**56**	**$4,998,830.00**
Industrial	1	$605,920.00
Residential	55	$4,392,910.00
Kennewick	**847**	**$231,341,920.00**
Agricultural	4	$1,212,650.00
Commercial	6	$839,970.00
Residential	837	$229,289,300.00
Prosser	**190**	**$34,925,450.00**
Commercial	8	$775,430.00
Residential	182	$34,150,020.00
Richland	**610**	**$195,407,840.00**

Agricultural	2	$894,970.00
Commercial	6	$1,404,180.00
Residential	602	$193,108,690.00
West Richland	**451**	**$89,406,610.00**
Commercial	14	$1,552,040.00
Residential	437	$87,854,570.00
Total	**2931**	**$697,956,210.00**

Volcano Profile

Much of the information below was excerpted or derived from past Benton County Hazard Mitigation Plans or from the Washington Military Department's Washington State Enhanced Hazard Mitigation Plan (EHMP).

Local Event History

Stretching from northern California into British Columbia, the Cascade Range of the Pacific Northwest has more than a dozen active volcanoes, most of which are capable of explosive eruptions. The volcanos that erupted most recently were Mount St. Helens (Washington, 1980–86 and 2004–8) and Lassen Peak (California, 1914–17). On May 18, 1980, after two months of earthquakes and minor eruptions, Mount St. Helens exploded in one of the most devastating volcanic eruptions of the 20th century. Although less than 0.1 cubic mile of molten rock (magma) was erupted, 57 people died, and damage exceeded $1 billion. Fortunately, most people in the area were able to evacuate safely before the eruption as public officials had been alerted to the danger by the U.S. Geological Survey (USGS) and other scientists who were monitoring volcanic activity in the region.

Probability of Future Occurrence

The Pacific Ring of Fire, whose perimeter includes the Cascades, has produced 22 of the 25 largest volcanic eruptions over the last roughly 11,000 years. The USGS studies and monitors many of the active volcanos in Washington State. Studies have shown that Glacier Peak has erupted an estimated five times in the last 13,000 years; likewise Mount St. Helens last eruption on May 18, 1980 demonstrated that the Volcanos within the Cascade Mountain Range are still active, and they will erupt again. While not a common occurrence, there are, on average, two eruptions in the Cascade Mountain Range every 100 years. The map below (Figure 22) indicates that there is a 1 in 1,000 to 1 in 10,000 chance every year that either some or all jurisdictions in Benton County will receive 10 centimeters (approximately 4 inches) of ash fall from a volcanic eruption. The annual probability that Benton County will receive any ash fall during an eruption is much higher. It should be noted that probabilities of occurrence are influenced by size and duration of an eruption, the point of eruption, prevailing wind direction and wind speed, and other weather factors.

Figure 23) Probability map of at least 10.0 cm of ash accumulating as a result of a Mount St. Helen eruption.

Because of the historical infrequency of such events, it is unlikely that we will see a volcanic eruption in our lifetimes. However, due to the prevailing winds within Benton County, the impacts of a major eruption from Mount Adams, Mount Hood or Mount Saint Helens to persons, property, infrastructure, and the environment in Benton County would be serious though not necessarily catastrophic. Therefore, there is a **LOW** probability of such an event occurring, but a **MODERATE** risk to persons, property, and the environment in Benton County should an eruption occur.

Impacts of Volcanic Events

The volcanoes of the Cascade Range have produced more than 100 eruptions, most of them explosive, over the past few thousand years. Considering that individual Cascade volcanoes can lie dormant for many centuries between eruptions, the short- and long-range threats posed by volcanic activity are not always conspicuous. Pyroclastic flows, lava flows, and landslides can devastate areas 10 or more miles away and lahars can inundate valleys more than 50 miles downstream. Falling ash from explosive eruptions can disrupt human activities hundreds of miles downwind and drifting clouds of fine ash can cause severe damage to jet aircraft thousands of miles away. Erupting Cascade volcanoes are more prone than other U.S. volcanoes to explosive volcanic activity and present a unique and devastating set of hazards to communities that are in range. Because the population of the Pacific Northwest is rapidly expanding, the volcanoes of the Cascade Range in Washington, Oregon, and northern California are some of the most dangerous in the United States. Although Cascade volcanoes only erupt twice per century on average, they can be extremely dangerous as they tend to explode violently, feature permanent snow and ice cover that can melt rapidly and fuel large lahars, and are in proximity to important infrastructure, air routes, and populated areas of varying size and development.

Considering the proximity of Benton County to the Cascade Mountain Range, the greatest risk posed to the communities of Benton County during an explosive volcanic eruption would be ash fall. Volcanic ash is a mixture of small rock and glass particles that are small and light enough to be carried thousands of miles away from the point of eruption. Prolonged exposure to ash poses a health risk to people with respiratory conditions, children, and the elderly often resulting in an increase in the number of patient visits to medical facilities and high demand for medication and other medical supplies. Ash build up on the rooftops of building can weaken structures and cause them to collapse, potentially causing injury or death to occupants or bystanders. Water quality, wastewater management, and other municipal water treatment and water supply infrastructure can be impacted or disrupted by ash fall. In addition to the risk to human health, ash can disrupt everyday activities; vehicle engines can become clogged with ash causing them to stall, power distribution systems can fail, communication systems may be disrupted due to the scattering or absorption of radio signals, and crop damage and effects on livestock can range from minimal to severe[18]. Additionally, ash fall can disrupt transportation systems through the closing of roadways and airports, potentially resulting in an economic loss and stranded citizens.

Developmental Trends

Despite a steady increase in population and fluctuating demand for development, the vulnerability of Benton County to volcanic activity has not changed. While difficult to prepare for the consequences of ash fall, mitigation strategies, such as keeping roadways clear for emergency crews and first responders, can help protect and save lives during a volcanic eruption.

Value of Resources at Risk

It is difficult to estimate the value of resources at risk during a volcanic eruption. Costs associated with ash-related damage would likely depend on the duration of exposure and quantity of ash that settles within the municipality. Ash can collapse the roofs of buildings, impact water resources and infrastructure, clog vehicle engines, ground or damage airplanes, harm or kill livestock, crops, and other vegetation, and have adverse impacts on human and animal health. As indicated by the aftermath of the Mount St. Helens eruption in 1980, the damage caused by an eruption can total in the billions of dollars.

In addition to any kind of damage to infrastructure, there will be, depending on the volume of ash fall, high costs associated with clean-up efforts, the need for additional medical supplies, food and water, temporary shelter and transportation needs, and any other emergency supplies needed for both emergency responders and the general public.

City of Kennewick Profile

The City of Kennewick covers 27.7 square miles of land and 1.5 square miles of water along the south bank of the Columbia River southeast of the confluence of the Yakima and Columbia Rivers. With an estimated 2018 population of 81,850, Kennewick is the 13th largest city in Washington and the largest of the three Tri-Cities. Since its incorporation in 1904 Kennewick has seen steady population growth (Table 27). The City was primarily an agricultural center until the 1940s, when it began to experience growth associated with the Hanford Site. Leading up to and following extensive layoffs at the Hanford Site in 2011, Kennewick has developed as a bedroom community and shopping destination for the region. Kennewick is governed by an elected City Council. Daily operations are directed by the City Manager.

Table 26) Historic Populations of Kennewick, WA.

Census	Population	% Change
1910	1219	
1920	1684	38%
1930	1519	-10%
1940	1918	26%
1950	10106	427%
1960	14244	41%
1970	15212	7%
1980	34397	126%
1990	42155	23%
2000	54693	30%
2010	73917	35%

Capabilities Assessment

Mitigation capabilities are existing authorities, policies, programs, and resources that reduce hazard impacts or that could be used to implement hazard mitigation activities. Detailed Capabilities Assessments for Kennewick can be found in Appendix B.

Development Trends

As part of the Growth Management Act, the Washington State Office of Financial Management (OFM) has provided Benton County with a population estimate for a period ending in the year 2037. For planning purposes, the countywide population estimate was distributed on an existing percentage basis to the various cities and unincorporated areas within Benton County. Kennewick's official population forecast is a total of 112,044 in the incorporated area by the year 2037. Current 2018 population estimate within the incorporated area is 81,850.

Kennewick’s Comprehensive Plan includes a land use inventory which summarizes developed and buildable lands within current City limits and the 20-year Urban Growth Area. It also provides an estimate of acres needed for development to accommodate the projected 2037 population. Overall, the Comprehensive Plan indicates that an additional 1,687 beyond the acres already included in the Kennewick UGA will be required to support the expected development.

The current Kennewick UGA is scattered along the eastern City limits with additional parcels south of State Highway 240 in the northern part of the City and between Interstate 82 and Clearwater Avenue in the southwest portion of the City (Benton County Comprehensive Plan). To accommodate the projected population, increase, Kennewick is analyzing the areas to the southwest and southeast of the City for potential inclusion in the 50-year UGA (Kennewick Comprehensive Plan). The area south of Interstate 82 has been specifically targeted for possible expansion.

Kennewick Hazard Annex

Flood Profile

The City of Kennewick does not have any differing levels of risk associated with this hazard than Benton County as a whole. However, Kennewick's exposure to flooding will be different than that of Benton County and the other jurisdictions within the county.

Local Event History

The City of Kennewick was inundated by the May 31, 1948 Columbia River flood and was likely impacted by other flooding events that caused damage to Benton County (Table 27). Since most of the historic flood events involved the Yakima River it is difficult to determine which events would have caused damage to Kennewick.

Table 27) History of flood events that affected Benton County. Measurements were taken at Kiona.

Date	Flow (cfs)	Stage (ft)	Return Period (Yrs)	Comments
23-Dec-33	67000	21.57	167	Largest flood of record. Resulted in construction of extensive federal levee system in Yakima County.
17-Nov-06	66000	20.12	159	
17-Dec	53,800 at Prosser	18.5 est.		
11-Feb-96	49400	20.98	67	Benton County declared a federal disaster area (Note: crest may have reached up to 21.5 ft)
18-Jan-74	39700	18.56	36	Benton County declared a federal disaster area.
18-Nov-1896	38000	16.07	34	
30-May-48	37900	17.2	33	
13-Dec-21	35,800 at Parker			
17-Apr-04	32000	15.05	18	
26-Nov-09	30600	14.8	16	
23-Mar-10	29200	14.53	14	
6-Dec-75	28300	16.52	13	
28-Dec-80	27600	16.27	12	
4-Dec-77	27000	16.11	11	Benton County declared a federal disaster area.
3-Mar-01	26400	14	10	
14-Jun-03	26400	14	10	
2-Dec-95	26300	15.87	9	Benton County declared a federal disaster area.
10-Jan-09	25400	15.55		Benton County declared a federal disaster area.
16-Jun-16	24,800 at Parker			
17-Feb-1898	23100	13.27	7	
27-Nov-90	22600	14.36	7	Benton County declared a federal disaster area.
1-Feb-65	22400	13.76	6	
22-Feb-82	22200	14.42	6	
5-Jun-13	20900	13.1	5	

13-Feb-51	20900	12.99	5	
23-Jan-19	20,600 at Parker			
15-Mar-72	20200	13.57	5	
22-May-56	20100	12.73	5	
18-Feb-17	7340	7.85		Flooding was a result of snow melt. Benton County declared a federal disaster area.

Probability of Future Occurrence

Kennewick has flooding potential due to its proximity to the Columbia, Snake, and Yakima rivers. The threat of flooding has been greatly reduced by the construction of dams along these rivers but some potential still exists. Therefore, Kennewick has a **MODERATE** probability of flooding. Due to the centrally-located, highly-valuable resources in Kennewick, a flood event carries a **MODERATE** risk. The flash flooding potential of Zintel Canyon was reduced by the construction of the Zintel Dam and risk associated with levy failure was reduced with canal lining.

The Kennewick Flood Map (Figure 24) shows that all structures that are susceptible to flooding fall within flood zones A, AE, or AO (Table 28). This means there is a 1% chance, more for structures located in zone AO, that structures will be subjected to flood conditions annually and a 26% chance that they will be subjected to flood conditions over the life of a 30-year mortgage.

Table 28) National Flood Insurance Program (NFIP) flood zone categories and descriptions.

ZONE	DESCRIPTION
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.

AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.

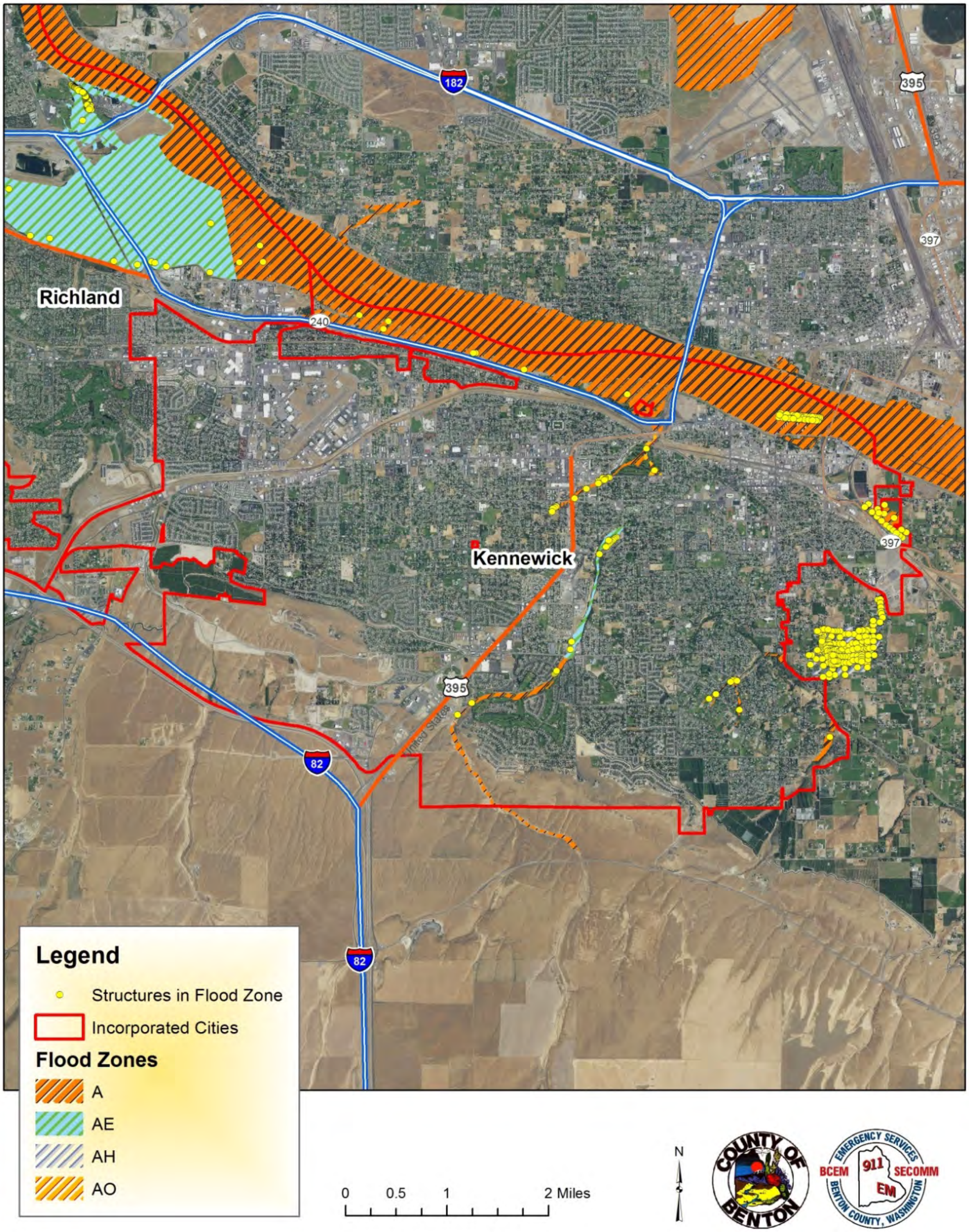


Figure 24) National Flood Insurance Program flood zone map for Kennewick, WA.

Structures in flood zone AO will likely be inundated with 1 to 3 feet of water during a flood event while it is unknown what depths to expect during a flood event for flood zone A as an analysis has been not been performed in those areas.

Impacts of Flooding

Potential impacts caused by flooding in Kennewick include increased landslide risk, damage to infrastructure or roads, and damage to personal property. Refer to *Benton County Annex* for additional information.

Development Trends

As both population and demand for development are projected to increase for the City of Kennewick, it should be expected that Kennewick, over time, will have more infrastructure at risk during a flood event. Land use planning and adherence to building codes in flood sensitive areas should help reduce the amount of infrastructure at risk during a flood event.

Value of Resources at Risk

In total, the City of Kennewick has 108 structures, six of which are government owned (Table 29), in areas that are designated flood zones that are currently appraised at just over $501 million (Table 30). The majority of the structures, 93 of 108, are located in flood zone A (Table 28) which means there is a 26% chance that they will flood over the life of a 30 year mortgage. Looking at the flood map for Kennewick (Figure 24) damage from flooding would be a result of a Columbia River flood event.

Table 29) Total number and total value of appraised Government structures in designated flood zones in Kennewick, WA (includes only incorporated Government structures).

Flood Zones	Appraised Gov't Struct.	Value of Appraised Gov't Struct
A	6	$ 64,781,660.00
Total	**6**	**$ 64,781,660.00**

Table 30) Total number and total value of appraised structures in designated flood zones in Kennewick, WA (includes only incorporated structures).

Flood Zone	Appraised Structures	Value of Appraised Structures
A	93	$ 500,155,770.00
AE	13	$ 1,008,890.00
AO	2	$ 278,290.00
Total	**108**	**$ 501,442,950.00**

Drought Profile

The City of Kennewick does not have any differing levels of risk associated with this hazard than Benton County as a whole.

Local Event History

Through the analysis of 100-year drought data (1895-1995), the EHMP reports that most of Washington State was in severe or extreme drought at least 5% of the time during that period. Kennewick experienced severe or extreme drought 20-30% of the time during that 100 years. During the severe drought event that occurred in 2005, the Governor of Washington requested agricultural disaster designations from the U.S. Secretary of Agriculture because of significant crop damage. Benton County was one of the 15 counties that were included in the disaster request.

Probability of Future Occurrence

Kennewick does not differ from the rest of Benton County regarding future drought probability. It is reasonable to anticipate drought in 20 to 30 out of the next 100 years, resulting in a **MODERATE** probability rating. Because the population relies heavily on agriculture, and support industries tied to agriculture, there is a **MODERATE** risk associated with drought.

Impacts of Drought

Under drought conditions in the City of Kennewick, the agriculture and water transportation industries would be most heavily impacted. Both of these industries depend on steady water flow in the Snake and Columbia rivers. Drought impacts to agriculture and transportation would potentially harm Kennewick's local economy.

Drought also increases the threat of wildfire ignition and spread by accelerating depletion of soil and vegetation moisture and by reducing water available for fire suppression. Dried fuels in and around Kennewick are at the highest risk of ignition in the late summer and early fall.

Development Trends

As both population and demand for development are expected to increase, the City of Kennewick should expect an increase in water usage as well. With increased pressure on water sources, Kennewick will become more sensitive to drought conditions and will likely have to implement water conservation practices earlier during a period of drought. New development may also be vulnerable to wildfire as a result of the increase in fire risk that is often associated with drought conditions.

Value of Resources at Risk

The agriculture industry represents the most at-risk values to the City of Kennewick in the case of a severe drought. Those values are discussed in detail in the Drought Profile within the *Benton County Annex*. The City of Kennewick would be especially affected by drought impacts to the agriculture industry because of the number of people relying on the local economy, directly or indirectly, for income.

Wildfire Profile

For a complete analysis of the wildfire hazard in Benton County, refer to the Wildfire Hazards section in Chapter 3. The information in that section is a complete excerpt of chapter 4 of the Benton County Community Wildfire Protection Plan which is why it is presented in the same section of this plan.

Local Event History

The City of Kennewick has not had any large-scale wildfire events in recent history, but Benton County has experienced numerous fires since 1981. ***Table 3 in the wildfire section of chapter 3 shows wildland fires 300 acres in size or larger that occurred in Benton County since 1981.*** Although large historic fires have not directly impacted Kennewick, local fire personnel respond to numerous ignitions along the roadways, railways, and in undeveloped areas within and immediately surrounding the city annually.

Probability of Future Occurrence

There is a **HIGH** probability of fire ignitions in the city; however, these ignitions are unlikely to result in large areas burned due to the availability of rapid response. Property that suffers damage due to wildfire could potentially harm the local agriculture industry or support industries. There is, therefore, a **MODERATE** risk associated with wildfire in Kennewick.

Impacts of Wildfire Events

With a large population, and therefore a greater number of people living and working in the wildland-urban interface, Kennewick has greater impact potential in the case of a serious wildfire event. The impacts to the area that were discussed in the *Benton County Annex* are comparable to the potential impacts that a wildfire event would have on Kennewick.

Zintel Canyon, a natural area within the city limits of Kennewick, would likely impact surrounding neighborhoods in the event of a wildfire. Considering that it is a park with high levels of human activity and is characterized by a natural cover type, the wildfire risk at the park is higher than surrounding areas. A Zintel Canyon fire could threaten homes and property and possibly displace residents in impact-areas.

Refer to the wildfire section in chapter 3 for information about specific fire protection issues in Benton County.

Development Trends

As both population and demand for development are projected to increase for the City of Kennewick, it should be expected that Kennewick, over time, will have more infrastructure at risk during a wildfire event. Land use planning, adherence to Firewise or other community wildfire standards in WUI areas, and fire-resistant construction should help reduce the amount of infrastructure at risk during a wildfire event.

Refer to the wildfire section in chapter 3 for information about the wildland urban interface in Benton County and the specific risks associated with additional expansion.

Value of Resources at Risk

The values of at-risk resources in and around Kennewick are generally greater than the rest of the county. This is because of the greater number of structures and personal property, and because of the much larger population of Kennewick compared to the rest of the county. This means there are more people relying on the local economy, infrastructure, and other elements that could be distressed by a serious wildfire event.

Refer to the wildfire section in chapter 3 for relative threat level mapping information for Benton County and specifics about high-value resources at risk.

Severe Weather Profile

The City of Kennewick does not have any differing levels of risk associated with this hazard than Benton County as a whole.

Local Event History

Severe storms, especially severe wind storms, are common in Benton County during the spring and fall months and all areas of Benton County are vulnerable to the impacts of severe storms. Severe wind storms that occur in the Columbia River Basin routinely have wind speeds that can reach 60 mph but some storms, including winter storms, are capable of even greater wind speeds:

- During a five-day windstorm event in January 1972, wind speeds (gusts) up to 150 mph were recorded on Rattlesnake Mountain. In Toppenish (Yakima County), the windstorm leveled buildings, tore off roofs, and overturned trailers. It is estimated that the storm caused $250,000 in damages (1972 dollars) in Benton County alone.
- In a January 1990 windstorm, wind gusts up to 81 mph were recorded causing an estimated $3,000,000 in damages.
- In the winter of 1996-1997, Benton County experienced a massive storm that brought heavy snow accumulation, high winds and rain and led to a FEMA Disaster Declaration.
- Severe windstorms were also experienced in December 1995 and December 2001, causing damage to roofs, trees, and other property.
- In 2006 a windstorm affected all 39 counties in Washington, causing $50 million in damage statewide.

The most recent severe storm event was in February 2017. Heavy snow and rain caused flooding and eventually led to a FEMA Major Disaster Declaration.

Probability of Future Occurrence

Regionally, severe storms are expected to occur regularly resulting in a **HIGH** probability. Therefore, Kennewick can anticipate at least one severe storm each year and very likely multiple storms. Disaster events caused by severe storms are not expected to happen as regularly but predicting when and what events will occur is not possible. Severe storms pose a **MODERATE** risk to Kennewick.

Impacts of Severe Weather Events

As mentioned above, impacts from severe storms often manifest in the form of another hazard type, such as flooding, landslides, and lightning-caused wildfire. Windstorms can greatly affect Kennewick, possibly impacting power sources or causing debris hazards. Unexpected or unusually heavy snowstorms can also have a major impact on Kennewick especially because of its large population. Stress on infrastructure or a major disruption of transportation caused by severe weather, could potentially create a disaster event that impacts human safety and commerce.

Development Trends

The population of Kennewick has increased over the previous decade and therefore much of the demand for development has increased. There have been no changes in development that affect this jurisdiction's vulnerability regarding this hazard.

Value of Resources at Risk

The values of resources at risk in and near Kennewick can be significant. Kennewick is a major component of the Tri-Cities metropolitan area, the industrial, economic, and political hub of Benton County. Because of the confluence of the Columbia and Snake rivers near Kennewick, the prolific agriculture industry, and neighboring industries, Kennewick contains substantial infrastructure, personal property, municipal facilities, and industrial facilities.

It is difficult to estimate potential losses in Kennewick due to severe weather. Construction throughout the County has been implemented in the presence of high wind events, and with typical levels of snow accumulation in mind and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

Earthquake Profile

Local Event History

Because of its location near the collision boundary of two major tectonic plates, Washington State is particularly vulnerable to a variety of earthquakes. FEMA has determined that Washington State ranks second (behind only California) among states most susceptible to damaging earthquakes in terms of economic loss. FEMA notes that a majority of the state is at risk to strong shaking (on a scale of minimal to strong) with shaking magnitude generally decreasing from west to east.

The Washington coast and the greater Puget Sound Basin are most at risk although damaging earthquakes have occurred east of the Cascades. The Puget Sound basin had damaging earthquakes in 1909, 1939, 1946, 1949, 1965, and 2001. Eastern Washington had large earthquakes in 1872 near Lake Chelan and in 1936 near Walla Walla. The 1872 earthquake near Lake Chelan was the states most widely felt shallow earthquake. The magnitude for this event has been estimated at 7.4. The 1936 magnitude 6.1 earthquake near Walla Walla was also a shallow event. Because of their remote locations damage was light from these two quakes. Ground shaking from historic earthquakes in Washington and the western U.S. has been noted in Benton County, and has resulted in only minor damage in several events.

The EHMP examines two significant earthquake events near Benton County that have occurred since 1872:

Lake Chelan Earthquake– December 14, 1872

Likely originating northeast of Chelan, WA, the magnitude 6.8 (est.) Chelan Earthquake was felt from British Columbia to Oregon and from the Pacific Ocean to Montana. At the time there were few man-made structures in the epicenter area near Lake Chelan so most of the regional impacts were ground affects. Observed after the earthquake were huge landslides, massive fissures in the ground, and a 27-foot high geyser. Extensive landslides occurred in the slide-prone shorelines of the Columbia River. One massive slide, at Ribbon Cliff between Entiat and Winesap, blocked the Columbia River for several hours. In addition to the Columbia River shoreline, landslides also occurred throughout the Cascade Mountains.

As of 2014 geologists had begun the process of interpreting a large amount of evidence that they suspect will indicate the exact location of the epicenter of the 1872 earthquake. As of the update of this plan, the study is still in progress, but some researchers believe the epicenter is located in Spencer Canyon, near Orondo, WA but this is yet to be confirmed. Determining the exact location of the epicenter is important as the fault is capable of producing another large earthquake in the future. Knowing where an earthquake may occur will help researchers predict the potential impacts it could have on nearby communities and help them prepare.

Milton-Freewater Earthquake – July 15, 1936

The earthquake, magnitude 6.1, occurred at 11:05 a.m. The epicenter was about 5 miles south-southeast of Walla Walla. It was widely felt through Oregon, Washington and northern Idaho, with the greatest shaking occurring in northeast Oregon. Property damage was estimated at $100,000 (in 1936 dollars) in, what was at the time, a sparsely populated area.

In recent years, geologists have attempted to find the exact location of the epicenter of the Milton-Freewater earthquake. As of the update of this plan, geologists are attempting to determine exactly which fault was the source of the quake as it could either have occurred on the RAW or on the Hite fault. The location of the epicenter has implications for impacts of any future earthquakes occurring along the same fault and the way that communities prepare for such event. The results are expected to be available in the near future.

Probability of Future Occurrence

Because of the infrequency of such devastating events, there is a **MODERATE** probability for a potentially damaging earthquake to occur that would result in many people being injured or killed and damaging private property, government infrastructure and the local economy. However, there is a **HIGH** risk to the citizens, infrastructure, and economy of Kennewick should such an earthquake occur.

Impacts of Earthquakes

An in-depth examination of the impacts that an earthquake event might have on the area can be found in the *Benton County Annex*. The impacts discussed are comparable to the potential overall impacts that could occur within the City of Kennewick.

Considering Kennewick's proximity to the Columbia and Snake Rivers, Kennewick is at risk for flooding should an upstream dam fail as the result of an earthquake. Please refer to the *Benton County Annex* for more information about Columbia River dams and Dworshak Dam. The study by Sherrod et al (2016) supports that a fault (part of the Wallula fault zone) capable of producing earthquakes passes through the City of Kennewick, close to Trios Hospital and Southridge High School and is indicated by the upheaval that created the Thompson Hill, Badger Mountain, Red Mountain, and Rattlesnake Mountain "ridge". A fault located directly under the City of Kennewick has the potential to cause significant damage to infrastructure and would place the general populous at risk.

Infrastructure that could be damaged by an earthquake with a local epicenter includes Zintel Dam. Depending on the extent of the damage, there could be an increase in the risk of flash flooding for communities down canyon from Zintel Dam until repairs are made. Also susceptible to earthquakes are large canal syphons that are approximately nine feet in diameter.

Development Trends

The population of Kennewick has increased over the previous decade and therefore demand for development has increased as well. With additional development and infrastructure, Kennewick will become more vulnerable to Earthquake hazards. However, land use planning, adherence to and development of building codes, seismically sound engineering, and community preparedness will help to minimize the impact of an earthquake on the City of Kennewick.

Value of Resources at Risk

According to the Washington Earthquake Risk Assessment, earthquakes resulting from fault movement in or near Benton County could cause approximately $25 to 926 million in damages to Kennewick (Table 31). Of the 24,019 structures that were included in the different analyses, up to 1,970 structures were lost in the Rattlesnake Wallula Fault scenario totaling more than $925 million in damages. Figure 25 shows the areas of Kennewick that are likely to experience the greatest losses in dollars.

Table 31) Washington Earthquake Risk Assessment HAZUS Earthquake scenarios for Kennewick, WA. Total number of structures and total value of structures used in the analyses are included below the table.

City of Kennewick Earthquake Scenarios	Total Loss Value (Building and Contents)	Total Loss Ratio (Building and Contents)
M7.4 Saddle Mountain Fault	$24,980,593	0.2%
M7.4 Rattlesnake Wallula Fault	$925,490,068	8.2%
M7.1 Horse Heaven Hills Fault	$482,755,433	4.3%
HAZUS Analysis (Earthquake Loss Ratio >= 10%)	**Number of Structures**	**Percent of Total Structures**
Hazus Earthquake Summary	3072	12.8%

Total number of structures identified in analyses:	24,019
Total value of all structures and structure content:	$11,349,094,210

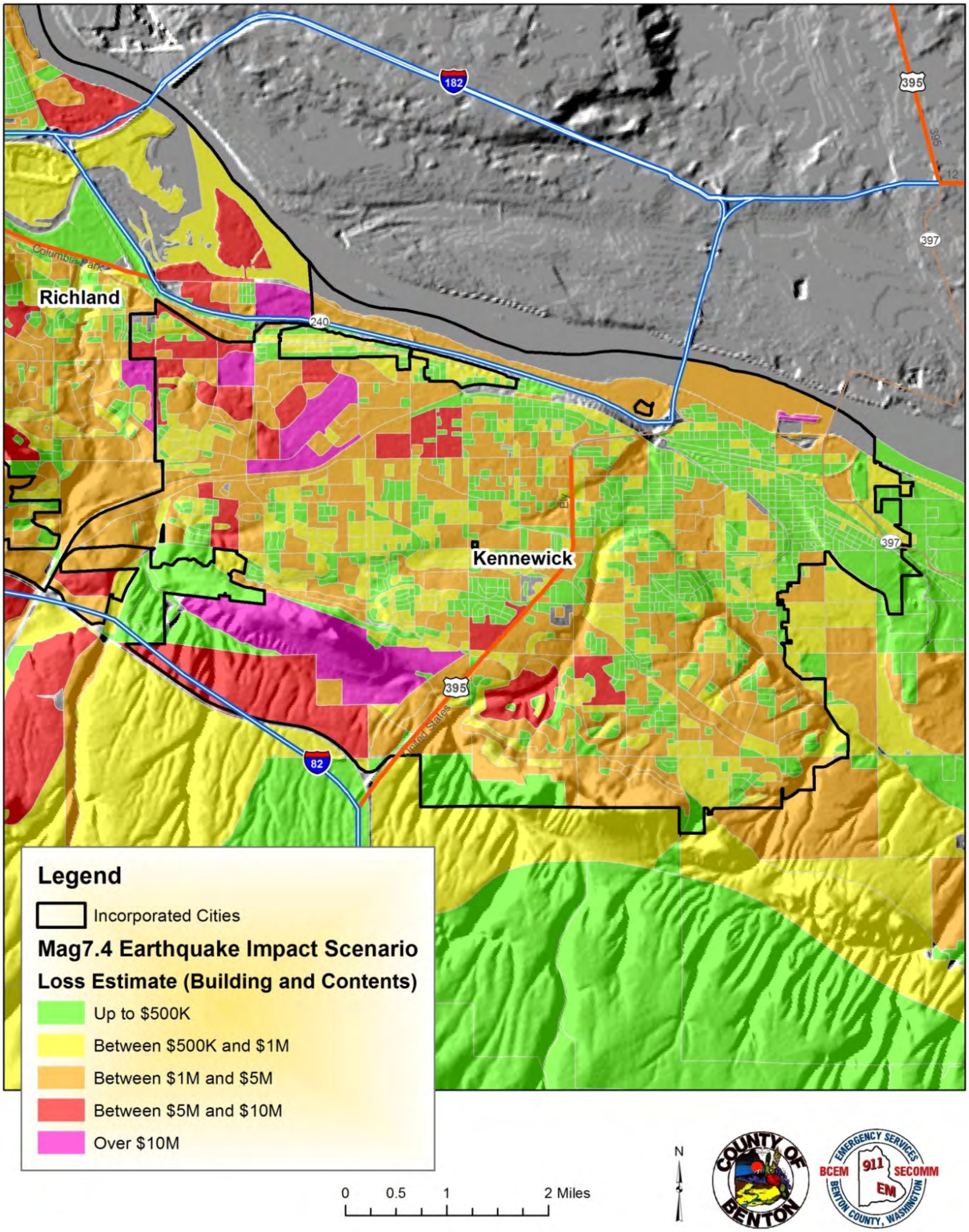


Figure 25) Mag 7.4 Earthquake impact scenario map for Kennewick, WA. The different colors represent potential financial losses (in dollars) for different parts of Kennewick.

Landslide Profile

Local Event History

Washington has a long history of landslides. Widespread landslides have historically occurred during large storm events (1983, 1996, 1997, 2007, and 2009) and earthquakes (1949, 1965 and 2001). Landslides can also move without large events and without warning, such as the Aldercrest-Banyon landslide in Cowlitz County, the Carlyon Beach/Hunters Point landslide in Thurston County, and the Nile Landslide in Yakima County. Landslides can also be caused by volcanoes, such as the debris avalanche of the Mt. St. Helens eruption of 1980 and subsequent lahars (volcanic debris flows).

In 1982 in Benton County, the construction of Interstate-82 between Prosser and Benton City at mile marker 92 reactivated a historical landslide causing between $10 and $15 million in damages. Most landslides in Benton County have occurred along the steep slopes of Interstate 82 and along the Columbia River west of Paterson, WA.

Probability of Future Occurrence

Most of Kennewick is at **LOW** risk for a landslide. However, as a result of steeper terrain and erosive soils, the ridges on the SW side of Kennewick have the highest risk for a landslide or land movement event. Refer to Figure 26 which details critical landslide prone areas in and near Kennewick.

Impacts of Landslide Events

Potential impacts that the City of Kennewick would experience in the case of a landslide or land movement event are comparable to those highlighted in the *Benton County Annex*. The biggest concerns for Kennewick are threats to human safety, disruptions to the local economy and infrastructure, and damages to personal and municipal property. Specifically, the homes and other structures located on the north slopes of the ridges on the SW side of Kennewick are at a higher risk and may be damaged during a landslide or land movement event.

Development Trends

The population of Kennewick has increased over the previous decade and therefore much of the demand for development has increased. As a result, new homes are being constructed beyond the inner-city limits on the slopes of the ridges that are on the SW side of Kennewick. Interest in those new neighborhoods has increased the amount of development taking place on landslide or land-movement prone slopes.

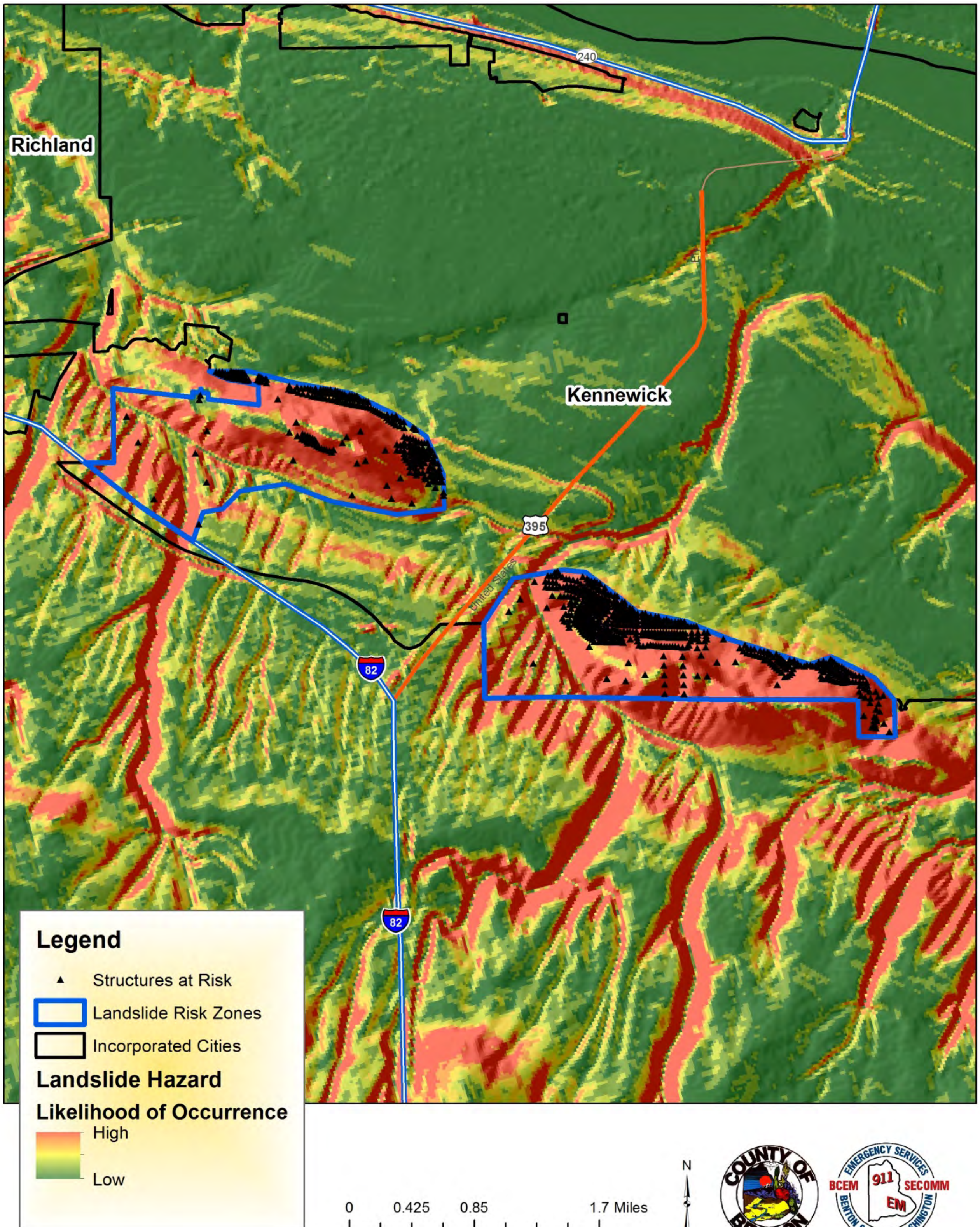


Figure 26) Structures at risk within landslide prone areas in Kennewick, WA.

Values of Resources at Risk

The values of resources at risk in and near Kennewick can be significant. Kennewick is a major component of the Tri-Cities metropolitan area, the industrial, economic, and political hub of Benton County. Because of the confluence of the Columbia and Snake rivers near Kennewick, the prolific agriculture industry, and neighboring industries, Kennewick contains substantial infrastructure, personal property, municipal facilities, and industrial facilities. In total, there are 847 structures in Kennewick that are in designated high-risk landslide zones (Table 32). The appraised value of these structures, 99% of which are residential and would be the neighborhoods on the SW side of Kennewick, is just over $230 million.

Table 32) Number and value of appraised structures by type in designated high-risk landslide zones in Kennewick, WA.

Building Type	Number of Appraised Structures	Value of Appraised Structures
Agricultural	4	$1,212,650.00
Commercial	6	$839,970.00
Residential	837	$229,289,300.00
Total	**847**	**$231,341,920.00**

Volcano Profile

Kennewick does not differ from Benton County as a whole with regard to volcanic hazards.

Local Event History

Stretching from northern California into British Columbia, the Cascade Range of the Pacific Northwest has more than a dozen active volcanoes, most of which are capable of explosive eruptions. The volcanos that erupted most recently were Mount St. Helens (Washington, 1980–86 and 2004–8) and Lassen Peak (California, 1914–17). On May 18, 1980, after two months of earthquakes and minor eruptions, Mount St. Helens exploded in one of the most devastating volcanic eruptions of the 20th century. Although less than 0.1 cubic mile of molten rock (magma) was erupted, 57 people died, and damage exceeded $1 billion. Fortunately, most people in the area were able to evacuate safely before the eruption as public officials had been alerted to the danger by the U.S. Geological Survey (USGS) and other scientists who were monitoring volcanic activity in the region.

Probability of Future Occurrence

Because of the historical infrequency of such events, it is unlikely that we will see a volcanic eruption in our lifetimes. However, due to the prevailing winds within Benton County, the impacts of a major eruption from Mount Adams, Mount Hood or Mount Saint Helens to persons, property, infrastructure, and the environment in Benton County would be serious though not necessarily catastrophic. Therefore, there is a **LOW** probability of such an event occurring, but a **MODERATE** risk to persons, property, and the environment in Benton County should an eruption occur.

Impacts of Volcano Events

Refer to the *Benton County Annex* for volcano event impacts that would be expected to affect all jurisdictions in a similar manner. A volcanic eruption would likely be preceded or accompanied by seismic activity. Considering the fault connectivity noted by Blakely et al (2011), Kennewick could potentially experience local seismic activity which could produce landslides, flooding, ground cracking, and soil liquefaction.

Development Trends

The population of Kennewick has increased over the previous decade and therefore much of the demand for development has increased. There have been no changes in development that affect this jurisdiction's vulnerability regarding this hazard.

Values of Resources at Risk

It is difficult to estimate the value of resources at risk during a volcanic eruption. Costs associated with ash-related damage would likely depend on the duration of exposure and quantity of ash that settles within the municipality. Ash can collapse the roofs of buildings, impact water resources and infrastructure, clog vehicle engines, ground or damage airplanes, harm or kill livestock, crops, and other vegetation, and have adverse impacts on human and animal health. As indicated by the aftermath of the Mount St. Helens eruption in 1980, the damage caused by an eruption can total in the billions of dollars.

In addition to any kind of damage to infrastructure, there will be, depending on the volume of ash fall, high costs associated with clean-up efforts, the need for additional medical supplies, food and water, temporary shelter and transportation needs, and any other emergency supplies needed for both emergency responders and the general public.

City of Richland Profile

The City of Richland lies at the confluence of the Columbia and Yakima rivers, encompassing land on the west bank of the Columbia River, and north and south of the mouth of the Yakima River. Richland was established in 1892 as an agricultural community. In 1942, with the development of the Hanford Site, Richland was transformed from a small town of 247 residents to a federally owned town of 11,000 (Table 34). Self-rule was re-established in 1958. Richland's estimated 2018 population was 55,320 (April 1, 2018 OFM Estimate). Richland continues to be a center of production and research into nuclear energy and related technology. It has been the home of Pacific Northwest National Laboratory (PNNL) since 1965. One of the two Laser Interferometer Gravitational-Wave Observatory sites is located immediately north of Richland. The City covers approximately 35.72 square miles of land and 3.39 square miles of water. Richland is governed by an elected City Council. Daily operations are directed by the City Manager.

Table 33) Historic population of Richland, WA

Census	Population	% Change
1910	350	
1920	279	-20%
1930	208	-25%
1940	247	19%
1950	21809	8729%
1960	23548	8%
1970	26290	12%
1980	33578	28%
1990	32315	-4%
2000	38708	20%
2010	48058	24%

Capabilities Assessment

Mitigation capabilities are existing authorities, policies, programs, and resources that reduce hazard impacts or that could be used to implement hazard mitigation activities. Detailed Capabilities Assessments for Richland can be found in Appendix B.

Development Trends

As part of the Growth Management Act, the Washington State Office of Financial Management (OFM) has provided Benton County with a population estimate for a period ending in the year 2040. For planning purposes, the countywide population estimate was distributed on an existing percentage basis to the various cities and unincorporated areas within Benton County. Richland's official population forecast is a total of 81,366in the incorporated area by the year 2040. Current 2018 population estimate within the incorporated area is 55,320.

Richland's Comprehensive Plan includes an analysis of available land use and capacity. It also provides an estimate of acres needed for development to accommodate the projected 2040 population. Overall, the Comprehensive Plan indicates that the City has sufficient land within its current UGA to accommodate the land needs for the projected residential, commercial, and industrial growth.

The current Richland UGA is separated into five distinct areas with the majority of the UGA land base divided between the Badger Mountain South area and the Horn Rapids area. The Badger Mountain South area is a master-planned community of 1,480 acres located in the southwest side of the City. The area is intended to be developed with 5,000 homes, businesses, and other community activities. The Horn Rapids area is located on the north side of the City and constitutes two planning areas: a) the Horn

Rapids Industrial Park area, a triangular area bounded by Horn Rapids Road to the north and State Route 240 to the south; and b) the 1,641 acres Horn Rapids North Industrial Area, north of Horn Rapids Road. The 1,641-acre industrial area has recently been transferred from the US Department of Energy to the City of Richland and has been specifically set aside for industrial development.

Richland Hazard Annex

Flood Profile

The City of Richland does not have any differing levels of risk associated with this hazard than Benton County as a whole. However, Richland's exposure to flooding will be different than that of Benton County as well as other jurisdictions within the county.

Local Event History

The City of Richland was inundated by the May 31, 1948 Columbia River flood and was likely impacted by other flooding events that caused damage to Benton County (Table 34). As the Columbia River runs along the eastern edge of Richland and the Yakima River bisects the city, Richland would likely have been exposed to most historical flood events in Benton County; particularly flood events associated with the Yakima River.

Table 34) History of flood events that affected Benton County. Measurements were taken at Kiona.

Date	Flow (cfs)	Stage (ft)	Return Period (Yrs)	Comments
23-Dec-33	67000	21.57	167	Largest flood of record. Resulted in construction of extensive federal levee system in Yakima County.
17-Nov-06	66000	20.12	159	
17-Dec	53,800 at Prosser	18.5 est.		
11-Feb-96	49400	20.98	67	Benton County declared a federal disaster area (Note: crest may have reached up to 21.5 ft)
18-Jan-74	39700	18.56	36	Benton County declared a federal disaster area.
18-Nov-1896	38000	16.07	34	
30-May-48	37900	17.2	33	
13-Dec-21	35,800 at Parker			
17-Apr-04	32000	15.05	18	
26-Nov-09	30600	14.8	16	
23-Mar-10	29200	14.53	14	
6-Dec-75	28300	16.52	13	
28-Dec-80	27600	16.27	12	
4-Dec-77	27000	16.11	11	Benton County declared a federal disaster area.
3-Mar-01	26400	14	10	
14-Jun-03	26400	14	10	
2-Dec-95	26300	15.87	9	Benton County declared a federal disaster area.
10-Jan-09	25400	15.55		Benton County declared a federal disaster area.
16-Jun-16	24,800 at Parker			
17-Feb-1898	23100	13.27	7	
27-Nov-90	22600	14.36	7	Benton County declared a federal disaster area.
1-Feb-65	22400	13.76	6	
22-Feb-82	22200	14.42	6	

5-Jun-13	20900	13.1	5	
13-Feb-51	20900	12.99	5	
23-Jan-19	20,600 at Parker			
15-Mar-72	20200	13.57	5	
22-May-56	20100	12.73	5	
18-Feb-17	7340	7.85		Flooding was a result of snow melt. Benton County declared a federal disaster area.

Probability of Future Occurrence

Richland has flooding potential due to its proximity to the Columbia and Yakima rivers. Flooding threat has been greatly reduced with the implementation of dams along these rives but some potential still exists, particularly from the Yakima River. Because the Yakima River bisects the city, Richland has a **MODERATE** to **HIGH** probability of flooding as the Yakima River isn't as large as the Columbia River and does not have the same number of Dams or means of control in place. Due to the centrally-located, highly-valuable resources in Richland, a flood event carries a **MODERATE** risk.

The Richland Flood Map (Figure 27) shows that all structures that are susceptible to flooding fall within flood zones A and AE (Table 35). This means there is a 1% chance that structures will be subjected to flood conditions annually and a 26% chance that they will be subjected to flood conditions over the life of a 30-year mortgage. However, no analysis has been performed in areas designated as Flood Zone A, so depth of potential flooding is unknown.

Impacts of Flood Events

Potential impacts caused by flooding in Richland include increased landslide risk, damage to infrastructure or roads, and damage to personal property. Residential areas along the Yakima River are likely to be affected the most by a flood event. Refer to *Benton County Annex* for additional information about the impacts of flood events.

Development Trends

As both population and demand for development are projected to increase for the City of Richland, it should be expected that Richland, over time, will have more infrastructure at risk during a flood event. Land use planning and adherence to building codes in flood sensitive areas should help reduce the amount of infrastructure at risk during a flood event.

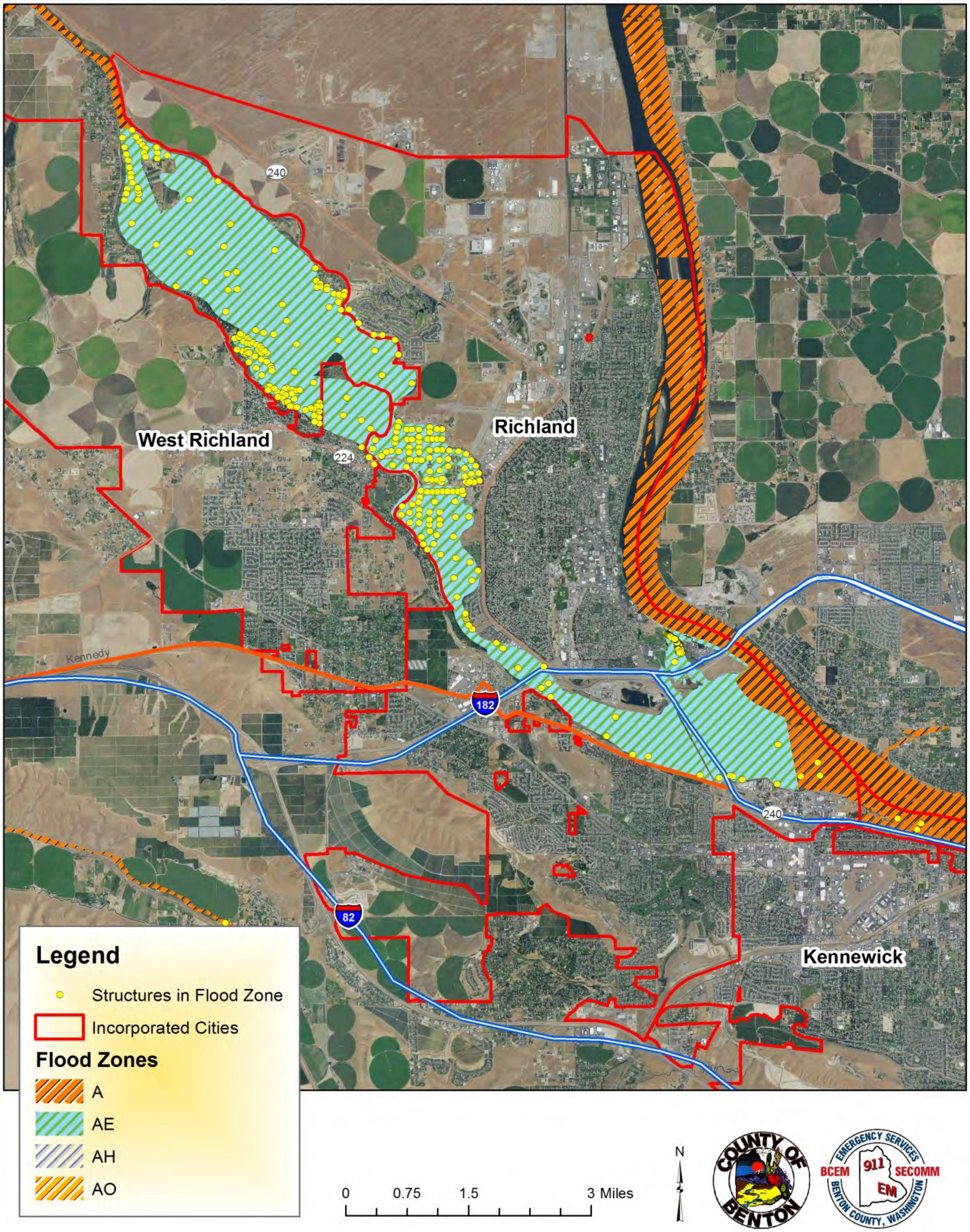


Figure 27) National Flood Insurance Program flood zone map for Richland, WA.

Table 35) National Flood Insurance Program (NFIP) flood zone categories and descriptions.

ZONE	DESCRIPTION
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.

Value of Resources at Risk

Looking at the flood map for Richland (Figure 27) damage from flooding would be a result of a Columbia River and/or Yakima River flood event. In total the City of Richland has 200 structures, 28 of which are government owned (Table 36), in designated flood zones that are currently appraised at just over $49 million (Table 37). The majority of the structures, 197 of 200 total structures, are located in flood zone AE (Table 35) which means there is a 26% chance that they will flood over the life of a 30-year mortgage.

Table 36) Total number and total value of appraised Government structures in designated flood zones in Richland, WA (includes only incorporated Government structures).

Flood Zone	Appraised Gov't Struct.	Value of Appraised Gov't Struct.
A	3	$ 27,164,020.00
AE	25	$ 22,232,270.00
Total	**28**	**$ 49,396,290.00**

Table 37) Total number and total value of appraised structures in designated flood zones in Richland, WA (includes only incorporated structures).

Flood Zone	Appraised Structures	Value of Appraised Structures
A	3	$ 27,164,020.00
AE	197	$ 55,638,760.00
Total	**200**	**$ 82,802,780.00**

Drought Profile

Local Event History

Through analysis of 100-year drought data (1895-1995), the EHMP reports that most of Washington State was in severe or extreme drought at least 5% of the time during that period. Richland experienced severe or extreme drought 20-30% of the time during that 100 years. During the severe drought event that occurred in 2005, the Governor of Washington requested agricultural disaster designations from the U.S. Secretary of Agriculture because of significant crop damage from drought. Benton County was one of the 15 counties that were included in the disaster request.

Probability of Future Occurrence

Richland does not differ from the rest of Benton County regarding future drought probability. It is reasonable to anticipate drought in 20 to 30 out of the next 100 years, resulting in a **MODERATE** probability rating. Because the population relies heavily on agriculture, and support industries tied to agriculture, there is a **MODERATE** risk associated with drought.

Impacts of Drought Events

Under drought conditions in the City of Richland, the agriculture and water transportation industries would be most heavily impacted. Both of these industries depend on steady water flow in the Snake and Columbia rivers. Although agriculture and transportation are less important to the City of Richland relative to other jurisdictions within Benton County, drought impacts to these industries would still potentially harm Richland's local economy.

Drought also increases the threat of wildfire ignition and spread by accelerating depletion of soil and vegetation moisture and by reducing water available for fire suppression. The expanding WUI around

Richland would be at increased risk for severe wildfire under drought conditions during the late summer and early fall.

Development Trends

As both the population of Richland and demand for development are expected to increase, the City of Richland should expect an increase in water usage as well. With increased pressure on water sources, Richland will become more sensitive to drought conditions and will likely have to implement water conservation practices earlier during a period of drought. Increased fire risk associated with drought conditions may also make additional development vulnerable to wildfire.

Value of Resources at Risk

The agriculture industry represents the most at-risk values to the City of Richland in the case of a severe drought. Those values are discussed in detail in the Drought Profile within the *Benton County Annex*. The City of Richland would be especially affected by impacts to these values because of the number of people relying on the local economy, directly or indirectly, for their own income.

Wildfire Profile

For a complete analysis of the wildfire hazard in Benton County, refer to the Wildfire Hazards section in Chapter 3. The information in that section is a complete excerpt of chapter 4 of the Benton County Community Wildfire Protection Plan which is why it is presented in the same section of this plan.

Local Event History

The City of Richland has not had any large-scale wildfire events in recent history, but Benton County has experienced numerous fires since 1981. ***Table 3 in the wildfire section of chapter 3 shows wildland fires 300 acres in size or larger that occurred in Benton County since 1981.*** Although large historic fires have not directly impacted Richland, local fire personnel respond to numerous ignitions along the roadways, railways, and in undeveloped areas within and immediately surrounding the city annually. In July of 2017, a fire occurred on Bateman Island, in Richland. Although the fire was only about 70 acres, it lasted for several days and closed the island for almost one year. The cost for the fire was approximately $100,000.

Probability of Future Occurrence

There is a **HIGH** probability of fire ignitions in the city; however, these ignitions are unlikely to result in large areas burned due to the availability of rapid response. Property that suffers damage to due wildfire could potentially harm the local agriculture industry or support industries. There is, therefore, a **MODERATE** risk associated with wildfire in Richland.

Impacts of Wildfire

With a large population, and therefore a greater number of people living and working in the wildland-urban interface, Richland has greater impact potential in the case of a serious wildfire event. The impacts to the area that were discussed in the *Benton County Annex* are comparable to the potential impacts that a wildfire event would have on Richland.

The City of Richland has identified a number of natural/recreation areas that have a higher potential for ignition and are therefore have a greater wildfire risk. The Yakima Delta, Bateman Island (which is currently closed to the public as of May 2018), portions of Leslie Canyon, portions of WE Johnson Park, Country Ridge HOA canyon property, BLM land between Keene Rd. and Heritage Hills, and Badger Mountain. Richland fire personnel intend to conduct fuels projects in most of these areas.

Refer to the wildfire section in chapter 3 for information about specific fire protection issues in Benton County.

Development Trends

As both population and demand for development are projected to increase for the City of Richland, it should be expected that Richland, over time, will have more infrastructure at risk during a wildfire event. Land use planning, adherence to Firewise or other community wildfire standards in WUI areas, and fire-resistant construction should help reduce the amount of infrastructure at risk during a wildfire event.

Refer to the wildfire section in chapter 3 for information about the wildland urban interface in Benton County and the specific risks associated with additional expansion.

Value of Resources at Risk

The values of at-risk resources in and around Richland are generally greater than the rest of the county. This is because of the greater number of structures and personal property, and because of the much larger population of Richland compared to the rest of the county. This means there are more people relying on the local economy, infrastructure, and other elements that could be distressed by a serious wildfire event.

Refer to the wildfire section in chapter 3 for relative threat level mapping information for Benton County and specifics about high-value resources at risk.

Severe Weather Profile

The City of Richland does not have any differing levels of risk associated with this hazard than Benton County as a whole.

Local Event History

Severe storms, especially severe wind storms, are common in Benton County during the spring and fall months and all areas of Benton County are vulnerable to the impacts of severe storms. Severe wind storms that occur in the Columbia River Basin routinely have wind speeds that can reach 60 mph but some storms, including winter storms, are capable of even greater wind speeds:

- During a five-day windstorm event in January 1972, wind speeds (gusts) up to 150 mph were recorded on Rattlesnake Mountain. In Toppenish (Yakima County), the windstorm leveled buildings, tore off roofs, and overturned trailers. It is estimated that the storm caused $250,000 in damages (1972 dollars) in Benton County alone.

- In a January 1990 windstorm, wind gusts up to 81 mph were recorded causing an estimated $3,000,000 in damages.
- In the winter of 1996-1997, Benton County experienced a massive storm that brought heavy snow accumulation, high winds and rain and led to a FEMA Disaster Declaration.
- Severe windstorms were also experienced in December 1995 and December 2001, causing damage to roofs, trees, and other property.
- In 2006 a windstorm affected all 39 counties in Washington, causing $50 million in damage statewide.

The most recent severe storm event was in February 2017. Heavy snow and rain caused flooding and eventually led to a FEMA Major Disaster Declaration.

Probability of Future Occurrence

Regionally, severe storms are expected to occur regularly resulting in a **HIGH** probability. Therefore, Richland can anticipate at least one severe storm each year and very likely multiple storms. Disaster events caused by severe storms are not expected to happen as regularly but predicting when and what events will occur is not possible. Severe storms pose a **MODERATE** risk to Richland.

Impacts of Severe Weather Events

As mentioned above, impacts from severe storms often manifest in the form of another hazard type, such as flooding, landslides, and lightning-caused wildfire. Windstorms can greatly affect Richland, possibly impacting power sources or causing debris hazards. Unexpected or unusually heavy snowstorms can also have a major impact on Richland especially because of its large population. Stress on infrastructure or a major disruption of transportation caused by severe weather, could potentially create a disaster event that impacts human safety and commerce.

Development Trends

The population of Richland has increased over the previous decade and therefore much of the demand for development has increased. There have been no changes in development that affect this jurisdiction’s vulnerability regarding this hazard.

Value of Resources at Risk

The values of resources at risk in and near Richland can be significant. Richland is a major component of the Tri-Cities metropolitan area, the industrial, economic, and political hub of Benton County. Because of the confluence of the Columbia and Snake rivers near Richland, the prolific agriculture industry, and neighboring industries, Richland contains substantial infrastructure, personal property, municipal facilities, and industrial facilities.

It is difficult to estimate potential losses in Richland due to severe weather. Construction throughout the County has been implemented in the presence of high wind events, and with typical levels of snow accumulation in mind and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

Earthquake Profile

Local Event History

Because of its location near the collision boundary of two major tectonic plates, Washington State is particularly vulnerable to a variety of earthquakes. FEMA has determined that Washington State ranks second (behind only California) among states most susceptible to damaging earthquakes in terms of economic loss. FEMA notes that a majority of the state is at risk to strong shaking (on a scale of minimal to strong) with shaking magnitude generally decreasing from west to east.

The Washington coast and the greater Puget Sound Basin are most at risk although damaging earthquakes have occurred east of the Cascades. The Puget Sound basin had damaging earthquakes in 1909, 1939, 1946, 1949, 1965, and 2001. Eastern Washington had large earthquakes in 1872 near Lake Chelan and in 1936 near Walla Walla. The 1872 earthquake near Lake Chelan was the states most widely felt shallow earthquake. The magnitude for this event has been estimated at 7.4. The 1936 magnitude 6.1 earthquake near Walla Walla was also a shallow event. Because of their remote locations damage was light from these two quakes. Ground shaking from historic earthquakes in Washington and the western U.S. has been noted in Benton County, and has resulted in only minor damage in several events.

The EHMP examines two significant earthquake events near Benton County that have occurred since 1872:

Lake Chelan Earthquake– December 14, 1872

Likely originating northeast of Chelan, WA, the magnitude 6.8 (est.) Chelan Earthquake was felt from British Columbia to Oregon and from the Pacific Ocean to Montana. At the time there were few man-made structures in the epicenter area near Lake Chelan so most of the regional impacts were ground affects. Observed after the earthquake were huge landslides, massive fissures in the ground, and a 27-foot high geyser. Extensive landslides occurred in the slide-prone shorelines of the Columbia River. One massive slide, at Ribbon Cliff between Entiat and Winesap, blocked the Columbia River for several hours. In addition to the Columbia River shoreline, landslides also occurred throughout the Cascade Mountains.

As of 2014 geologists had begun the process of interpreting a large amount of evidence that they suspect will indicate the exact location of the epicenter of the 1872 earthquake. As of the update of this plan, the study is still in progress, but some researchers believe the epicenter is located in Spencer Canyon, near Orondo, WA but this is yet to be confirmed. Determining the exact location of the epicenter is important as the fault is capable of producing another large earthquake in the future. Knowing where an earthquake may occur will help researchers predict the potential impacts it could have on nearby communities and help them prepare.

Milton-Freewater Earthquake – July 15, 1936

The earthquake, magnitude 6.1, occurred at 11:05 a.m. The epicenter was about 5 miles south-southeast of Walla Walla. It was widely felt through Oregon, Washington and northern Idaho, with the greatest shaking occurring in northeast Oregon. Property damage was estimated at $100,000 (in 1936 dollars) in, what was at the time, a sparsely populated area.

In recent years, geologists have attempted to find the exact location of the epicenter of the Milton-Freewater earthquake. As of the update of this plan, geologists are attempting to determine exactly which fault was the source of the quake as it could either have occurred on the RAW or on the Hite fault. The location of the epicenter has implications for impacts of any future earthquakes occurring along the same fault and the way that communities prepare for such event. The results are expected to be available in the near future.

Probability of Future Occurrence

Because of the infrequency of such devastating events, there is a **MODERATE** probability for a potentially damaging earthquake to occur that would result in many people being injured or killed and damaging private property, government infrastructure and the local economy. However, there is a **HIGH** risk to the citizens, infrastructure, and economy of Richland should such an earthquake occur.

Impacts of Earthquake Events

An in-depth examination of the impacts that an earthquake event might have on the area can be found in the *Benton County Annex*. The impacts discussed are comparable to the potential overall impacts that could occur within the City of Richland.

Considering Richland's proximity to the Columbia and Snake Rivers, Richland is at risk for flooding should an upstream dam fail as the result of an earthquake. Please refer to the *Benton County Annex* for more information about Columbia River dams and Dworshak Dam. The study by Sherrod et al (2016) supports that a fault (part of the Wallula fault zone) capable of producing earthquakes passes through the City of Kennewick, close to Trios Hospital and Southridge High School and is indicated by the upheaval that created the Thompson Hill, Badger Mountain, Red Mountain, and Rattlesnake Mountain "ridge". A fault passing directly under the neighboring City of Kennewick has the potential to cause significant damage to infrastructure and would place the general populous of Richland at risk.

Development Trends

The population of Richland has increased over the previous decade and therefore demand for development has increased as well. With additional development and infrastructure, Richland will become more vulnerable to Earthquake hazards. However, land use planning, adherence to and development of building codes, seismically sound engineering, and community preparedness will help to minimize the impact of an earthquake on the City of Richland.

Value of Resources at Risk

According to the Washington Earthquake Risk Assessment, earthquakes resulting from fault movement in or near Benton County could cause approximately $50 to 743 million in damages to Richland (Table 38). Of the 19,479 structures that were included in the different analyses, up to 1,286 structures were lost in the Rattlesnake Wallula Fault scenario totaling more than $742 million in damages. Figure 28 shows the areas of Richland that are likely to experience the greatest losses in dollars.

Table 38) Washington Earthquake Risk Assessment HAZUS Earthquake scenarios for Richland, WA. Total number of structures and total value of structures used in the analyses are included below the table.

City of Richland Earthquake Scenarios	Total Loss Value (Building and Contents)	Total Loss Ratio (Building and Contents)
M7.4 Saddle Mountain Fault	$50,293,151	0.4%
M7.4 Rattlesnake Wallula Fault	$742,963,157	6.6%
M7.1 Horse Heaven Hills Fault	$423,116,533	3.8%
HAZUS Analysis (Earthquake Loss Ratio >= 10%)	**Number of Structures**	**Percent of Total Structures**
Hazus Earthquake Summary	880	4.5%

Total number of structures identified in analyses: 19,479

Total value of all structures and structure content: $11,188,840,940

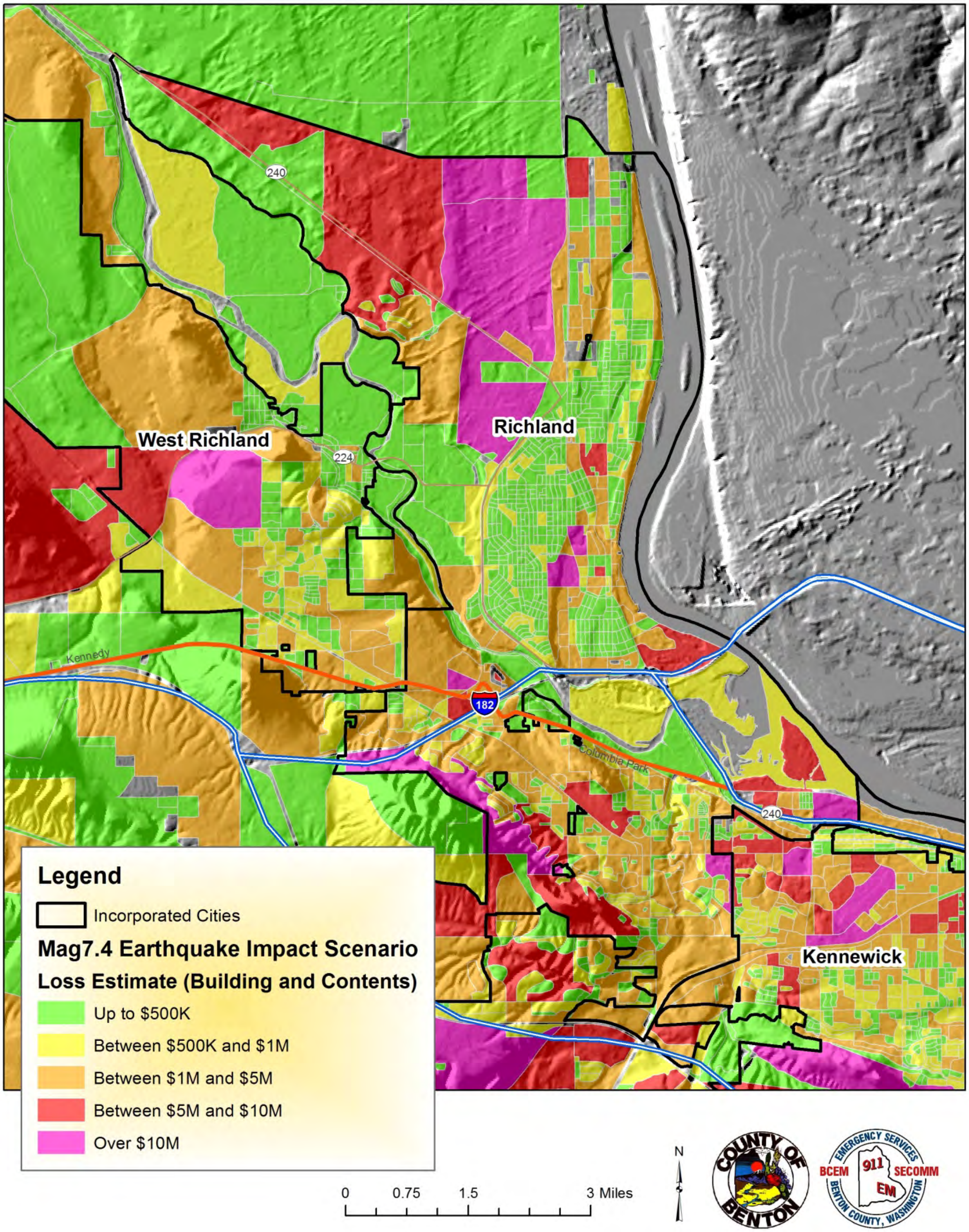


Figure 28) Mag 7.4 Earthquake impact scenario map for Richland, WA. The different colors represent potential financial losses (in dollars) for different parts of Richland.

Landslide Profile

Local Event History

Washington has a long history of landslides. Widespread landslides have historically occurred during large storm events (1983, 1996, 1997, 2007, and 2009) and earthquakes (1949, 1965 and 2001). Landslides can also move without large events and without warning, such as the Aldercrest-Banyon landslide in Cowlitz County, the Carlyon Beach/Hunters Point landslide in Thurston County, and the Nile Landslide in Yakima County. Landslides can also be caused by volcanoes, such as the debris avalanche of the Mt. St. Helens eruption of 1980 and subsequent lahars (volcanic debris flows).

In 1982 in Benton County, the construction of Interstate-82 between Prosser and Benton City at mile marker 92 reactivated a historical landslide causing between $10 and $15 million in damages. Most landslides in Benton County have occurred along the steep slopes of Interstate 82 and along the Columbia River west of Paterson, WA.

Probability of Future Occurrence

Most of Richland is at **LOW** risk for a landslide but there are areas that are considered to be high risk. As a result of steeper terrain and erosive soils, Badger Mountain and similar ridges are considered to be high risk for landslides or land movement.

Impacts of Landslide Events

Potential impacts that the City of Richland would experience in the case of a land movement event are comparable to those highlighted in the *Benton County Annex*. The biggest concerns for Richland are threats to human safety, disruptions to the local economy and infrastructure, and damages to personal and municipal property. Specifically, the homes and other structures located on the northeast slopes of the ridges in the Badger Mountain area are at a higher risk and may be damaged during a landslide or land movement event.

Development Trends

The population of Richland has increased over the previous decade and therefore much of the demand for development has increased. As a result, new homes are being constructed beyond the inner-city limits on slopes in the Badger Mountain area. Interest in those new neighborhoods has increased the amount of development taking place on landslide or land-movement prone slopes.

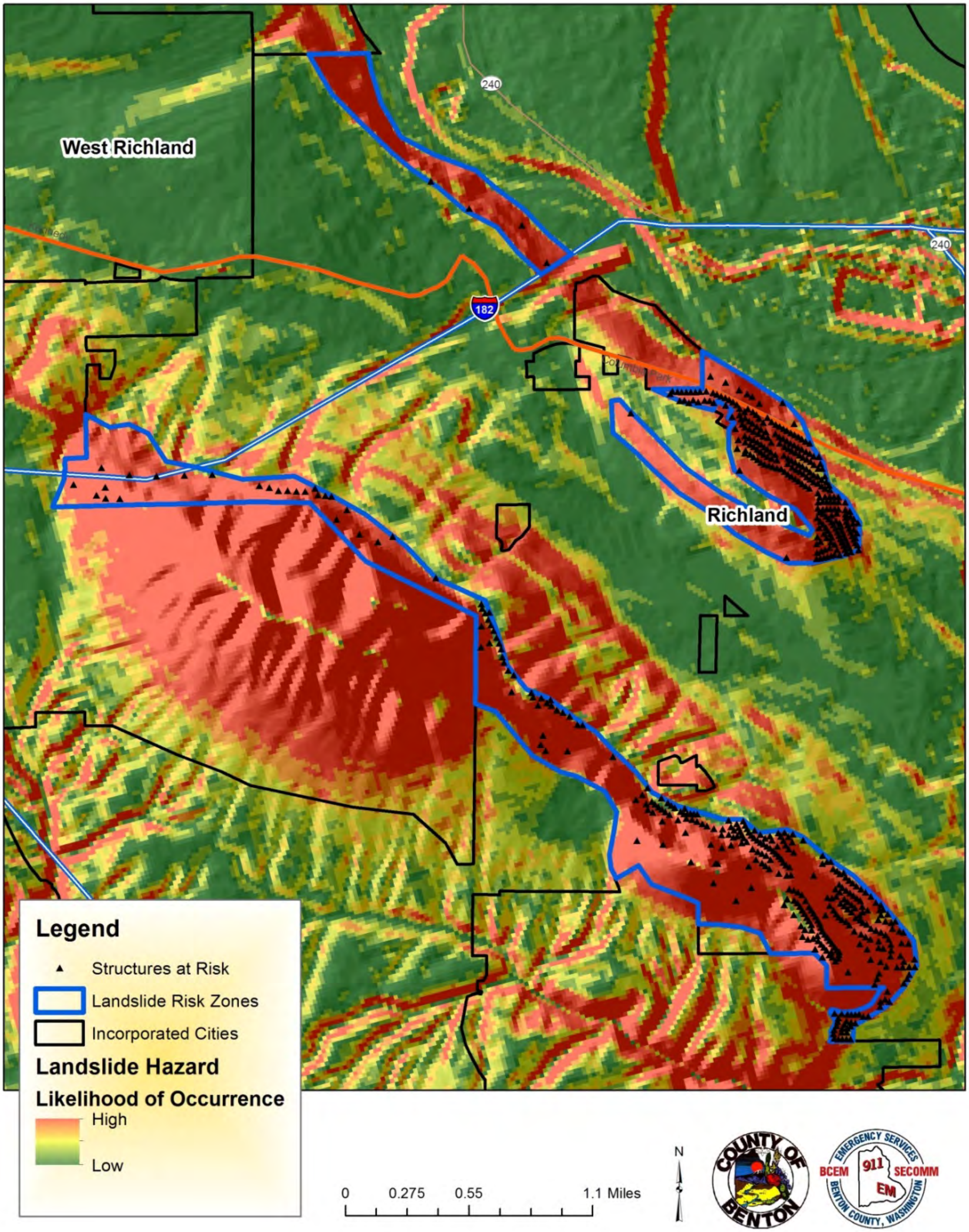


Figure 29) Structures at risk within landslide prone areas in Richland, WA.

Values of Resources at Risk

The values of resources at risk in and near Richland can be significant. Richland is a major component of the Tri-Cities metropolitan area, the industrial, economic, and political hub of Benton County. Because of the confluence of the Columbia and Snake rivers near Richland, the prolific agriculture industry, and neighboring industries, Richland contains substantial infrastructure, personal property, municipal facilities, and industrial facilities. In total, there are 610 structures in Richland that are in designated high-risk landslide zones (Table 39). The appraised value of these structures, 99% of which are residential, is just over $195 million.

Table 39) Number and value of appraised structures by type in designated high-risk landslide zones in Richland, WA.

Building Type	Number of Appraised Structures	Value of Appraised Structures
Agricultural	2	$894,970.00
Commercial	6	$1,404,180.00
Residential	602	$193,108,690.00
Total	**610**	**$195,407,840.00**

Volcano Profile

Richland does not differ from Benton County as a whole with regard to volcanic hazards.

Local Event History

Stretching from northern California into British Columbia, the Cascade Range of the Pacific Northwest has more than a dozen active volcanoes, most of which are capable of explosive eruptions. The volcanos that erupted most recently were Mount St. Helens (Washington, 1980–86 and 2004–8) and Lassen Peak (California, 1914–17). On May 18, 1980, after two months of earthquakes and minor eruptions, Mount St. Helens exploded in one of the most devastating volcanic eruptions of the 20th century. Although less than 0.1 cubic mile of molten rock (magma) was erupted, 57 people died, and damage exceeded $1 billion. Fortunately, most people in the area were able to evacuate safely before the eruption as public officials had been alerted to the danger by the U.S. Geological Survey (USGS) and other scientists who were monitoring volcanic activity in the region.

Probability of Future Occurrence

Because of the historical infrequency of such events, it is unlikely that we will see a volcanic eruption in our lifetimes. However, due to the prevailing winds within Benton County, the impacts of a major eruption from Mount Adams, Mount Hood or Mount Saint Helens to persons, property, infrastructure, and the environment in Benton County would be serious though not necessarily catastrophic. Therefore, there is a **LOW** probability of such an event occurring, but a **MODERATE** risk to persons, property, and the environment in Benton County should an eruption occur.

Impacts of Volcano Events

Refer to the *Benton County Annex* for volcano event impacts that would be expected to affect all jurisdictions in a similar manner. A volcanic eruption would likely be preceded or accompanied by seismic activity. Considering the fault connectivity noted by Blakely et al (2011), Richland could potentially experience local seismic activity which could produce landslides, flooding, ground cracking, and soil liquefaction.

Development Trends

The population of Richland has increased over the previous decade and therefore much of the demand for development has increased. There have been no changes in development that affect this jurisdiction's vulnerability regarding this hazard.

Values of Resources at Risk

It is difficult to estimate the value of resources at risk during a volcanic eruption. Costs associated with ash-related damage would likely depend on the duration of exposure and quantity of ash that settles within the municipality. Ash can collapse the roofs of buildings, impact water resources and infrastructure, clog vehicle engines, ground or damage airplanes, harm or kill livestock, crops, and other vegetation, and have adverse impacts on human and animal health. As indicated by the aftermath of the Mount St. Helens eruption in 1980, the damage caused by an eruption can total in the billions of dollars.

In addition to any kind of damage to infrastructure, there will be, depending on the volume of ash fall, high costs associated with clean-up efforts, the need for additional medical supplies, food and water, temporary shelter and transportation needs, and any other emergency supplies needed for both emergency responders and the general public.

City of Prosser Profile

The City of Prosser is located west of the Tri-Cities along Interstate 82 and covers approximately 4.49 square miles of land and 0.04 square miles of water. Prosser was first incorporated in 1899 and has served as the Benton County seat since the County's establishment in 1885. Prosser's estimated 2018 population was 6,125 (Table 41). The City is bisected by the Yakima River. Prosser serves as a local center supporting surrounding agricultural uses, including several area wineries, fruit orchards, pasture and dryland wheat fields. Within and adjacent to the City are several agricultural processing facilities and fertilizer plants. Prosser is governed by a Mayor and an elected City Council.

Table 40) Historic population of Prosser, WA

Census	Population	% Change
1900	229	
1910	1298	5%
1920	1697	31%
1930	1569	-8%
1940	1719	10%
1950	2636	53%
1960	2763	5%
1970	2954	7%
1980	3896	32%
1990	4476	15%
2000	4838	8%
2010	5714	18%

Capabilities Assessment

Mitigation capabilities are existing authorities, policies, programs, and resources that reduce hazard impacts or that could be used to implement hazard mitigation activities. Detailed Capabilities Assessments for Prosser can be found in Appendix B.

Development Trends

As part of the Growth Management Act, the Washington State Office of Financial Management (OFM) has provided Benton County with a population estimate for a period ending in the year 2025. For planning purposes, the countywide population estimate was distributed on an existing percentage basis to the various cities and unincorporated areas within Benton County. Prosser's official GMA population forecast is a total of 6,735 in the incorporated area by the year 2025. Current 2018 population estimate within the incorporated area is 6,125.

Prosser's Comprehensive Plan includes an analysis of available land use and capacity. It also provides an estimate of acres needed for development to accommodate the projected 2025 population. Overall, the Comprehensive Plan indicates that the City has insufficient land within current City limits to accommodate the land needs for the projected residential, commercial, and industrial growth. However, ample area exists in the Prosser Urban Growth Area (UGA) to accommodate the forecasted growth.

The Prosser Comprehensive Plan provides the following description of the Prosser UGA:

Northern Boundary: The area's northernmost border starts east of the Hogue Cellars Winery, incorporating the area between the railroad line and the Yakima River, then running west along the southern shore of the Yakima River. Once the boundary hits I82, it crosses the highway and continues northwest along the highway to the city limits, following the city limits to the channel or centerline of section 36, thence north to O.I.E., following OIE to Johnson road; following Johnson road to the Western Boundary.

Eastern Boundary: On its eastern border, the study area follows the existing City boundaries except for the area between I-82 and the Yakima River. Here, the UGA is expanded, including some of the area between I-82 and SR 22.

Southern Boundary: The UGA's southern boundary is the same as for the existing City limit boundary-except for a line that is the northern boundary of parcel 107850000000000 (which would be the easterly extension of Park Street) that connects the southern city limits, thereby including an unincorporated area south of Highway SR221.

Western Boundary: The western boundary runs along Missimer Road south to Buena Vista. The boundary then goes east to Moore Road, then south on Moore Road to the Yakima River. South of the Yakima River, the western boundary runs along the river to Richards Road, and then south to the southern boundary.

The Prosser Comprehensive Plan also identifies two additional areas which are particularly suitable for urban development and should be considered for inclusion in the UGA if necessary. These areas are both adjacent to Interstate 82 near the eastern portion of the City of Prosser.

Prosser Hazard Annex

Flood Profile

The City of Prosser does not have any differing levels of risk associated with this hazard than Benton County as a whole. However, Prosser's exposure to flooding will be different than that of Benton County as well as other jurisdictions within Benton County.

Local Event History

The City of Prosser is located close to the western edge of Benton County and is bisected by the Yakima River. Because of its proximity to the Yakima River, it is likely that Prosser was affected by many of the same flood events that affected Benton County, but given that Prosser is situated further from the Columbia and Snake Rivers, it is unclear if there were any impacts from floods associated with these two rivers (Table 41). Runoff from the slopes to the south of Prosser has also caused issues related to flooding. Run off from heavy precipitation and snow melt is channeled by steep slopes into certain of Prosser on the south side of the Yakima River.

Table 41) History of flood events that affected Benton County. Measurements were taken at Kiona.

Date	Flow (cfs)	Stage (ft)	Return Period (Yrs)	Comments
23-Dec-33	67000	21.57	167	Largest flood of record. Resulted in construction of extensive federal levee system in Yakima County.
17-Nov-06	66000	20.12	159	
17-Dec	53,800 at Prosser	18.5 est.		
11-Feb-96	49400	20.98	67	Benton County declared a federal disaster area (Note: crest may have reached up to 21.5 ft)
18-Jan-74	39700	18.56	36	Benton County declared a federal disaster area.
18-Nov-1896	38000	16.07	34	
30-May-48	37900	17.2	33	
13-Dec-21	35,800 at Parker			
17-Apr-04	32000	15.05	18	
26-Nov-09	30600	14.8	16	
23-Mar-10	29200	14.53	14	
6-Dec-75	28300	16.52	13	
28-Dec-80	27600	16.27	12	
4-Dec-77	27000	16.11	11	Benton County declared a federal disaster area.
3-Mar-01	26400	14	10	
14-Jun-03	26400	14	10	
2-Dec-95	26300	15.87	9	Benton County declared a federal disaster area.
10-Jan-09	25400	15.55		Benton County declared a federal disaster area.
16-Jun-16	24,800 at Parker			
17-Feb-1898	23100	13.27	7	
27-Nov-90	22600	14.36	7	Benton County declared a federal disaster area.

1-Feb-65	22400	13.76	6	
22-Feb-82	22200	14.42	6	
5-Jun-13	20900	13.1	5	
13-Feb-51	20900	12.99	5	
23-Jan-19	20,600 at Parker			
15-Mar-72	20200	13.57	5	
22-May-56	20100	12.73	5	
18-Feb-17	7340	7.85		Flooding was a result of snow melt. Benton County declared a federal disaster area.

Probability of Future Occurrence

Prosser has flooding potential due to its proximity to the Yakima River. Flood-potential has been greatly reduced with the construction of dams along major waterways but some potential still exists, particularly from the Yakima River. Because the Yakima River boarders the city, Prosser has a **MODERATE** to **HIGH** probability of flooding as the Yakima River isn't as large as the Columbia River and does not have the same number of dams or means of control in place. Because of the values and services Prosser offers to surrounding communities, a flood event carries a **MODERATE** risk.

The Prosser Flood Map (Figure 30) shows that all structures that are susceptible to flooding fall within flood zones A and AE (Table 43). This means there is a 1% chance that structures will be subjected to flood conditions annually and a 26% chance that they will be subjected to flood conditions over the life of a 30-year mortgage. However, no analysis has been performed in areas designated as Flood Zone A, so depth of potential flooding is unknown.

Impacts of Flood Events

Potential impacts caused by flooding in Prosser include increased landslide risk, damage to infrastructure or roads, and damage to personal property. Structures located adjacent to the Yakima River will likely be impacted the most. Refer to Benton County Annex for additional information.

Development Trends

As both population and demand for development are projected to increase for the City of Prosser, it should be expected that Prosser, over time, will have more infrastructure at risk during a flood event. Land use planning and adherence to building codes in flood sensitive areas should help reduce the amount of infrastructure at risk during a flood event.

Value of Resources at Risk

Looking at the flood map for Prosser (Figure 30) damage from flooding would be a result of a Yakima River flood event. In total the City of Prosser has 6 structures, none of which are government owned, in designated flood zones that are currently appraised at $879,740.00 (Table 42). All structures are located in flood zone A (Table 43) which means there is a 26% chance that they will flood over the life of a 30-year mortgage. However, no analysis has been performed in areas designated as Flood Zone A, so depth of potential flooding is unknown.

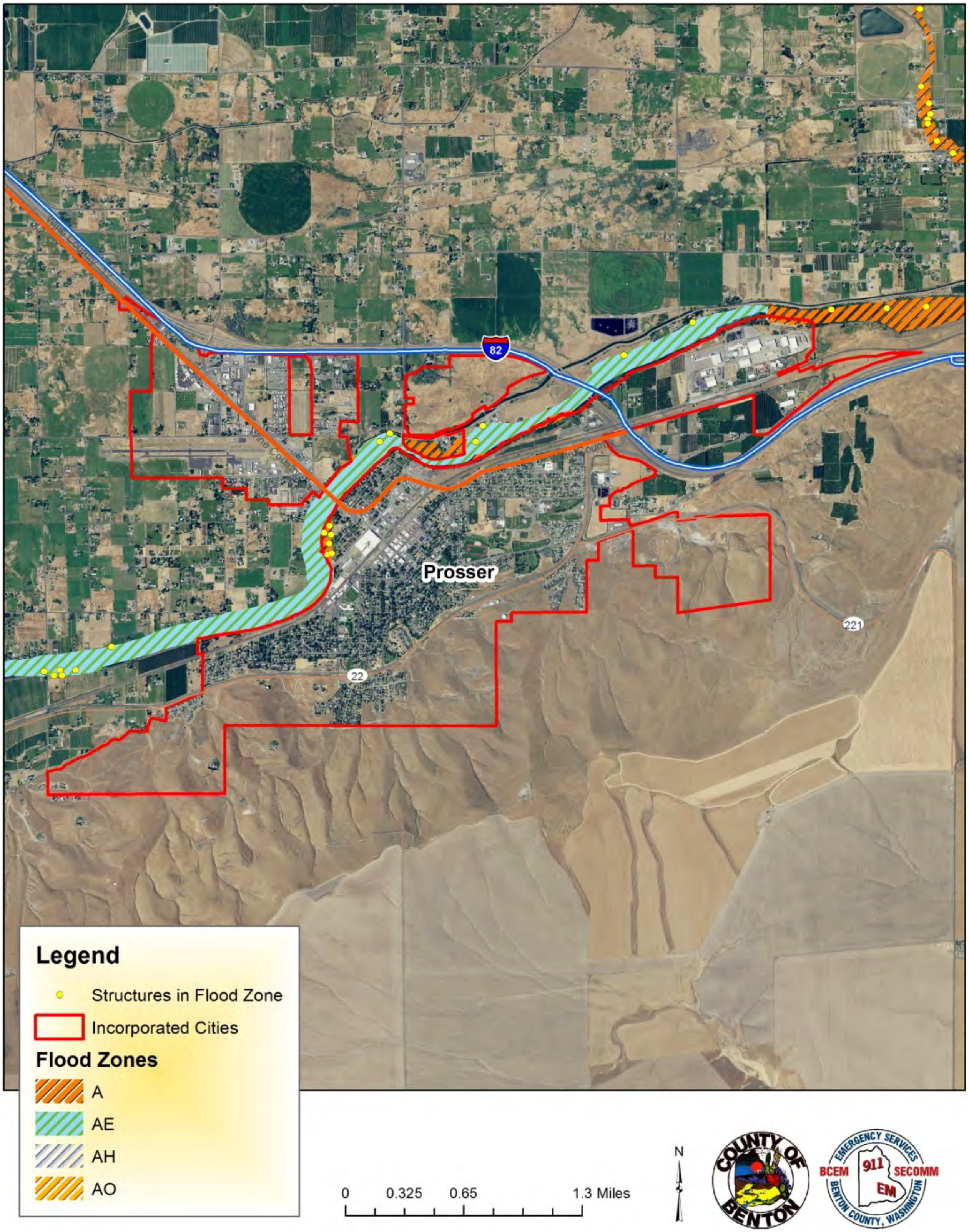


Figure 30) National Flood Insurance Program flood zone map for Prosser, WA.

Table 42) Total number and value of appraised structures in designated flood zones in Prosser, WA (includes only incorporated structures).

Flood Zone	Appraised Structures	Value of Appraised Structures
A	6	$ 879,740.00
Total	**6**	**$ 879,740.00**

Table 43) National Flood Insurance Program (NFIP) flood zone categories and descriptions.

ZONE	DESCRIPTION
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.

Drought Profile

Local Event History

Through analysis of 100-year drought data (1895-1995), the EHMP reports that most of Washington State was in severe or extreme drought at least 5% of the time during that period. Prosser experienced severe or extreme drought 20-30% of the time during that 100 years. During the severe drought event that occurred in 2005, the Governor of Washington requested agricultural disaster designations from the U.S. Secretary of Agriculture because of significant crop damage from drought. Benton County was one of the 15 counties that were included in the disaster request.

Probability of Future Occurrence

Prosser does not differ from the rest of Benton County regarding future drought probability. It is reasonable to anticipate drought in 20 to 30 out of the next 100 years, resulting in a **MODERATE** probability rating. Because the population relies heavily on agriculture, and support industries tied to agriculture, there is a **MODERATE** risk associated with drought.

Impacts of Drought Events

Under drought conditions in the City of Prosser, the agriculture industry would be most heavily impacted. Irrigation supporting the agriculture industry depends on steady water flow in the Yakima, Columbia, and Snake Rivers. Drought impacts to agriculture would potentially harm Prosser's local economy.

Drought also increases the threat of wildfire ignition and spread by accelerating depletion of soil and vegetation moisture and by reducing water available for fire suppression. The expanding WUI around Prosser would be at increased risk for severe wildfire under drought conditions during the late summer and early fall. Additionally, the I-82/US 12 corridor has a history of and is at a higher risk of wildfire than surrounding areas. Drought would only increase the risk of wildfire on the steep slopes just south of Prosser.

Development Trends

As both population and demand for development are expected to increase, the City of Prosser should expect an increase in water usage making it more sensitive to drought conditions. Even though the increase in water usage in Prosser will be minimal due to its smaller size, it will likely have to implement water conservation practices earlier during a period of drought; particularly as larger neighboring communities place additional stress on water supplies. Increased wildfire risk associated with drought conditions will also make new development more vulnerable to wildfire, especially new housing on the slopes of the Horse Heaven Hills.

Value of Resources at Risk

The agriculture industry represents the most at-risk values to the City of Prosser in the case of a severe drought. Those values are discussed in detail in the Drought Profile within the Benton County Annex. The City of Prosser would be especially affected by impacts to these values because of the number of people relying on the local economy, directly or indirectly, for their own income.

Wildfire Profile

For a complete analysis of the wildfire hazard in Benton County, refer to the Wildfire Hazards section in Chapter 3. The information in that section is a complete excerpt of chapter 4 of the Benton County Community Wildfire Protection Plan which is why it is presented in the same section of this plan.

Local Event History

The City of Prosser has been directly impacted by several large-scale wildfires in the past, including the Ward Gap fire that occurred in 2016 and the Montecito fire that occurred in 2018. ***Table 3 in the wildfire section of chapter 3 shows wildland fires 300 acres in size or larger that occurred in Benton County since 1981.*** Since 1980 the city has had wildfire within the southwest corner of the incorporated area on the north facing slopes of Horse Heaven Hills (see Figure 2, wildfire hazard profile). There have been other fires on the same slopes of the Horse Heaven Hills further east along the I-82/US 12 corridor.

Probability of Future Occurrence

There is a **HIGH** probability of fire ignitions in the city, particularly on the south side of highway 22 on the slopes of the Horse Heaven Hills. These ignitions are unlikely to result in large areas burned due to the availability of rapid response, but there is potential for fire to make a run upslope and into the dry agricultural areas of the Horse Heaven Hills. Property that suffers damage due to wildfire could potentially harm the local agriculture industry or support industries. There is, therefore, a **HIGH** risk associated with wildfire in Prosser.

Impacts of Wildfire

The Yakima River bisects the City of Prosser; the part of the city on the north side of the river is interfaced with agriculture while the portion on the south side of the river, particularly the fringe along highway 22, more closely resembles WUI conditions. As the slopes of the Horse Heaven Hills have burned in the past, another wildfire in that area could have significant impacts on homes and other structures along the highway 22 corridor. The overall impacts to the area that were discussed in the *Benton County Annex* are comparable to the potential impacts that a wildfire event would have on Prosser.

Refer to the wildfire section in chapter 3 for information about specific fire protection issues in Benton County.

Development Trends

As both population and demand for development are projected to increase for the City of Prosser, it should be expected that Prosser, over time, will have more infrastructure at risk during a wildfire event. Land use planning, adherence to Firewise or other community wildfire standards in WUI areas, and fire-resistant construction should help reduce the amount of infrastructure at risk during a wildfire event.

Refer to the wildfire section in chapter 3 for information about the wildland urban interface in Benton County and the specific risks associated with additional expansion.

Value of Resources at Risk

Because it is a smaller community, the values of at-risk resources in and around Prosser are not as high as some of the larger cities. In addition to being smaller in size, the incorporated area is concentrated and there are only a few small neighborhoods on the south end of town that "sprawl" out and resemble WUI conditions. Aside from the businesses located throughout the city, agriculture is an important part of Prosser's economy. Prosser is also likely to be the home of a number of people that work in the tri-cities area.

Refer to the wildfire section in chapter 3 for relative threat level mapping information for Benton County and specifics about high-value resources at risk.

Severe Weather Profile

The City of Prosser does not have any differing levels of risk associated with this hazard than Benton County as a whole.

Local Event History

Severe storms, especially severe wind storms are common in Benton County during the spring and fall months and all areas of Benton County are vulnerable to the impacts of severe storms. Severe wind storms that occur in the Columbia River Basin routinely have wind speeds that can reach 60 mph but some storms, including winter storms, are capable of even greater wind speeds:

- During a five-day windstorm event in January 1972, wind speeds (gusts) up to 150 mph were recorded on Rattlesnake Mountain. In Toppenish (Yakima County), the windstorm leveled buildings, tore off roofs, and overturned trailers. It is estimated that the storm caused $250,000 in damages (1972 dollars) in Benton County alone.
- In a January 1990 windstorm, wind gusts up to 81 mph were recorded causing an estimated $3,000,000 in damages.
- In the winter of 1996-1997, Benton County experienced a massive storm that brought heavy snow accumulation, high winds and rain and led to a FEMA Disaster Declaration.
- Severe windstorms were also experienced in December 1995 and December 2001, causing damage to roofs, trees, and other property.
- In 2006 a windstorm affected all 39 counties in Washington, causing $50 million in damage statewide.

The most recent severe storm event was in February 2017. Heavy snow and rain caused flooding and eventually led to a FEMA Major Disaster Declaration.

Probability of Future Occurrence

Regionally, severe storms are expected to occur regularly resulting in a **HIGH** probability. Therefore, Prosser can anticipate at least one severe storm each year and very likely multiple storms. Disaster events caused by severe storms are not expected to happen as regularly but predicting when and what events will occur is not possible. Severe storms pose a **MODERATE** risk to Prosser.

Impacts of Severe Weather Events

As mentioned above, impacts from severe storms often manifest in the form of another hazard type, such as flooding, landslides, and lightning-caused wildfire. Windstorms can greatly affect Prosser, possibly impacting power sources or causing debris hazards. Unexpected or unusually heavy snowstorms can also have a major impact on Prosser if outside resources or emergency resources are needed. Residents that commute to the tri-cities area may also encounter problems going to and from their homes. Disruption to transportation could put lives at risk.

Development Trends

The population of Prosser has increased over the previous decade and therefore much of the demand for development has increased. There have been no changes in development that affect this jurisdiction's vulnerability regarding this hazard.

Value of Resources at Risk

Because it is a smaller community, the values of at-risk resources in and around Prosser are not as high as some of the larger cities. Even though it is smaller, Prosser serves as a local center supporting surrounding agricultural uses, wineries, fruit orchards, pasture, and dryland wheat fields. A severe weather event in Prosser could have detrimental effects on crop yield and agricultural production.

It is difficult to estimate potential losses in Prosser due to severe weather. Construction throughout the County has been implemented in the presence of high wind events, and with typical levels of snow accumulation in mind and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

Earthquake Profile

Local Event History

Because of its location near the collision boundary of two major tectonic plates, Washington State is particularly vulnerable to a variety of earthquakes. FEMA has determined that Washington State ranks second (behind only California) among states most susceptible to damaging earthquakes in terms of economic loss. FEMA notes that a majority of the state is at risk to strong shaking (on a scale of minimal to strong) with shaking magnitude generally decreasing from west to east.

The Washington coast and the greater Puget Sound Basin are most at risk although damaging earthquakes have occurred east of the Cascades. The Puget Sound basin had damaging earthquakes in 1909, 1939, 1946, 1949, 1965, and 2001. Eastern Washington had large earthquakes in 1872 near Lake Chelan and in 1936 near Walla Walla. The 1872 earthquake near Lake Chelan was the states most widely felt shallow earthquake. The magnitude for this event has been estimated at 7.4. The 1936 magnitude 6.1 earthquake near Walla Walla was also a shallow event. Because of their remote locations damage was light from these two quakes. Ground shaking from historic earthquakes in Washington and the western U.S. has been noted in Benton County, and has resulted in only minor damage in several events.

The EHMP examines two significant earthquake events near Benton County that have occurred since 1872:

Lake Chelan Earthquake– December 14, 1872

Likely originating northeast of Chelan, WA, the magnitude 6.8 (est.) Chelan Earthquake was felt from British Columbia to Oregon and from the Pacific Ocean to Montana. At the time there were few man-made structures in the epicenter area near Lake Chelan so most of the regional impacts were ground affects. Observed after the earthquake were huge landslides, massive fissures in the ground, and a 27-foot high geyser. Extensive landslides occurred in the slide-prone shorelines of the Columbia River. One massive slide, at Ribbon Cliff between Entiat and Winesap, blocked the Columbia River for several hours. In addition to the Columbia River shoreline, landslides also occurred throughout the Cascade Mountains.

As of 2014 geologists had begun the process of interpreting a large amount of evidence that they suspect will indicate the exact location of the epicenter of the 1872 earthquake. As of the update of this plan, the study is still in progress, but some researchers believe the epicenter is located in Spencer Canyon, near Orondo, WA but this is yet to be confirmed. Determining the exact location of the epicenter is important as the fault is capable of producing another large earthquake in the future. Knowing where an earthquake may occur will help researchers predict the potential impacts it could have on nearby communities and help them prepare.

Milton-Freewater Earthquake – July 15, 1936

The earthquake, magnitude 6.1, occurred at 11:05 a.m. The epicenter was about 5 miles south-southeast of Walla Walla. It was widely felt through Oregon, Washington and northern Idaho, with the greatest shaking occurring in northeast Oregon. Property damage was estimated at $100,000 (in 1936 dollars) in, what was at the time, a sparsely populated area.

In recent years, geologists have attempted to find the exact location of the epicenter of the Milton-Freewater earthquake. As of the update of this plan, geologists are attempting to determine exactly which fault was the source of the quake as it could either have occurred on the RAW or on the Hite fault. The location of the epicenter has implications for impacts of any future earthquakes occurring along the same fault and the way that communities prepare for such event. The results are expected to be available in the near future.

Probability of Future Occurrence

Because of the infrequency of such devastating events, there is a **MODERATE** probability for a potentially damaging earthquake to occur that would result in many people being injured or killed and damaging private property, government infrastructure and the local economy. However, there is a **HIGH** risk to the citizens, infrastructure, and economy of Prosser should such an earthquake occur.

Impacts of Earthquakes

An in-depth examination of the impacts that an earthquake event might have on the area can be found in the *Benton County Annex*. The impacts discussed are comparable to the potential impacts specific to the City of Prosser.

Considering Prosser's proximity to the Yakima River, there is a risk for flooding should an upstream dam fail as the result of an earthquake. Please refer to the *Benton County Annex* for more information about Columbia River dams and Dworshak Dam. The study by Sherrod et al (2016) supports that a fault (part of the Wallula fault zone) capable of producing earthquakes passes through the City of Kennewick, close to Trios Hospital and Southridge High School and is indicated by the upheaval that created the Thompson Hill, Badger Mountain, Red Mountain, and Rattlesnake Mountain "ridge". A fault located nearby to the northeast has the potential to cause significant damage to infrastructure and would place the general populous of Prosser.

Development Trends

The population of Prosser has increased over the previous decade and therefore much of the demand for development has increased. With additional development and infrastructure, Prosser will become more vulnerable to Earthquake hazards. However, the impacts of an earthquake should be minimized through land use planning and seismically-sound structural designs.

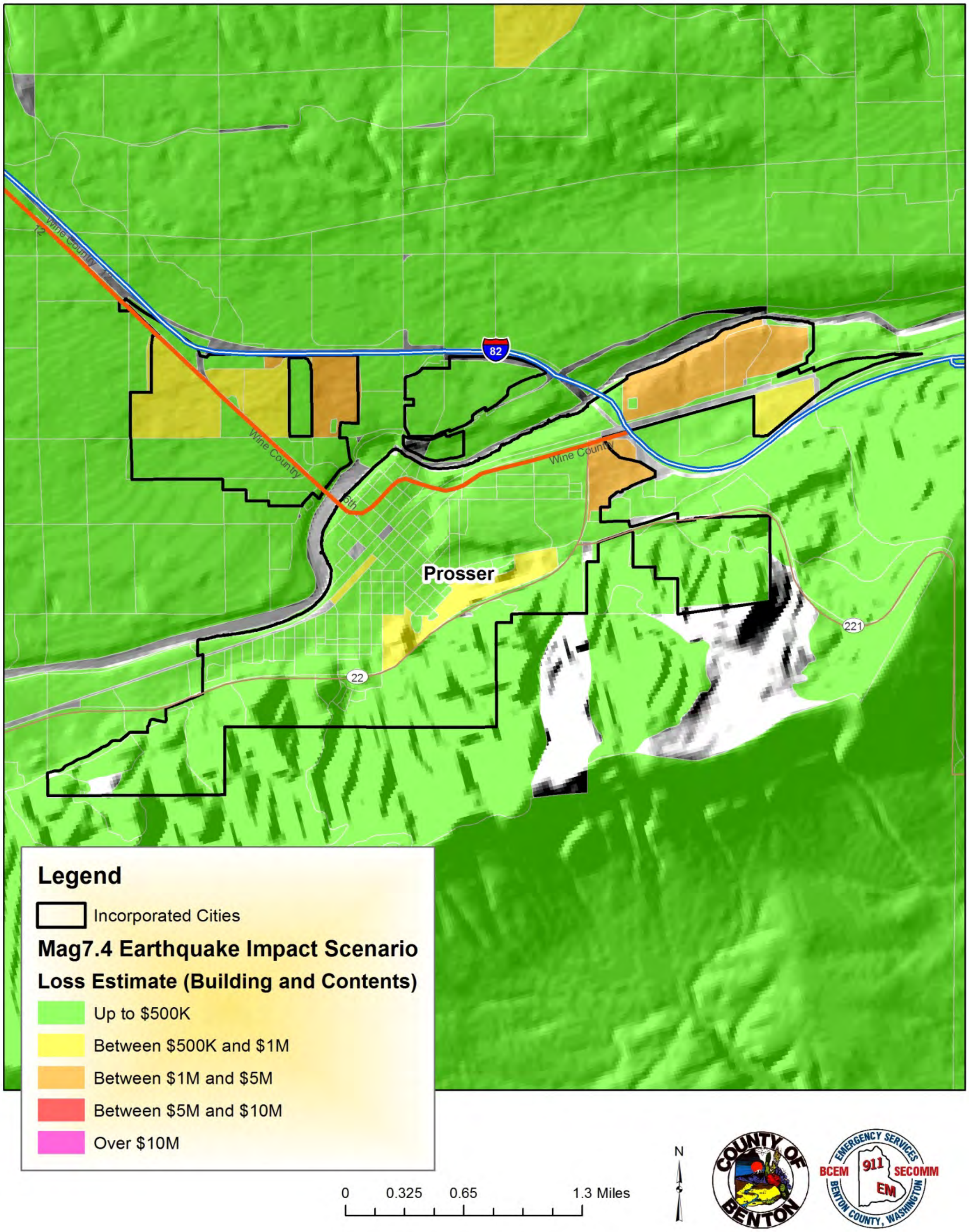


Figure 31) Mag 7.4 Earthquake impact scenario map for Prosser, WA. The different colors represent potential financial losses (in dollars) for different parts of Prosser.

Value of Resources at Risk

According to the Washington Earthquake Risk Assessment, earthquakes resulting from fault movement in or near Benton County could cause approximately $2.4 to 27 million in damages to the City of Prosser (Table 44). Of the 2,161 structures that were included in the different analyses, up to 61 structures were lost in the Horse Heaven Hills Fault scenario totaling more than $26 million in damages. Figure 31 shows the areas of Prosser that are likely to experience the greatest losses in dollars.

Table 44) Washington Earthquake Risk Assessment HAZUS Earthquake scenarios for Prosser, WA. Total number of structures and total value of structures used in the analyses are included below the table.

City of Prosser Earthquake Scenarios	Total Loss Value (Building and Contents)	Total Loss Ratio (Building and Contents)
M7.4 Saddle Mountain Fault	$2,471,654	0.3%
M7.4 Rattlesnake Wallula Fault	$25,288,039	2.6%
M7.1 Horse Heaven Hills Fault	$26,742,393	2.8%
HAZUS Analysis (Earthquake Loss Ratio >= 10%)	**Number of Structures**	**Percent of Total Structures**
Hazus Earthquake Summary	3	0.1%
Total number of structures identified in analyses:		2,161
Total value of all structures and structure content:		$963,913,630

Landslide Profile

Local Event History

Washington has a long history of landslides. Widespread landslides have historically occurred during large storm events (1983, 1996, 1997, 2007, and 2009) and earthquakes (1949, 1965 and 2001). Landslides can also move without large events and without warning, such as the Aldercrest-Banyon landslide in Cowlitz County, the Carlyon Beach/Hunters Point landslide in Thurston County, and the Nile Landslide in Yakima County. Landslides can also be caused by volcanoes, such as the debris avalanche of the Mt. St. Helens eruption of 1980 and subsequent lahars (volcanic debris flows).

In 1982 in Benton County, the construction of Interstate-82 between Prosser and Benton City at mile marker 92 reactivated a historical landslide causing between $10 and $15 million in damages. Most landslides in Benton County have occurred along the steep slopes of Interstate 82 and along the Columbia River west of Paterson, WA.

Probability of Future Occurrence

The northern portions of Prosser are at **LOW** risk for a landslide. However, as a result of steeper terrain and erosive soils that are characteristic of the slopes of Horse heaven Hills, most of the southern edge of the city is at high risk. Refer to Figure 32 below, which shows critical and landslide prone areas in and near Prosser.

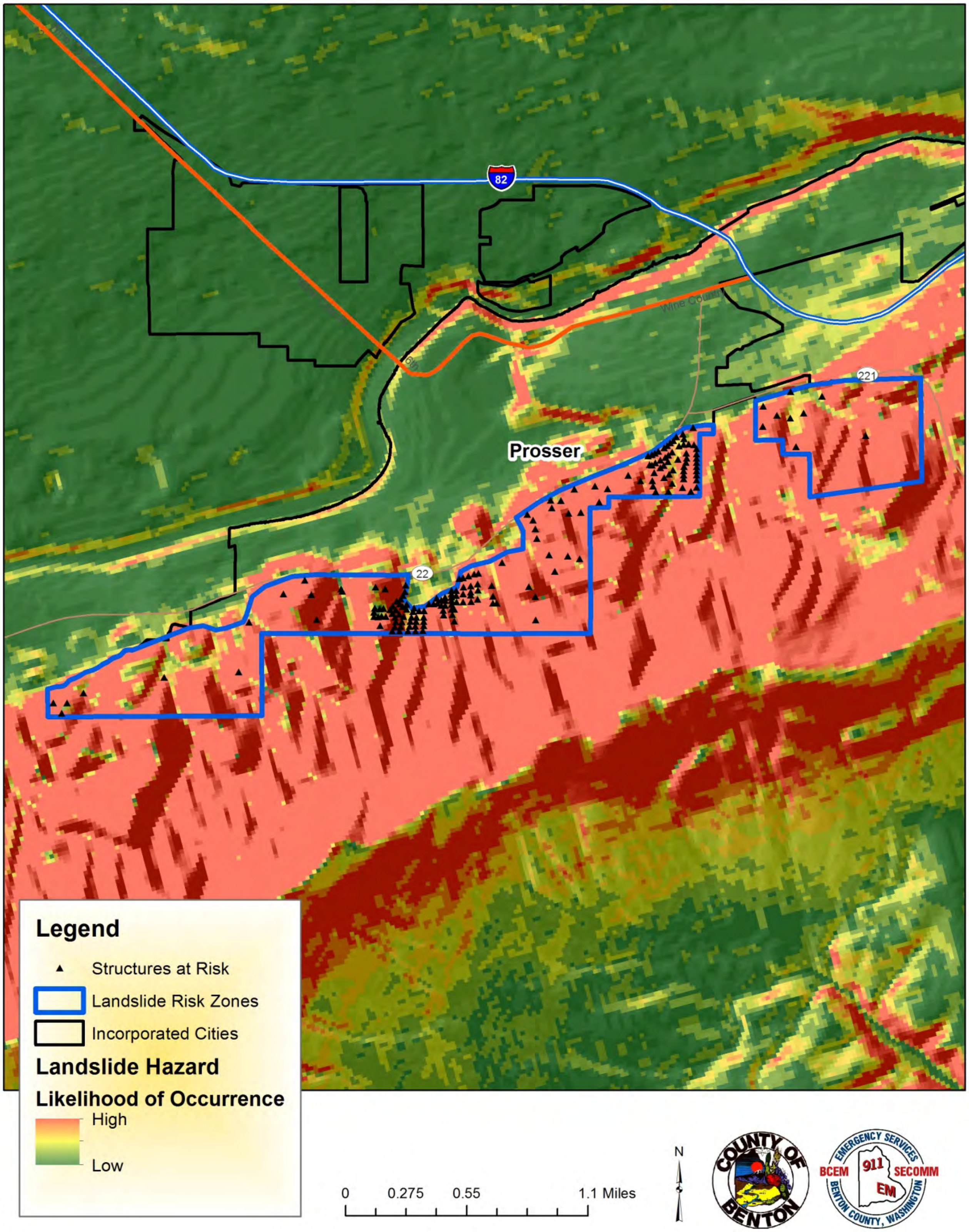


Figure 32) Structures at risk within landslide prone areas in Prosser, WA.

Impacts of Landslide Events

Potential impacts that the City of Prosser would experience in the case of a land movement event are comparable to those highlighted in the *Benton County Annex*. The biggest concerns for Prosser are threats to human safety, disruptions to the local economy and infrastructure, and damages to personal and municipal property. Since most of the structures that are located in high risk areas are residential, damage to homes would be the most likely impact of a landslide or land movement event in Prosser.

Development Trends

The population of Prosser has increased over the previous decade and therefore much of the demand for development has increased. As a result, new homes are being constructed on the south side of Prosser on the toe of the Horse Heaven Hills slopes which have been designated as high risk for landslides or land movement. Interest in those new neighborhoods has increased the amount of development taking place on landslide or land-movement prone slopes.

Values of Resources at Risk

In total, there are 190 structures in Prosser that are in designated high-risk landslide zones (Table 45). The appraised value of these structures, 96% of which are residential, is just under $34 million.

Table 45) Number and value of appraised structures by type in designated high-risk landslide zones in Prosser, WA.

Building Type	Number of Appraised Structures	Value of Appraised Structures
Commercial	8	$775,430.00
Residential	182	$34,150,020.00
Total	**190**	**$34,925,450.00**

Volcano Profile

Prosser does not differ from Benton County as a whole with regard to volcanic hazards.

Local Event History

Stretching from northern California into British Columbia, the Cascade Range of the Pacific Northwest has more than a dozen active volcanoes, most of which are capable of explosive eruptions. The volcanos that erupted most recently were Mount St. Helens (Washington, 1980–86 and 2004–8) and Lassen Peak (California, 1914–17). On May 18, 1980, after two months of earthquakes and minor eruptions, Mount St. Helens exploded in one of the most devastating volcanic eruptions of the 20th century. Although less than 0.1 cubic mile of molten rock (magma) was erupted, 57 people died, and damage exceeded $1 billion. Fortunately, most people in the area were able to evacuate safely before the eruption as public officials had been alerted to the danger by the U.S. Geological Survey (USGS) and other scientists who were monitoring volcanic activity in the region.

Probability of Future Occurrence

Because of the historical infrequency of such events, it is unlikely that we will see a volcanic eruption in our lifetimes. However, due to the prevailing winds within Benton County, the impacts of a major eruption from Mount Adams, Mount Hood or Mount Saint Helens to persons, property, infrastructure, and the environment in Benton County would be serious though not necessarily catastrophic. Therefore, there is a **LOW** probability of such an event occurring, but a **MODERATE** risk to persons, property, and the environment in Benton County should an eruption occur.

Impacts of Volcano Events

Refer to the *Benton County Annex* for volcano event impacts that would be expected to affect all jurisdictions in a similar manner. A volcanic eruption would likely be preceded or accompanied by seismic activity. Considering the fault connectivity noted by Blakely et al (2011), Prosser could potentially experience local seismic activity which could produce landslides, flooding, ground cracking, and soil liquefaction.

Development Trends

The population of Prosser has increased over the previous decade and therefore much of the demand for development has increased. There have been no changes in development that affect this jurisdiction's vulnerability regarding this hazard.

Values of Resources at Risk

It is difficult to estimate the value of resources at risk during a volcanic eruption. Costs associated with ash-related damage would likely depend on the duration of exposure and quantity of ash that settles within the municipality. Ash can collapse the roofs of buildings, impact water resources and infrastructure, clog vehicle engines, ground or damage airplanes, harm or kill livestock, crops, and other vegetation, and have adverse impacts on human and animal health. As indicated by the aftermath of the Mount St. Helens eruption in 1980, the damage caused by an eruption can total in the billions of dollars.

In addition to any kind of damage to infrastructure, there will be, depending on the volume of ash fall, high costs associated with clean-up efforts, the need for additional medical supplies, food and water, temporary shelter and transportation needs, and any other emergency supplies needed for both emergency responders and the general public.

City of West Richland Profile

The City of West Richland is located west of Richland between Interstate 82 and State Highway 240. West Richland principally serves as a bedroom community for the Tri-Cities area. The area now considered West Richland was developed in the 1950s as residents moved across the Yakima River to avoid government restrictions on the community of Richland, which was federally owned between 1942 and 1958. The City's estimated 2018 population was 15,320. The City encompasses 21.92 square miles of land and 0.20 square miles of water. A single owner, the Lewis and Clark Ranch, holds almost 8,000 acres of the undeveloped land in West Richland. West Richland is governed by a Mayor and an elected City Council.

Table 46) Historic population of West Richland, WA

Census	Population	% Change
1960	1347	
1970	1107	-18%
1980	2938	165%
1990	4003	36%
2000	8315	108%
2010	11811	42%

Capabilities Assessment

Mitigation capabilities are existing authorities, policies, programs, and resources that reduce hazard impacts or that could be used to implement hazard mitigation activities. Detailed Capabilities Assessments for West Richland can be found in Appendix B.

Development Trends

As part of the Growth Management Act, the Washington State Office of Financial Management (OFM) has provided Benton County with a population estimate for a period ending in the year 2037. For planning purposes, the countywide population estimate was distributed on an existing percentage basis to the various cities and unincorporated areas within Benton County. West Richland's official population forecast is a total of 22,409 in the incorporated area by the year 2037. Current 2018 population estimate within the incorporated area is 15,320.

West Richland's Comprehensive Plan includes an analysis of available land use and capacity. It also provides an estimate of acres needed for development to accommodate the projected 2037 population. Overall, the Comprehensive Plan indicates that the City has more than sufficient land within its current UGA to accommodate the land needs for the projected residential, commercial, and industrial growth.

The City of West Richland is unique in that the physical size of the city limits greatly exceeds that which is necessary to support the population as about half of the City, by size, is currently used for agricultural production and does not include urban services. As a result, West Richland's UGA is small, only encompassing 67 acres not already included within City limits. This UGA includes several small parcels located near the southern and southwestern City limits.

West Richland Hazard Annex

Flood Profile

The City of West Richland does not have any differing levels of risk associated with this hazard than Benton County as a whole. However, West Richland's exposure to flooding will be different than that of Benton County as well as other jurisdictions within Benton County.

Local Event History

West Richland is bordered by the Yakima River; almost half of the perimeter of the incorporated area follows the contour of the Yakima River. Because of its proximity to the Yakima River, it is likely that West Richland was affected by many of the same flood events that affected Benton County, but given that West Richland is situated further back from the Columbia and Snake Rivers, it is unclear if there were any impacts from floods associated with these two rivers (Table 47).

Table 47) History of flood events that affected Benton County. Measurements were taken at Kiona.

Date	Flow (cfs)	Stage (ft)	Return Period (Yrs)	Comments
23-Dec-33	67000	21.57	167	Largest flood of record. Resulted in construction of extensive federal levee system in Yakima County.
17-Nov-06	66000	20.12	159	
17-Dec	53,800 at Prosser	18.5 est.		
11-Feb-96	49400	20.98	67	Benton County declared a federal disaster area (Note: crest may have reached up to 21.5 ft)
18-Jan-74	39700	18.56	36	Benton County declared a federal disaster area.
18-Nov-1896	38000	16.07	34	
30-May-48	37900	17.2	33	
13-Dec-21	35,800 at Parker			
17-Apr-04	32000	15.05	18	
26-Nov-09	30600	14.8	16	
23-Mar-10	29200	14.53	14	
6-Dec-75	28300	16.52	13	
28-Dec-80	27600	16.27	12	
4-Dec-77	27000	16.11	11	Benton County declared a federal disaster area.
3-Mar-01	26400	14	10	
14-Jun-03	26400	14	10	
2-Dec-95	26300	15.87	9	Benton County declared a federal disaster area.
10-Jan-09	25400	15.55		Benton County declared a federal disaster area.
16-Jun-16	24,800 at Parker			
17-Feb-1898	23100	13.27	7	
27-Nov-90	22600	14.36	7	Benton County declared a federal disaster area.
1-Feb-65	22400	13.76	6	
22-Feb-82	22200	14.42	6	

5-Jun-13	20900	13.1	5	
13-Feb-51	20900	12.99	5	
23-Jan-19	20,600 at Parker			
15-Mar-72	20200	13.57	5	
22-May-56	20100	12.73	5	
18-Feb-17	7340	7.85		Flooding was a result of snow melt. Benton County declared a federal disaster area.

Probability of Future Occurrence

West Richland has flooding potential due to its proximity to the Yakima and Columbia Rivers. Flooding threat has been greatly reduced with the implementation of dams along these rives but some potential still exists, particularly from the Yakima River. Because the Yakima River boarders the city, West Richland has a **MODERATE** to **HIGH** probability of flooding as the Yakima River isn't as large as the Columbia River and does not have the same number of Dams or means of control in place. Due to the centrally-located, highly-valuable resources in West Richland, a flood event carries a **MODERATE** risk.

The West Richland Flood Map (Figure 33) shows that all structures that are susceptible to flooding fall within flood zones A and AE (Table 48). This means there is a 1% chance that structures will be subjected to flood conditions annually and a 26% chance that they will be subjected to flood conditions over the life of a 30-year mortgage. However, no analysis has been performed in areas designated as Flood Zone A, so depth of potential flooding is unknown.

Table 48) National Flood Insurance Program (NFIP) flood zone categories and descriptions.

ZONE	DESCRIPTION
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26%

	chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.

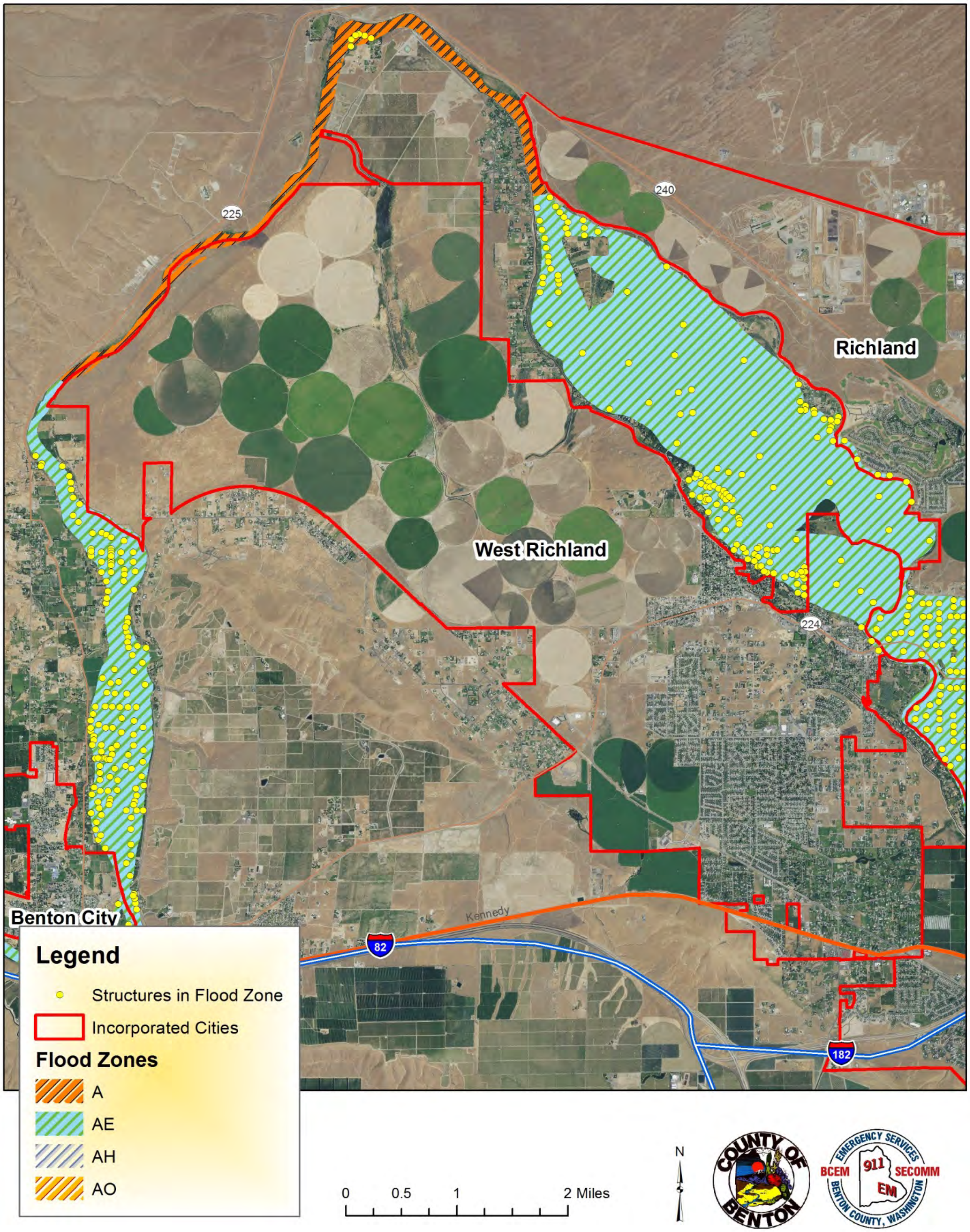


Figure 33) National Flood Insurance Program flood zone map for West Richland, WA.

Impacts of Flood Events

Potential impacts caused by flooding in West Richland include increased landslide risk, damage to infrastructure or roads, and damage to personal property. Structures located adjacent to the Yakima River will likely be impacted the most. Refer to Benton County Annex for additional information.

Development Trends

As both population and demand for development are projected to steadily increase for the City of West Richland, it should be expected that West Richland, over time, will have more infrastructure at risk during a flood event. Land use planning and adherence to building codes in flood sensitive areas should help reduce the amount of infrastructure at risk during a flood event.

Value of Resources at Risk

Looking at the flood map for West Richland (Figure 33), damage from flooding would be a result of a Yakima River flood event. In total the City of West Richland has 8 structures, none of which are government owned, in designated flood zones that are currently appraised at more than $2.2 million (Table 49). All structures that are susceptible to flooding fall within flood zones A and AE (Table 47). This means there is a 1% chance that structures will be subjected to flood conditions annually and a 26% chance that they will be subjected to flood conditions over the life of a 30-year mortgage. However, no analysis has been performed in areas designated as Flood Zone A, so depth of potential flooding is unknown.

West Richland has flooding potential due to its proximity to the Yakima and Columbia Rivers. Flooding threat has been greatly reduced with the implementation of dams along these rives but some potential still exists, particularly from the Yakima River. Because the Yakima River boarders the city, West Richland has a **MODERATE** to **HIGH** probability of flooding as the Yakima River isn't as large as the Columbia River and does not have the same number of Dams or means of control in place. Due to the centrally-located, highly-valuable resources in West Richland, a flood event carries a **MODERATE** risk.

Table 49) Total number and total value of appraised structures in designated flood zones in West Richland, WA (only includes incorporated structures).

Flood Zone	Appraised Structures	Value of Appraised Structures
AE	8	$ 2,232,280.00
Total	**8**	**$ 2,232,280.00**

Drought Profile

Local Event History

Through analysis of 100-year drought data (1895-1995), the EHMP reports that most of Washington State was in severe or extreme drought at least 5% of the time during that period. West Richland experienced severe or extreme drought 20-30% of the time during that 100 years. During the severe drought event that occurred in 2005, the Governor of Washington requested agricultural disaster designations from the U.S. Secretary of Agriculture because of significant crop damage from drought. Benton County was one of the 15 counties that were included in the disaster request.

Probability of Future Occurrence

West Richland does not differ from the rest of Benton County regarding future drought probability. It is reasonable to anticipate drought in 20 to 30 out of the next 100 years, resulting in a **MODERATE** probability rating. Because the population relies heavily on agriculture, and support industries tied to agriculture, there is a **MODERATE** risk associated with drought.

Impacts of Drought Events

Under drought conditions in the City of West Richland, the agriculture industry would be most heavily impacted. Irrigation supporting the agriculture industry depends on steady water flow in the Columbia and Snake Rivers. Drought impacts to agriculture would potentially harm West Richland's local economy.

Drought also increases the threat of wildfire ignition and spread by accelerating depletion of soil and vegetation moisture and by reducing water available for fire suppression. The expanding WUI around West Richland would be at increased risk for severe wildfire under drought conditions during the late summer and early fall.

Development Trends

As both the population of West Richland and demand for development are expected to increase, the City of West Richland should expect an increase in water usage as well. With increased pressure on water sources, West Richland will become more sensitive to drought conditions and will likely have to implement water conservation practices sooner during a period of drought. Increased fire risk associated with drought conditions may also make additional development vulnerable to wildfire; particularly on the west side of West Richland.

Value of Resources at Risk

The agriculture industry represents the most at-risk values to the City of West Richland in the case of a severe drought. Those values are discussed in detail in the Drought Profile within the *Benton County Annex*. The City of West Richland would be especially affected by impacts to these values because of the number of people relying on the local economy, directly or indirectly, for their own income.

Wildfire Profile

For a complete analysis of the wildfire hazard in Benton County, refer to the Wildfire Hazards section in Chapter 3. The information in that section is a complete excerpt of chapter 4 of the Benton County Community Wildfire Protection Plan which is why it is presented in the same section of this plan.

Local Event History

The City of West Richland has been directly impacted by several large-scale wildfires in the past, including the Rye Grass fire of 2016. ***Table 3 in the wildfire section of chapter 3 shows wildland fires 300 acres in size or larger that occurred in Benton County since 1981.*** In addition to infrequent large fires, local fire personnel also respond to numerous ignitions along the roadways, railways, and in undeveloped areas within and immediately surrounding the city annually. Since 1981, there have been multiple wild fires on the north end of West Richland which were likely on the north side of the Yakima River and a few on the ridge southwest of West Richland (see Figure 2, wildfire hazard profile). Considering that the north end of West Richland is irrigated agriculture, these fires likely posed little threat to infrastructure in West Richland.

Probability of Future Occurrence

There is a **HIGH** probability of fire ignitions in the city; however, these ignitions are unlikely to result in large areas burned due to the availability of rapid response. Property that suffers damage to due wildfire could potentially harm the local agriculture industry, particularly the north end of West Richland, or support industries. There is, therefore, a **HIGH** risk associated with wildfire in Richland.

Impacts of Wildfire Events

With a moderate population, and therefore a significant number of people living and working in or near the wildland-urban interface, West Richland has greater impact potential in the case of a serious wildfire event. The impacts to the area that were discussed in the *Benton County Annex* are comparable to the potential impacts that a wildfire event would have on West Richland.

West Richland's exposure to wildfire may be less than that of neighboring cities as most of the incorporated area is bordered by the Yakima River and irrigated agriculture on the north end of the city could potentially serve as a buffer. However, undeveloped terrain on the south/southwest, in the event of a wildfire, could impact residential areas on that side of West Richland.

Refer to the wildfire section in chapter 3 for information about specific fire protection issues in Benton County.

Development Trends

As both population and demand for development are projected to increase for the City of West Richland, it should be expected that West Richland, over time, will have more infrastructure at risk during a wildfire event. Land use planning, adherence to Firewise or other community wildfire standards in WUI areas, and fire-resistant construction should help reduce the amount of infrastructure at risk during a wildfire event.

Refer to the wildfire section in chapter 3 for information about the wildland urban interface in Benton County and the specific risks associated with additional expansion.

Value of Resources at Risk

The values of at-risk resources in and around West Richland are moderate compared to the rest of the county. This is because of the greater number of structures, personal property, and moderate population in West Richland that are in proximity to larger populations and expansive infrastructure in neighboring cities. This means there are more people relying on the local economy, infrastructure, and other elements that could be distressed by a serious wildfire event.

Refer to the wildfire section in chapter 3 for relative threat level mapping information for Benton County and specifics about high-value resources at risk.

Severe Weather Profile

The City of West Richland does not have any differing levels of risk associated with this hazard than Benton County as a whole.

Local Event History

Severe storms, especially severe wind storms are common in Benton County during the spring and fall months and all areas of Benton County are vulnerable to the impacts of severe storms. Severe wind storms that occur in the Columbia River Basin routinely have wind speeds that can reach 60 mph but some storms, including winter storms, are capable of even greater wind speeds:

- During a five-day windstorm event in January 1972, wind speeds (gusts) up to 150 mph were recorded on Rattlesnake Mountain. In Toppenish (Yakima County), the windstorm leveled buildings, tore off roofs, and overturned trailers. It is estimated that the storm caused $250,000 in damages (1972 dollars) in Benton County alone.
- In a January 1990 windstorm, wind gusts up to 81 mph were recorded causing an estimated $3,000,000 in damages.
- In the winter of 1996-1997, Benton County experienced a massive storm that brought heavy snow accumulation, high winds and rain and led to a FEMA Disaster Declaration.
- Severe windstorms were also experienced in December 1995 and December 2001, causing damage to roofs, trees, and other property.
- In 2006 a windstorm affected all 39 counties in Washington, causing $50 million in damage statewide.

The most recent severe storm event was in February 2017. Heavy snow and rain caused flooding and eventually led to a FEMA Major Disaster Declaration.

Probability of Future Occurrence

Regionally, severe storms are expected to occur regularly resulting in a **HIGH** probability. Therefore, West Richland can anticipate at least one severe storm each year and very likely multiple storms. Disaster events caused by severe storms are not expected to happen as regularly but predicting when and what events will occur is not possible. Severe storms pose a **MODERATE** risk to West Richland.

Impacts of Severe Weather Events

As mentioned above, impacts from severe storms often manifest in the form of another hazard type, such as flooding, landslides, and lightning-caused wildfire. Windstorms can greatly affect West Richland, possibly impacting power sources or causing debris hazards. Unexpected or unusually heavy snowstorms can also have a major impact on West Richland especially because of its large population. Stress on infrastructure or a major disruption of transportation caused by severe weather, could potentially create a disaster event that impacts human safety and commerce.

Development Trends

The population of West Richland has increased over the previous decade and therefore much of the demand for development has increased. There have been no changes in development that affect this jurisdiction’s vulnerability regarding this hazard.

Value of Resources at Risk

The values of resources at risk in and near West Richland can be significant. West Richland is a significant component of the Tri-Cities metropolitan area, the industrial, economic, and political hub of Benton County. Characterized by a prolific agricultural industry and various other industrial facilities, West Richland contains substantial infrastructure, personal property, municipal facilities, and industrial facilities that could be at risk during a severe weather event.

It is difficult to estimate potential losses in West Richland due to severe weather. Construction throughout the county has been implemented in the presence of high wind events, and with typical levels of snow accumulation in mind and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

Earthquake Profile

Local Event History

Because of its location near the collision boundary of two major tectonic plates, Washington State is particularly vulnerable to a variety of earthquakes. FEMA has determined that Washington State ranks second (behind only California) among states most susceptible to damaging earthquakes in terms of economic loss. FEMA notes that a majority of the state is at risk to strong shaking (on a scale of minimal to strong) with shaking magnitude generally decreasing from west to east.

The Washington coast and the greater Puget Sound Basin are most at risk although damaging earthquakes have occurred east of the Cascades. The Puget Sound basin had damaging earthquakes in 1909, 1939, 1946, 1949, 1965, and 2001. Eastern Washington had large earthquakes in 1872 near Lake Chelan and in 1936 near Walla Walla. The 1872 earthquake near Lake Chelan was the states most widely felt shallow earthquake. The magnitude for this event has been estimated at 7.4. The 1936 magnitude 6.1 earthquake near Walla Walla was also a shallow event. Because of their remote locations damage was light from these two quakes. Ground shaking from historic earthquakes in Washington and the western U.S. has been noted in Benton County, and has resulted in only minor damage in several events.

The EHMP examines two significant earthquake events near Benton County that have occurred since 1872:

Lake Chelan Earthquake– December 14, 1872

Likely originating northeast of Chelan, WA, the magnitude 6.8 (est.) Chelan Earthquake was felt from British Columbia to Oregon and from the Pacific Ocean to Montana. At the time there were few man-made structures in the epicenter area near Lake Chelan so most of the regional impacts were ground affects. Observed after the earthquake were huge landslides, massive fissures in the ground, and a 27-foot high geyser. Extensive landslides occurred in the slide-prone shorelines of the Columbia River. One massive slide, at Ribbon Cliff between Entiat and Winesap, blocked the Columbia River for several hours. In addition to the Columbia River shoreline, landslides also occurred throughout the Cascade Mountains.

As of 2014 geologists had begun the process of interpreting a large amount of evidence that they suspect will indicate the exact location of the epicenter of the 1872 earthquake. As of the update of this plan, the study is still in progress, but some researchers believe the epicenter is located in Spencer Canyon, near Orondo, WA but this is yet to be confirmed. Determining the exact location of the epicenter is important as the fault is capable of producing another large earthquake in the future. Knowing where an earthquake may occur will help researchers predict the potential impacts it could have on nearby communities and help them prepare.

Milton-Freewater Earthquake – July 15, 1936

The earthquake, magnitude 6.1, occurred at 11:05 a.m. The epicenter was about 5 miles south-southeast of Walla Walla. It was widely felt through Oregon, Washington and northern Idaho, with the greatest shaking occurring in northeast Oregon. Property damage was estimated at $100,000 (in 1936 dollars) in, what was at the time, a sparsely populated area.

In recent years, geologists have attempted to find the exact location of the epicenter of the Milton-Freewater earthquake. As of the update of this plan, geologists are attempting to determine exactly which fault was the source of the quake as it could either have occurred on the RAW or on the Hite fault. The location of the epicenter has implications for impacts of any future earthquakes occurring along the same fault and the way that communities prepare for such event. The results are expected to be available in the near future.

Probability of Future Occurrence

Because of the infrequency of such devastating events, there is a **MODERATE** probability for a potentially damaging earthquake to occur that would result in many people being injured or killed and damaging private property, government infrastructure and the local economy. However, there is a **HIGH** risk to the citizens, infrastructure, and economy of West Richland should such an earthquake occur.

Impacts of Earthquakes

An in-depth examination of the impacts that an earthquake event might have on the area can be found in the *Benton County Annex*. The impacts discussed are comparable to the potential impacts specific to the City of West Richland.

Considering West Richland's proximity to the Yakima, Columbia, and Snake Rivers, West Richland is at risk for flooding should an upstream dam fail as the result of an earthquake. Please refer to the *Benton County Annex* for more information about Columbia River dams and Dworshak Dam. The study by Sherrod et al (2016) supports that a fault (part of the Wallula fault zone) capable of producing earthquakes passes through the City of Kennewick, close to Trios Hospital and Southridge High School and is indicated by the upheaval that created the Thompson Hill, Badger Mountain, Red Mountain, and Rattlesnake Mountain "ridge". A fault running along the northwest edge of West Richland has the potential to cause significant damage to infrastructure and would place the general populous of West Richland at risk.

Development Trends

The population of West Richland has increased over the previous decade and therefore much of the demand for development has increased. With additional development and infrastructure, West Richland will become more vulnerable to Earthquake hazards. However, the impacts of an earthquake should be minimized through land use planning and earthquake-resistant structure designs.

Value of Resources at Risk

According to the Washington Earthquake Risk Assessment, earthquakes resulting from fault movement in or near Benton County could cause approximately $7 to 127 million in damages to West Richland (Table 50). Of the 5,316 structures that were included in the different analyses, up to 388 structures were lost in the Rattlesnake Wallula Fault scenario totaling more than $127 million in damages. Figure 34 shows the areas of West Richland that are likely to experience the greatest losses in dollars.

Table 50) Washington Earthquake Risk Assessment HAZUS Earthquake scenarios for West Richland, WA. Total number of structures and total value of structures used for the analyses are included below the table.

City of West Richland Earthquake Scenarios	Total Loss Value (Building and Contents)	Total Loss Ratio (Building and Contents)
M7.4 Saddle Mountain Fault	$6,946,223	0.4%
M7.4 Rattlesnake Wallula Fault	$127,077,873	7.3%
M7.1 Horse Heaven Hills Fault	$69,945,178	4.0%
HAZUS Analysis (Earthquake Loss Ratio >= 10%)	**Number of Structures**	**Percent of Total Structures**
Hazus Earthquake Summary	107	2.0%

Total number of structures identified in analyses: 5,316

Total value of all structures and structure content: $1,748,640,995

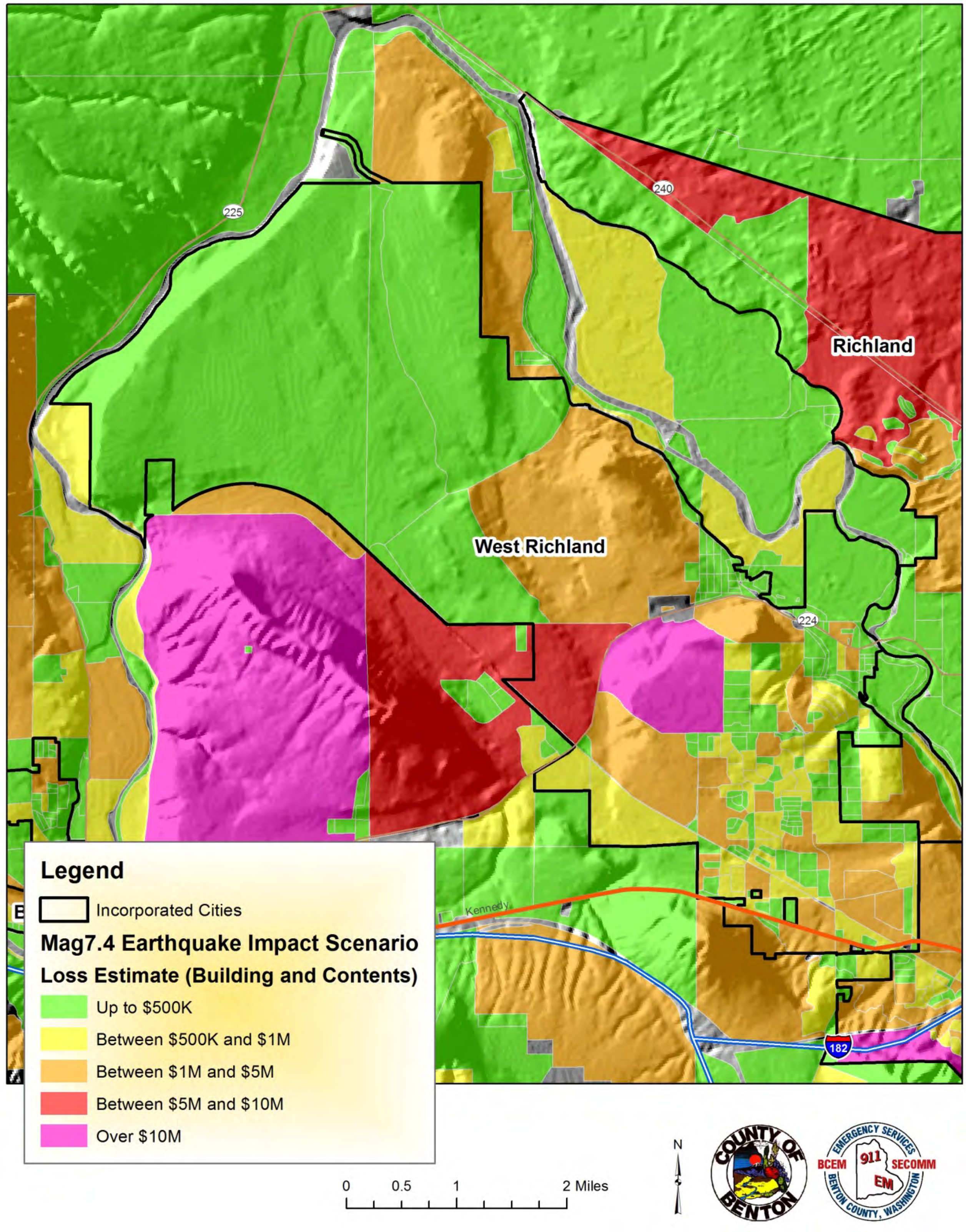


Figure 34) Mag 7.4 Earthquake impact scenario map for West Richland, WA. The different colors represent potential financial losses (in dollars) for different parts of West Richland.

Landslide Profile

Local Event History

Washington has a long history of landslides. Widespread landslides have historically occurred during large storm events (1983, 1996, 1997, 2007, and 2009) and earthquakes (1949, 1965 and 2001). Landslides can also move without large events and without warning, such as the Aldercrest-Banyon landslide in Cowlitz County, the Carlyon Beach/Hunters Point landslide in Thurston County, and the Nile Landslide in Yakima County. Landslides can also be caused by volcanoes, such as the debris avalanche of the Mt. St. Helens eruption of 1980 and subsequent lahars (volcanic debris flows).

In 1982 in Benton County, the construction of Interstate-82 between Prosser and Benton City at mile marker 92 reactivated a historical landslide causing between $10 and $15 million in damages. Most landslides in Benton County have occurred along the steep slopes of Interstate 82 and along the Columbia River west of Paterson, WA.

Probability of Future Occurrence

Most of West Richland is at **LOW** risk for a landslide. However, as a result of erosive soils and moderate slope, portions of two different new neighborhoods are at **HIGH** risk for landslides and land movement. Refer to Figure 35 below, which displays critical and landslide prone areas in and near West Richland.

Impacts of Landslide Events

Potential impacts that the City of West Richland would experience in the case of a land movement event are comparable to those highlighted in the *Benton County Annex*. The biggest concerns for West Richland are threats to human safety, disruptions to the local economy and infrastructure, and damages to personal and municipal property. Since most of the structures that are located in high risk areas are residential, damage to homes would be the most likely impact of a landslide or land movement event in Prosser.

Development Trends

The population of West Richland has increased over the previous decade and therefore much of the demand for development has increased. As a result, new homes are being constructed on the slopes in the central portion of West Richland. Interest in those new neighborhoods has increased the amount of development taking place on landslide or land-movement prone slopes.

Values of Resources at Risk

In total, there are 451 structures in West Richland that are in designated high-risk landslide zones (Table 51). The appraised value of these structures, 97% of which are residential, is just under $89.5 million.

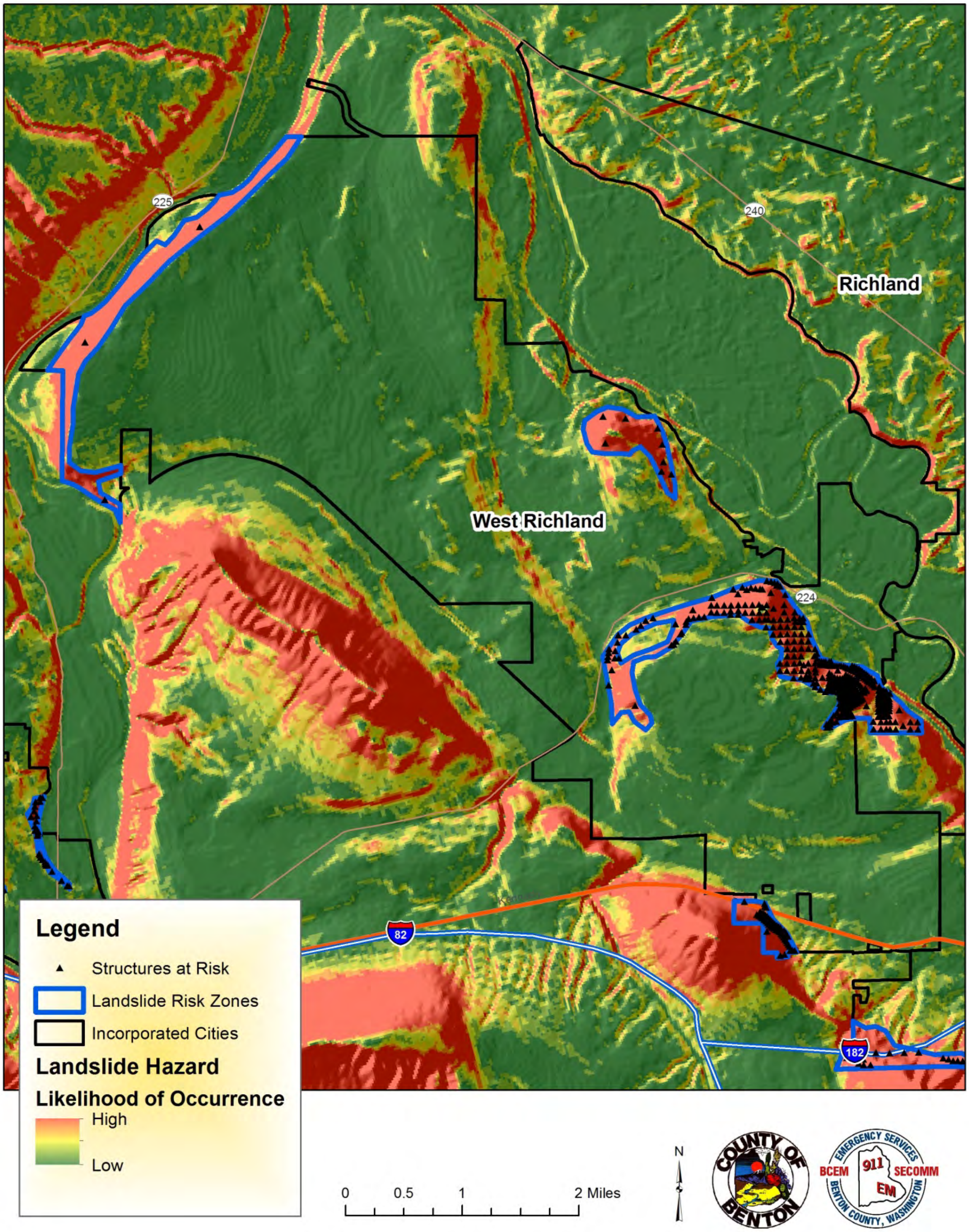


Figure 35) Structures at risk within landslide prone areas in West Richland, WA.

Table 51) Number and value of appraised structures by type in designated high-risk landslide zones in West Richland, WA.

Building Type	Number of Appraised Structures	Value of Appraised Structures
Commercial	14	$1,552,040.00
Residential	437	$87,854,570.00
Total	**451**	**$89,406,610.00**

Volcano Profile

West Richland does not differ from Benton County as a whole with regard to volcanic hazards.

Local Event History

Stretching from northern California into British Columbia, the Cascade Range of the Pacific Northwest has more than a dozen active volcanoes, most of which are capable of explosive eruptions. The volcanos that erupted most recently were Mount St. Helens (Washington, 1980–86 and 2004–8) and Lassen Peak (California, 1914–17). On May 18, 1980, after two months of earthquakes and minor eruptions, Mount St. Helens exploded in one of the most devastating volcanic eruptions of the 20th century. Although less than 0.1 cubic mile of molten rock (magma) was erupted, 57 people died, and damage exceeded $1 billion. Fortunately, most people in the area were able to evacuate safely before the eruption as public officials had been alerted to the danger by the U.S. Geological Survey (USGS) and other scientists who were monitoring volcanic activity in the region.

Probability of Future Occurrence

Because of the historical infrequency of such events, it is unlikely that we will see a volcanic eruption in our lifetimes. However, due to the prevailing winds within Benton County, the impacts of a major eruption from Mount Adams, Mount Hood or Mount Saint Helens to persons, property, infrastructure, and the environment in Benton County would be serious though not necessarily catastrophic. Therefore, there is a **LOW** probability of such an event occurring, but a **MODERATE** risk to persons, property, and the environment in Benton County should an eruption occur.

Impacts of Volcano Events

Refer to the *Benton County Annex* for volcano event impacts that would be expected to affect all jurisdictions in a similar manner. A volcanic eruption would likely be preceded or accompanied by seismic activity. Considering the fault connectivity noted by Blakely et al (2011), West Richland could potentially experience local seismic activity which could produce landslides, flooding, ground cracking, and soil liquefaction.

Development Trends

The population of West Richland has increased over the previous decade and therefore much of the demand for development has increased. There have been no changes in development that affect this jurisdiction’s vulnerability regarding this hazard.

Values of Resources at Risk

It is difficult to estimate the value of resources at risk during a volcanic eruption. Costs associated with ash-related damage would likely depend on the duration of exposure and quantity of ash that settles within the municipality. Ash can collapse the roofs of buildings, impact water resources and infrastructure, clog vehicle engines, ground or damage airplanes, harm or kill livestock, crops, and other vegetation, and have adverse impacts on human and animal health. As indicated by the aftermath of the Mount St. Helens eruption in 1980, the damage caused by an eruption can total in the billions of dollars.

In addition to any kind of damage to infrastructure, there will be, depending on the volume of ash fall, high costs associated with clean-up efforts, the need for additional medical supplies, food and water, temporary shelter and transportation needs, and any other emergency supplies needed for both emergency responders and the general public.

Benton City Profile

Table 52) Historic population of West Benton City, WA

Census	Population	% Change
1950	863	
1960	1210	40%
1970	1070	-12%
1980	1980	85%
1990	1775	-10%
2000	2624	48%
2010	3038	16%

Benton City is located west of Richland along Interstate 82 and is bisected by the Yakima River. The City was founded in 1909, built around railroad freight and passenger depots established by the Oregon Washington Railroad and Navigation line. Although initially owned and controlled by rail and land companies, Benton City was publicly incorporated in 1945. Benton City's estimated 2018 population was 3,405. The City encompasses 2.46 square miles of land and 0.03 square miles of water. Despite the proximity of the Hanford Site, Benton City remained focused on agriculture and has become known for its viniculture and wineries. Benton City is governed by an elected mayor and city council.

Capabilities Assessment

Mitigation capabilities are existing authorities, policies, programs, and resources that reduce hazard impacts or that could be used to implement hazard mitigation activities. Detailed Capabilities Assessments for Benton City can be found in Appendix B.

Development Trends

As part of the Growth Management Act, the Washington State Office of Financial Management (OFM) has provided Benton County with a population estimate for a period ending in the year 2037. For planning purposes, the countywide population estimate was distributed on an existing percentage basis to the various cities and unincorporated areas within Benton County. Benton City's official population forecast is a total of 5,812 in the incorporated area by the year 2040. Current 2018 population estimate within the incorporated area is 3,405.

Benton City's Comprehensive Plan includes an analysis of available land use and capacity. It also provides an estimate of acres needed for development to accommodate the projected 2040 population. Overall, the Comprehensive Plan indicates that the City has sufficient land within its current City limits and UGA to accommodate the land needs for the projected residential, commercial and industrial growth. However, there may be insufficient acres zoned for government use within either City limits or the UGA to accommodate the projected development.

Most of Benton City's UGA consists of area zoned for residential use on the northeast and northwest sides of the City. In addition, there is a parcel of the UGA located south of Interstate 82 and Kiona Road outside the southern City Limits and several smaller parcels located on either side of the Yakima River near the southern portion of Benton City.

Benton City Hazard Annex

Flood Profile

Benton City does not have any differing levels of risk associated with this hazard than Benton County as a whole. However, Benton City's exposure to flooding will be different than that of Benton County as well as other jurisdictions within Benton County.

Local Event History

Benton City is bordered by the Yakima River; almost half to two-thirds of the perimeter of the incorporated area follows the contour of the Yakima River. Because of its proximity to the Yakima River, Benton City has been affected by many of the same flood events that have affected Benton County. In 1996, access to a structure fire was impeded by flood waters in the area of 2nd and Abby. Parts of Benton City had also been evacuated. (Table 53).

Table 53) History of flood events that affected Benton County. Measurements were taken at Kiona.

Date	Flow (cfs)	Stage (ft)	Return Period (Yrs)	Comments
23-Dec-33	67000	21.57	167	Largest flood of record. Resulted in construction of extensive federal levee system in Yakima County.
17-Nov-06	66000	20.12	159	
17-Dec	53,800 at Prosser	18.5 est.		
11-Feb-96	49400	20.98	67	Benton County declared a federal disaster area (Note: crest may have reached up to 21.5 ft)
18-Jan-74	39700	18.56	36	Benton County declared a federal disaster area.
18-Nov-1896	38000	16.07	34	
30-May-48	37900	17.2	33	
13-Dec-21	35,800 at Parker			
17-Apr-04	32000	15.05	18	
26-Nov-09	30600	14.8	16	
23-Mar-10	29200	14.53	14	
6-Dec-75	28300	16.52	13	
28-Dec-80	27600	16.27	12	
4-Dec-77	27000	16.11	11	Benton County declared a federal disaster area.
3-Mar-01	26400	14	10	
14-Jun-03	26400	14	10	
2-Dec-95	26300	15.87	9	Benton County declared a federal disaster area.
10-Jan-09	25400	15.55		Benton County declared a federal disaster area.
16-Jun-16	24,800 at Parker			
17-Feb-1898	23100	13.27	7	
27-Nov-90	22600	14.36	7	Benton County declared a federal disaster area.
1-Feb-65	22400	13.76	6	
22-Feb-82	22200	14.42	6	

5-Jun-13	20900	13.1	5	
13-Feb-51	20900	12.99	5	
23-Jan-19	20,600 at Parker			
15-Mar-72	20200	13.57	5	
22-May-56	20100	12.73	5	
18-Feb-17	7340	7.85		Flooding was a result of snow melt. Benton County declared a federal disaster area.

Probability of Future Occurrence

Benton City has flooding potential due to its proximity to the Yakima River. Flood-potential has been greatly reduced with the construction of dams along major waterways but some potential still exists, particularly from the Yakima River. Because the Yakima River boarders the city, Benton City has a **MODERATE** to **HIGH** probability of flooding as the Yakima River isn't as large as the Columbia River and does not have the same number of dams or means of control in place. Because of the values and services Benton City offers to surrounding communities, a flood event carries a **MODERATE** risk.

The Benton City Flood Map (Figure 36) shows that all structures that are susceptible to flooding fall within flood zones A and AE (Table 54). This means there is a 1% chance that structures will be subjected to flood conditions annually and a 26% chance that they will be subjected to flood conditions over the life of a 30-year mortgage. However, no analysis has been performed in areas designated as Flood Zone A, so depth of potential flooding is unknown.

Table 54) National Flood Insurance Program (NFIP) flood zone categories and descriptions.

ZONE	DESCRIPTION
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26%

	chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.

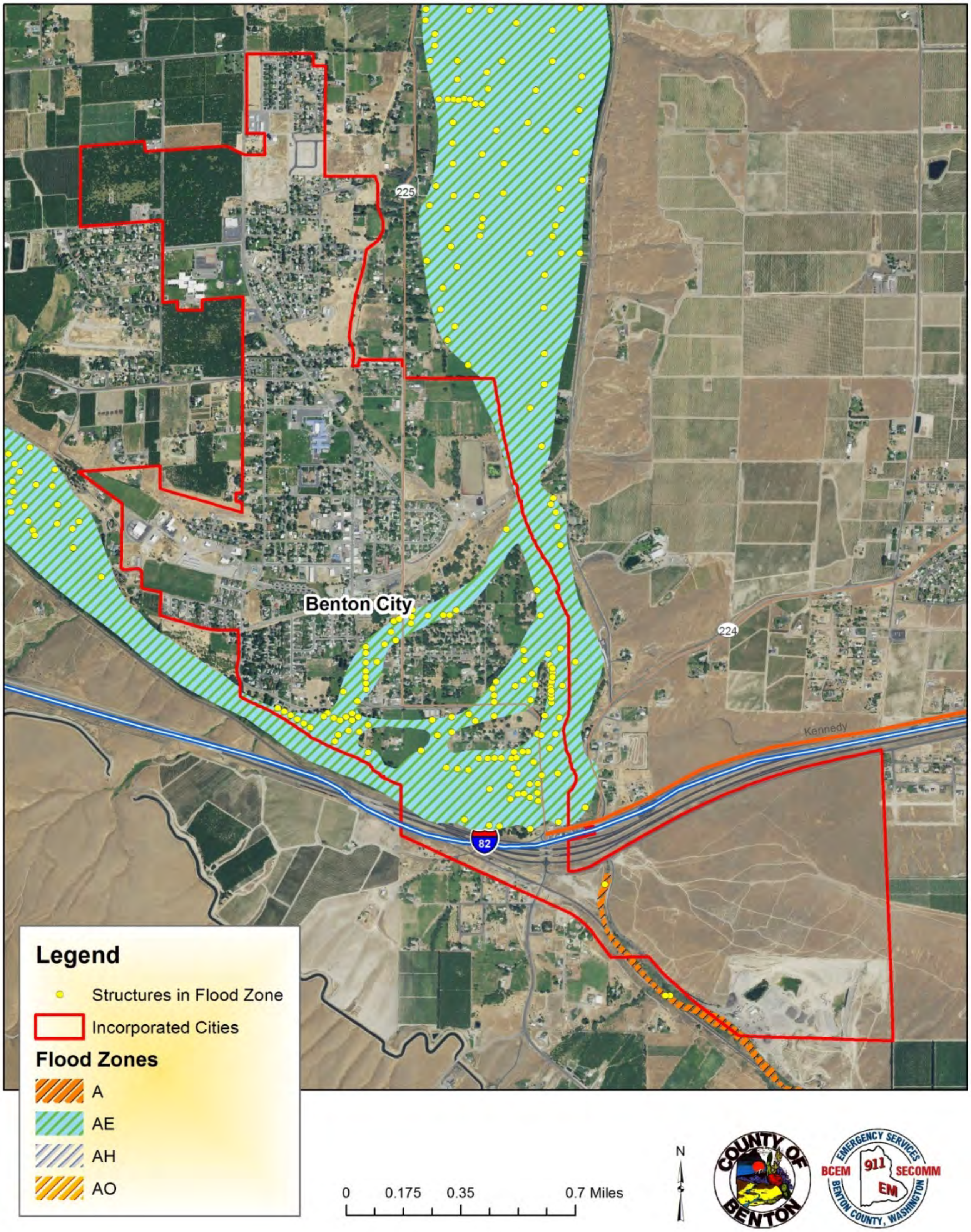


Figure 36) National Flood Insurance Program flood zone map for Benton City, WA

Impacts of Flood Events

Potential impacts caused by flooding in Benton City include increased landslide risk, damage to infrastructure or roads, and damage to personal property. Residential areas along the Yakima River are likely to be affected the most by a flood event. The impacts from the 1996 flood include the flooding of roads, disruption of emergency services (firefighters could not access a burning home), lift stations 4, 5, and 6 were inundated and had to be shut off, resulting in extensive efforts to repair lift station electrical systems, clean up and clear roadways, remove sand bags from around sewer drains and access points. Most residents living in the area south of the Kiona Canal were affected by the flooding.

Development Trends

As both population and demand for development are projected to steadily increase for Benton City, it should be expected that Benton City, over time, will have more infrastructure at risk during a flood event. Land use planning and adherence to building codes in flood sensitive areas should help reduce the amount of infrastructure at risk during a flood event.

Value of Resources at Risk

Looking at the flood map for Benton City (Figure 36), damage from flooding would be a result of a Yakima River flood event. In total the Benton City has 118 structures, none of which are government owned, in designated flood zones that are currently appraised at just over $12.2 million (Table 55). All structures are located in Flood Zones A and AE which means there is a %1 chance that they will flood annually and a 26% chance that they will flood over the life of a 30-year mortgage.

Table 55) Total number and total value of appraised structures in designated flood zones in Benton City, WA (only includes incorporated structures).

Flood Zone	Appraised Structures	Value of Appraised Structures
A	1	$ 38,850.00
AE	117	$ 12,161,340.00
Total	**118**	**$ 12,200,190.00**

Drought Profile

Local Event History

Through analysis of 100-year drought data (1895-1995), the EHMP reports that most of Washington State was in severe or extreme drought at least 5% of the time during that period. Benton City experienced severe or extreme drought 20-30% of the time during that 100 years. During the severe drought event that occurred in 2005, the Governor of Washington requested agricultural disaster designations from the U.S. Secretary of Agriculture because of significant crop damage from drought. Benton County was one of the 15 counties that were included in the disaster request.

Probability of Future Occurrence

Benton City does not differ from the rest of Benton County regarding future drought probability. It is reasonable to anticipate drought in 20 to 30 out of the next 100 years, resulting in a **MODERATE** probability rating. Because the population relies heavily on agriculture, and support industries tied to agriculture, there is a **MODERATE** risk associated with drought.

Impacts of Drought Events

Under drought conditions in Benton City, the agriculture would be most heavily impacted as it depends heavily on steady water flow in the Yakima River. Drought impacts to agriculture would potentially harm the city's local economy.

Drought also increases the threat of wildfire ignition and spread by accelerating depletion of soil and vegetation moisture and by reducing water available for fire suppression. The expanding WUI around Benton City would be at increased risk for severe wildfire under drought conditions during the late summer and early fall.

Development Trends

As both population and demand for development are expected to increase, Benton City should expect an increase in water usage making it more sensitive to drought conditions. Even though the increase in water usage in Benton City will be minimal due to its smaller size, it will likely have to implement water conservation practices earlier during a period of drought; particularly as larger neighboring communities place additional stress on water supplies. Increased wildfire risk associated with drought conditions will also make new development more vulnerable to wildfire, especially on the south side of I-82.

Value of Resources at Risk

The agriculture industry represents the most at-risk values to Benton City in the case of a severe drought. Those values are discussed in detail in the Drought Profile within the *Benton County Annex*. Benton City would be especially affected by impacts to these values because of the number of people relying on the local economy, directly or indirectly, for their own income.

Wildfire Profile

For a complete analysis of the wildfire hazard in Benton County, refer to the Wildfire Hazards section in Chapter 3. The information in that section is a complete excerpt of chapter 4 of the Benton County Community Wildfire Protection Plan which is why it is presented in the same section of this plan.

Local Event History

Benton City has been directly impacted by several large fires since 1990. ***Table 3 in the wildfire section of chapter 3 shows wildland fires 300 acres in size or larger that occurred in Benton County since 1981.*** Since 1980, Benton City has also had multiple fires in the southern portion of the incorporated area as well as numerous wildfires on the northeast facing slope of the Horse Heaven Hills (see Figure 2, wildfire hazard profile). There have been other fires on the same slopes of the Horse Heaven Hills further east and west along the I-82/US 12 corridor.

Probability of Future Occurrence

There is a **HIGH** probability of fire ignitions in the city, particularly on the south side of I-82 on the slopes of the Horse Heaven Hills. These ignitions are unlikely to result in large areas burned due to the availability of rapid response, but there is potential for fire to make a run upslope and into the dry agriculture areas of Horse Heaven Hills. Property that suffers damage due to wildfire could potentially harm the local agriculture industry or support industries. There is, therefore, a **HIGH** risk associated with wildfire in Benton City.

Impacts of Wildfire Events

The Yakima River borders most of Benton City; the part of the city on the north side of the river is interfaced with agriculture while the portion on the south side of the river is mostly undeveloped with minimal infrastructure that would be at risk during a wildfire. However, areas on the south side of I-82 have burned previously and could burn again which may impact residents, property, agriculture, and may even, under the required conditions, spread to the slopes of the Horse Heaven Hills. The overall impacts to the area that were discussed in the *Benton County Annex* are comparable to the potential impacts that a wildfire event would have on Benton City.

Refer to the wildfire section in chapter 3 for information about specific fire protection issues in Benton County.

Development Trends

As both population and demand for development are projected to increase for the Benton City, it should be expected that Benton City, over time, will have more infrastructure at risk during a wildfire event. Land use planning, adherence to Firewise or other community wildfire standards in WUI areas, and fire-resistant construction should help reduce the amount of infrastructure at risk during a wildfire event.

Refer to the wildfire section in chapter 3 for information about the wildland urban interface in Benton County and the specific risks associated with additional expansion.

Value of Resources at Risk

Because it is a smaller community, the values of at-risk resources in and around Benton City are not as high as some of the larger cities. In addition to being smaller in size, most infrastructure within the incorporated area is concentrated in the bend of the Yakima River (on the north side of the river) and there is only a gravel pit and very limited infrastructure in the undeveloped area on the south side of I-82. Aside from the businesses located throughout the city, agriculture is an important part of Benton City's economy. Benton City is also likely to be the home of a number of people that work in the tri-cities area.

Refer to the wildfire section in chapter 3 for relative threat level mapping information for Benton County and specifics about high-value resources at risk.

Severe Weather Profile

The Benton City does not have any differing levels of risk associated with this hazard than Benton County as a whole.

Local Event History

Severe storms, especially severe wind storms are common in Benton County during the spring and fall months and all areas of Benton County are vulnerable to the impacts of severe storms. Severe wind storms that occur in the Columbia River Basin routinely have wind speeds that can reach 60 mph but some storms, including winter storms, are capable of even greater wind speeds:

- During a five-day windstorm event in January 1972, wind speeds (gusts) up to 150 mph were recorded on Rattlesnake Mountain. In Toppenish (Yakima County), the windstorm leveled buildings, tore off roofs, and overturned trailers. It is estimated that the storm caused $250,000 in damages (1972 dollars) in Benton County alone.
- In a January 1990 windstorm, wind gusts up to 81 mph were recorded causing an estimated $3,000,000 in damages.
- In the winter of 1996-1997, Benton County experienced a massive storm that brought heavy snow accumulation, high winds and rain and led to a FEMA Disaster Declaration.
- Severe windstorms were also experienced in December 1995 and December 2001, causing damage to roofs, trees, and other property.
- In 2006 a windstorm affected all 39 counties in Washington, causing $50 million in damage statewide.

The most recent severe storm event was in February 2017. Heavy snow and rain caused flooding and eventually led to a FEMA Major Disaster Declaration.

Probability of Future Occurrence

Regionally, severe storms are expected to occur regularly resulting in a **HIGH** probability. Therefore, Benton City can anticipate at least one severe storm each year and very likely multiple storms. Disaster events caused by severe storms are not expected to happen as regularly but predicting when and what events will occur is not possible. Severe storms pose a **MODERATE** risk to Benton City.

Impacts of Severe Weather Events

As mentioned above, impacts from severe storms often manifest in the form of another hazard type, such as flooding, landslides, and lightning-caused wildfire. Windstorms can greatly affect Benton City, possibly impacting power sources or causing debris hazards. Unexpected or unusually heavy snowstorms can also have a major impact on Benton City if outside resources or emergency resources are needed. Residents that commute to the tri-cities area may also encounter problems going to and from their homes. Disruption to transportation could put lives at risk.

Development Trends

The population of Benton City has increased over the previous decade and therefore much of the demand for development has increased. There have been no changes in development that affect this jurisdiction’s vulnerability regarding this hazard.

Value of Resources at Risk

Because it is a smaller community, the values of at-risk resources in and around Benton City are not as high as some of the larger cities. Even though it is smaller, Benton City serves as a local center supporting surrounding agricultural uses, wineries, fruit orchards, pasture, and dryland wheat fields. A severe weather event in Benton City could have detrimental effects on crop yield and agricultural production.

It is difficult to estimate potential losses in Benton City due to severe weather. Construction throughout the County has been implemented in the presence of high wind events, and with typical levels of snow accumulation in mind and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

Earthquake Profile

Local Event History

Because of its location near the collision boundary of two major tectonic plates, Washington State is particularly vulnerable to a variety of earthquakes. FEMA has determined that Washington State ranks second (behind only California) among states most susceptible to damaging earthquakes in terms of economic loss. FEMA notes that a majority of the state is at risk to strong shaking (on a scale of minimal to strong) with shaking magnitude generally decreasing from west to east.

The Washington coast and the greater Puget Sound Basin are most at risk although damaging earthquakes have occurred east of the Cascades. The Puget Sound basin had damaging earthquakes in 1909, 1939, 1946, 1949, 1965, and 2001. Eastern Washington had large earthquakes in 1872 near Lake Chelan and in 1936 near Walla Walla. The 1872 earthquake near Lake Chelan was the states most widely felt shallow earthquake. The magnitude for this event has been estimated at 7.4. The 1936 magnitude 6.1 earthquake near Walla Walla was also a shallow event. Because of their remote locations damage was light from these two quakes. Ground shaking from historic earthquakes in Washington and the western U.S. has been noted in Benton County, and has resulted in only minor damage in several events.

The EHMP examines two significant earthquake events near Benton County that have occurred since 1872:

Lake Chelan Earthquake– December 14, 1872

Likely originating northeast of Chelan, WA, the magnitude 6.8 (est.) Chelan Earthquake was felt from British Columbia to Oregon and from the Pacific Ocean to Montana. At the time there were few man-made structures in the epicenter area near Lake Chelan so most of the regional impacts were ground affects. Observed after the earthquake were huge landslides, massive fissures in the ground, and a 27-foot high geyser. Extensive landslides occurred in the slide-prone shorelines of the Columbia River. One massive slide, at Ribbon Cliff between Entiat and Winesap, blocked the Columbia River for several hours. In addition to the Columbia River shoreline, landslides also occurred throughout the Cascade Mountains.

As of 2014 geologists had begun the process of interpreting a large amount of evidence that they suspect will indicate the exact location of the epicenter of the 1872 earthquake. As of the update of this plan, the study is still in progress, but some researchers believe the epicenter is located in Spencer Canyon, near Orondo, WA but this is yet to be confirmed. Determining the exact location of the epicenter is important as the fault is capable of producing another large earthquake in the future. Knowing where an earthquake may occur will help researchers predict the potential impacts it could have on nearby communities and help them prepare.

Milton-Freewater Earthquake – July 15, 1936

The earthquake, magnitude 6.1, occurred at 11:05 a.m. The epicenter was about 5 miles south-southeast of Walla Walla. It was widely felt through Oregon, Washington and northern Idaho, with the greatest shaking occurring in northeast Oregon. Property damage was estimated at $100,000 (in 1936 dollars) in, what was at the time, a sparsely populated area.

In recent years, geologists have attempted to find the exact location of the epicenter of the Milton-Freewater earthquake. As of the update of this plan, geologists are attempting to determine exactly which fault was the source of the quake as it could either have occurred on the RAW or on the Hite fault. The location of the epicenter has implications for impacts of any future earthquakes occurring along the same fault and the way that communities prepare for such event. The results are expected to be available in the near future.

Probability of Future Occurrence

Because of the infrequency of such devastating events, there is a **MODERATE** probability for a potentially damaging earthquake to occur that would result in many people being injured or killed and damaging private property, government infrastructure and the local economy. However, there is a **HIGH** risk to the citizens, infrastructure, and economy of Benton City should such an earthquake occur.

Impacts of Earthquakes

An in-depth examination of the impacts that an earthquake event might have on the area can be found in the *Benton County Annex*. The impacts discussed are comparable to the potential overall impacts that could occur within Benton City.

Considering Benton City’s proximity to the Yakima River, there is a risk for flooding should an upstream dam fail as the result of an earthquake. Please refer to the *Benton County Annex* for more information about Columbia River dams and Dworshak Dam. The study by Sherrod et al (2016) supports that a fault (part of the Wallula fault zone) capable of producing earthquakes passes through the City of Kennewick, close to Trios Hospital and Southridge High School and is indicated by the upheaval that created the Thompson Hill, Badger Mountain, Red Mountain, and Rattlesnake Mountain “ridge”. A fault located nearby to the northeast has the potential to cause significant damage to infrastructure and would place the general populous of Benton City at risk.

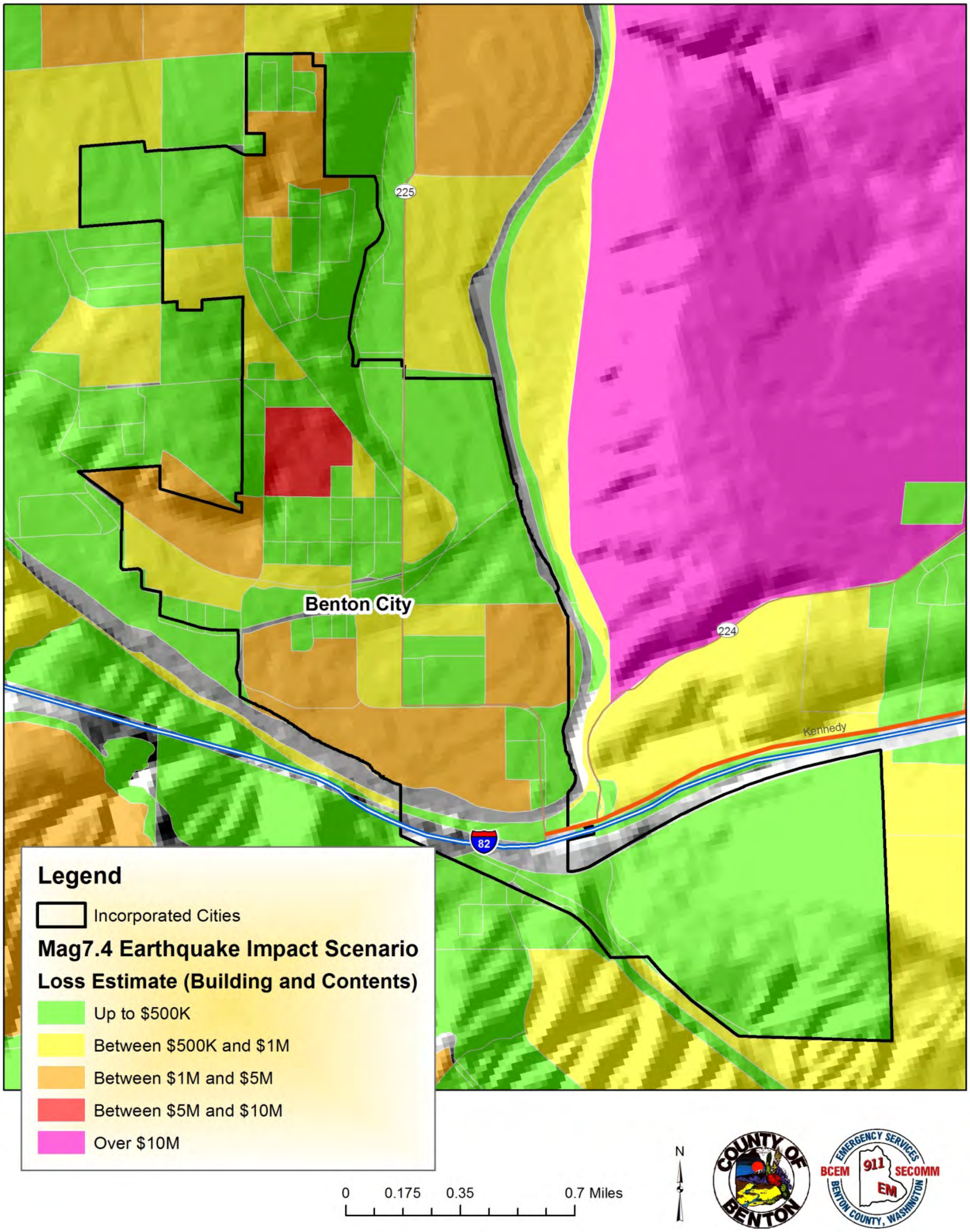


Figure 37) Mag 7.4 Earthquake impact scenario map for Benton City, WA. The different colors represent potential financial losses (in dollars) for different parts of Benton City.

Development Trends

The population of Benton City has increased over the previous decade and therefore much of the demand for development has increased. With additional development and infrastructure, Benton City will become more vulnerable to Earthquake hazards. However, the impacts of an earthquake should be minimized through land use planning and earthquake-resistant structure designs.

Value of Resources at Risk

According to the Washington Earthquake Risk Assessment, earthquakes resulting from fault movement in or near Benton County could cause approximately $1.2 to 32 million in damages to Benton City (Table 56). Of the 1,253 structures that were included in the different analyses, up to 151 structures were lost in the Rattlesnake Wallula Fault scenario totaling more than $32 million in damages. Figure 37 shows the areas of Benton City that are likely to experience the greatest losses in dollars.

Table 56) Washington Earthquake Risk Assessment HAZUS Earthquake scenarios for Benton City, WA. Total number of structures and total value of structures included in the analyses are included below the table.

Benton City Earthquake Scenarios	Total Loss Value (Building and Contents)	Total Loss Ratio (Building and Contents)
M7.4 Saddle Mountain Fault	$1,158,735	0.4%
M7.4 Rattlesnake Wallula Fault	$32,152,011	12.0%
M7.1 Horse Heaven Hills Fault	$22,120,715	8.3%
HAZUS Analysis (Earthquake Loss Ratio >= 10%)	**Number of Structures**	**Percent of Total Structures**
Hazus Earthquake Summary	450	35.9%
Total number of structures identified in analyses:		1,253
Total value of all structures and structure content:		$267,161,155

Landslide Profile

Local Event History

Washington has a long history of landslides. Widespread landslides have historically occurred during large storm events (1983, 1996, 1997, 2007, and 2009) and earthquakes (1949, 1965 and 2001). Landslides can also move without large events and without warning, such as the Aldercrest-Banyon landslide in Cowlitz County, the Carlyon Beach/Hunters Point landslide in Thurston County, and the Nile Landslide in Yakima County. Landslides can also be caused by volcanoes, such as the debris avalanche of the Mt. St. Helens eruption of 1980 and subsequent lahars (volcanic debris flows).

In 1982 in Benton County, the construction of Interstate-82 between Prosser and Benton City at mile marker 92 reactivated a historical landslide causing between $10 and $15 million in damages. Most landslides in Benton County have occurred along the steep slopes of Interstate 82 and along the Columbia River west of Paterson, WA.

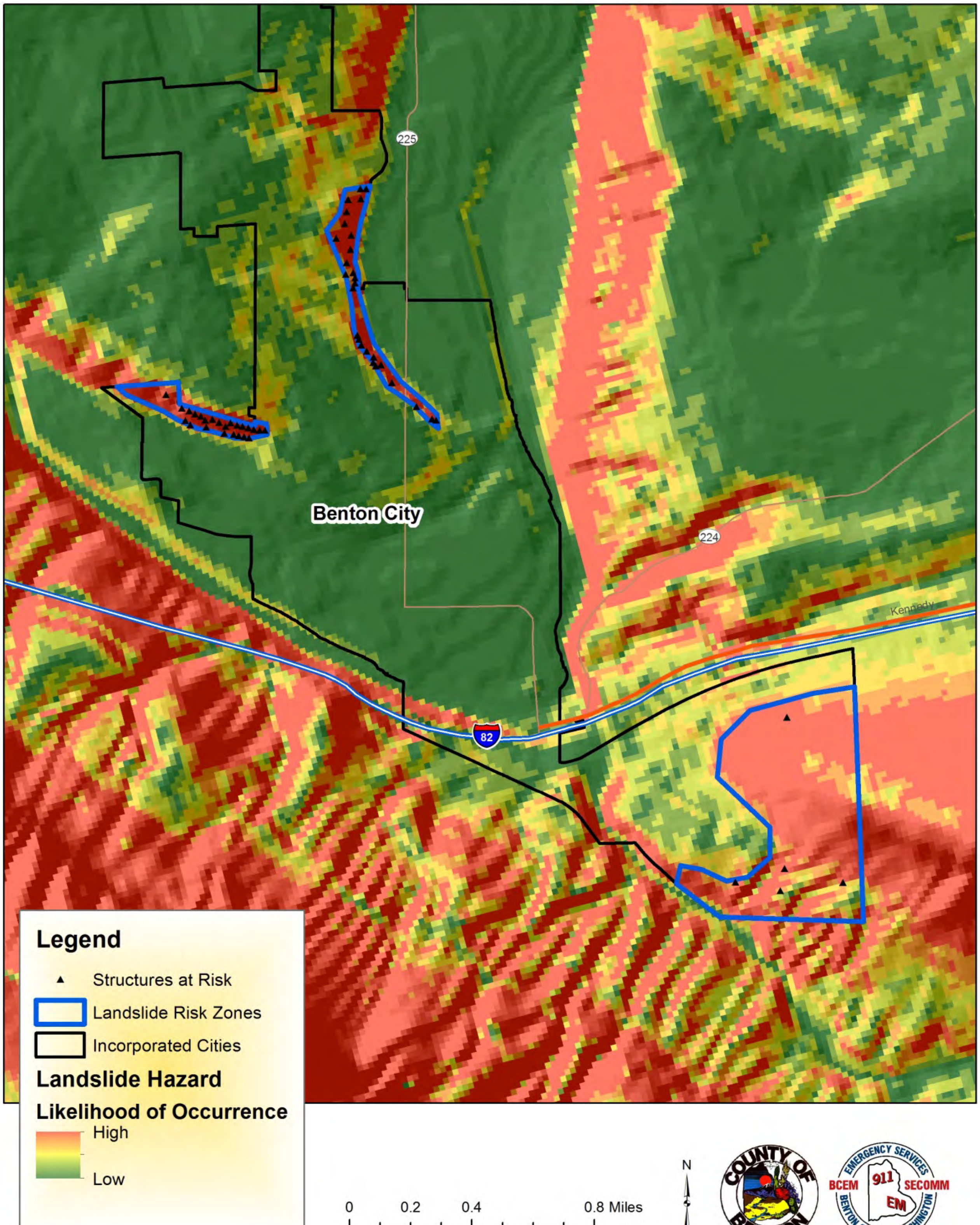


Figure 38) Structures at risk within landslide prone areas in Benton City, WA.

Probability of Future Occurrence

As a result of erosive soils and moderate slopes, there are small areas within Benton City that are at high risk for landslides or land movement. Refer to Figure 38 which displays critical and landslide prone areas in and near Benton City. The majority of Benton City is at **LOW** risk.

Impacts of Landslide Events

Potential impacts that Benton City would experience in the case of a land movement event are comparable to those highlighted in the *Benton County Annex*. The biggest concerns for Benton City are threats to human safety, disruptions to the local economy and infrastructure, and damages to personal and municipal property. Since most of the structures that are located in high risk areas are residential, damage to homes would be the most likely impact of a landslide or land movement event in Benton City.

Development Trends

The population of Benton City has increased over the previous decade and therefore much of the demand for development has increased. In response to previous demand for development, homes were constructed on or at the top of moderate slopes that have been designated as high risk for landslides or land movement. It appears that most of the land use in Benton City is for agriculture so it seems unlikely that a lot of new development would be located in the high-risk areas.

Values of Resources at Risk

In total, there are 56 structures in Benton City that are in designated high-risk landslide zones (Table 57). The appraised value of these structures, 98% of which are residential, is just under $5 million.

Table 57) Number and value of appraised structures by type in designated high-risk landslide zones in Benton City, WA.

Building Type	Number of Appraised Structures	Value of Appraised Structures
Industrial	1	$605,920.00
Residential	55	$4,392,910.00
Total	**56**	**$4,998,830.00**

Volcano Profile

Benton City does not differ from Benton County as a whole with regard to volcanic hazards.

Local Event History

Stretching from northern California into British Columbia, the Cascade Range of the Pacific Northwest has more than a dozen active volcanoes, most of which are capable of explosive eruptions. The volcanos that erupted most recently were Mount St. Helens (Washington, 1980–86 and 2004–8) and Lassen Peak (California, 1914–17). On May 18, 1980, after two months of earthquakes and minor eruptions, Mount St. Helens exploded in one of the most devastating volcanic eruptions of the 20th century. Although less than 0.1 cubic mile of molten rock (magma) was erupted, 57 people died, and damage exceeded $1 billion. Fortunately, most people in the area were able to evacuate safely before the eruption as public officials had been alerted to the danger by the U.S. Geological Survey (USGS) and other scientists who were monitoring volcanic activity in the region.

Probability of Future Occurrence

Because of the historical infrequency of such events, it is unlikely that we will see a volcanic eruption in our lifetimes. However, due to the prevailing winds within Benton County, the impacts of a major eruption from Mount Adams, Mount Hood or Mount Saint Helens to persons, property, infrastructure, and the environment in Benton County would be serious though not necessarily catastrophic. Therefore, there is a **LOW** probability of such an event occurring, but a **MODERATE** risk to persons, property, and the environment in Benton County should an eruption occur.

Impacts of Volcano Events

Refer to the *Benton County Annex* for volcano event impacts that would be expected to affect all jurisdictions in a similar manner. A volcanic eruption would likely be preceded or accompanied by seismic activity. Considering the fault connectivity noted by Blakely et al (2011), Benton City could potentially experience local seismic activity which could produce landslides, flooding, ground cracking, and soil liquefaction.

Development Trends

The population of Benton City has increased over the previous decade and therefore much of the demand for development has increased. There have been no changes in development that affect this jurisdiction's vulnerability regarding this hazard.

Values of Resources at Risk

It is difficult to estimate the value of resources at risk during a volcanic eruption. Costs associated with ash-related damage would likely depend on the duration of exposure and quantity of ash that settles within the municipality. Ash can collapse the roofs of buildings, impact water resources and infrastructure, clog vehicle engines, ground or damage airplanes, harm or kill livestock, crops, and other vegetation, and have adverse impacts on human and animal health. As indicated by the aftermath of the Mount St. Helens eruption in 1980, the damage caused by an eruption can total in the billions of dollars.

In addition to any kind of damage to infrastructure, there will be, depending on the volume of ash fall, high costs associated with clean-up efforts, the need for additional medical supplies, food and water, temporary shelter and transportation needs, and any other emergency supplies needed for both emergency responders and the general public.

Chapter 5: Mitigation Strategies

Mitigation Goals and Objectives

The goals and objectives, which guided the development of the plan, are intended to be implemented in the community by the year 2020. Each goal statement has objectives that provide a more specific framework for actions to be taken by the planning partners. They provide guidance for the development of the proposed mitigation action items in this section. Each mitigation action item is specifically designed to implement a corresponding goal and objective.

The following is a list of the goals and objectives for this hazard mitigation plan:

1. Encourage all sectors of the community to work together to create a disaster resistant community.
   a) Encourage participation in the planning process among local governmental entities.
   b) Encourage the promotion of hazard mitigation planning between local governmental entities, the business community, and volunteer organizations.
   c) Update the hazard mitigation plan on a regular basis, and as needed after a disaster event.
   d) Alert the community to the next update cycle of the hazard mitigation plan, and how they might become involved in that planning process.

2. Local governmental entities have the capabilities to develop, implement, and maintain effective hazard mitigation programs in Benton County.
   a) Maintain existing data. Also gather new data and information needed to define hazards, risk areas, and vulnerabilities in Benton County.
   b) Undertake an evaluation to determine the effectiveness of mitigation action items implemented in Benton County.

3. Collectively, the communities in Benton County have the capacity to initiate and sustain emergency operations during and after a disaster.
   a) Ensure that local emergency services have the capability to detect emergency situations and promptly initiate emergency response operations.
   b) Ensure that local emergency services facilities can withstand the impacts of disasters. Retrofit or relocate these facilities as needed.
   c) Ensure that utility and communications systems that support emergency services operations can withstand the impacts of disasters. Retrofit or relocate these facilities, as needed.

4. Local government operations are not significantly disrupted by disasters from natural hazards.
   a) Protect important local government records from the impacts of disasters.
   b) Retrofit or relocate buildings and facilities used for routine operations of government so they can withstand the impacts of disasters.
   c) Have redundant equipment, facilities and supplies on hand to reestablish local government operations after a disaster.
   d) Encourage the adoption of a plan and the identification of resources for how local government operations will be reestablished after a disaster.

5. Reduce the vulnerability to natural hazards to protect the health, safety and welfare of the community's residents and visitors.
   a) Provide the highest degree of natural hazard protection at the lowest-possible cost by working with natural systems and prioritizing prevention.
   b) Ensure there are adequate systems in place to provide emergency instructions during a disaster.
   c) Rely upon a combination of state or federal grants and locally generated funds (for the required match) to implement most mitigation action items.

6. Local governments support hazard mitigation planning and support the implementation of the mitigation action items for their jurisdiction.
   a) Support the integrations of mitigation action items from the hazard mitigation plan into local government comprehensive plans, development regulations, and Capitol Improvement Plans (CIPs).
   b) Support the adoption of Critical Area Ordinance (CAO) regulations, which prohibit inappropriate land uses within areas of high risk; and require mitigation measures when structures or facilities are allowed in areas of less risk.
   c) Adopt and enforce the most recent version of the International Building Code (IBC) along with its chapters as a way to address wind, fire, landslide and earthquake hazards.
   d) Support the adoption of land use designations, comprehensive plan policies, and development regulations which minimize new development within high hazard areas.
   e) Support the location of new facilities outside of areas vulnerable to the impacts of natural hazards.
   f) Design facilities to withstand the impacts of a disaster when it is not feasible to relocate them.
   g) Minimize the vulnerability of libraries, museums, and other institutions important to the daily lives of the community.

7. The local infrastructure of communities in Benton County is not significantly affected by a disaster from a natural hazard.
   a) Design and retrofit essential transportation facilities and systems to minimize the potential for disruption during a disaster.
   b) Design and retrofit essential water and sewer services to minimize the potential for disruption during a disaster.
   c) Encourage private sector hazard mitigation planning for the design and retrofit of energy and telecommunications infrastructure to minimize the potential for disruption during a disaster.
   d) Support key employers in the community to implement mitigation measures for their facilities and systems.

8. Residents understand the natural hazards of Benton County and are aware of ways to reduce their personal vulnerability to those hazards.
   a) Encourage the development, implementation and maintenance of education programs which explain the vulnerabilities and risks of natural hazards in Benton County, and ways to reduce their personal vulnerability to those hazards.

Encourage the development and implementation of education programs which explain the mitigation action items to be undertaken by various communities in Benton County.

Sources of Funding

All of the action items listed in the following tables will require some kind of funding, whether it be the donation of a person's time or an expensive county improvement project. Different types of projects will apply for funding from a variety of sources that cater specifically to accomplishing the goals of the action item. For example, a culvert replacement on a county road may be eligible for funding from the Natural Resource Conservation Service and the Washington State Department of Ecology.

The following is list of potential funding sources for mitigation projects in Benton County; however, this is in no way an exhaustive list:

Federal Funding Sources:

A. Hazard Mitigation Grants Program (FEMA)
B. Flood Mitigation Assistance Program (FEMA)
C. Pre-Disaster Mitigation Program (FEMA)
D. Homeland Security Grant Program (FEMA)
E. Federal Aviation Administration (U.S. Department of Transportation)
F. Federal Highway Administration (U.S Department of Transportation)
G. Community Development Block Grant Program (U.S. Department of Housing and Urban Development)
H. Natural Resource Conservation Service
I. U. S. Forest Service

State Funding Sources:

J. Flood Control Assistance Account Program (State of Washington Department of Ecology)
K. Washington State Department of Transportation (various programs)
L. Washington State Department of Natural Resources (DNR) Fire Prevention
M. Aquatic Lands Enhancement Area Program (DNR)
N. Washington State Department of Community, Trade and Economic Development's (DCTED) Grant
O. Washington State Department of Community, Trade and Economic Development's (DCTED) Public Works Trust Fund
P. Washington State Department of Community, Trade and Economic Development's (DCTED) Pre-Construction and Emergency Loans

Other Funding Sources:

Q. Annual allocations of the Parks Capital Improvements Program (for acquisition of sites along the shoreline)
R. Program for Growth Management Act compliance
S. Community Economic Revitalization Board

T. Insurance funds
U. Local Jurisdiction

Mitigation Action Items (MAI)

Mitigation action items make up the central piece of the Benton County Hazard Mitigation Plan. It is through the implementation of these action items that the communities within Benton County will truly become disaster resistant. For the purposes of this document, mitigation action items are defined as activities designed to reduce or eliminate losses resulting from natural hazards. These are the action items that the participating jurisdictions and organizations would implement when resources become available to do so.

Preparation of Mitigation action items

The mitigation action items were prepared by the members of the Hazard Mitigation Planning Committee based on the natural hazards addressed in this plan: flood, drought, wildfire, severe weather, earthquake, landslide, and volcano. Each member of the committee represented their entity and was responsible for gathering and coordinating the information required for their jurisdictional action items. Committee members either had sufficient information to form an action item or coordinated with staff in their jurisdictions that were most familiar with the facility, system, or geographic area being addressed. For each action item, a local mitigation action item template was prepared.

In addition to the basic statement explaining the mitigation action item, the template required additional information regarding a description of the problem, timeline on which the item will be implemented, potential funding source(s), as well as prioritization relative to all the mitigation action items from that governmental entity. The template also identified who would implement the mitigation action item when resources become available to do so.

Selection and Prioritization of Action Items

As part of the preparation process, all initiatives were prioritized by staff within the developing entity based on internal plans and policies. The priority of an initiative was determined and agreed upon by the entity that developed it based on community goals, feasibility, cost, and overall impact on the community. The numerical labeling and ordering of the initiatives does not have any implications for priority.

Progress on Local Mitigation efforts

With each revision of the Benton County Hazard Mitigation Plan and effort will be made to clarify the progress that has or has not been made toward the identified mitigation efforts. Each Mitigation Action Item (MAI) is identified with a timeline projection in the table format. There are currently 55 MAI's identified, 2 of those MAIS's are completed from the since the last plan update and 7 projects are on-going or done annually.

Mitigation Action Items: Benton County

The pages that follow document the specific hazard mitigation action items that this entity has elected to implement.

Flood

Benton County Flood MAI No. 1			
Mitigation Project Summary: Evaluate the development of a program (including obtaining a source of external funding) for acquisition of development rights within the Yakima River floodplain.			
Description of the Problem: Additional development can occur within the floodplain of the Yakima River, despite the potential for repetitive flood damage. An outright ban on development within the floodplain is not considered feasible.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Planning/Building Department	Contingent on Funding	B, J

Wildfire

Benton County Wildfire MAI No 1			
Mitigation Project Summary: Evaluate the development of a program of fire prevention inspections, particularly during those "red flag days" of high wildfire hazard. Target fire users and equipment operators.			
Description of the Problem: Many individuals are unaware of the potential wildland fire risk from "routine" actions.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Benton County Fire Marshal	2020	A, H, I

Benton County Wildfire MAI No 2			
Mitigation Project Summary: Evaluate the development of a program to control weeds and brush in interface areas. Where requirements for weed and brush control exist, expand enforcement as necessary to ensure the requirements are being met.			
Description of the Problem: A build-up of weeds and brush in interface areas contributes to the potential for wildfire.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Benton County Fire Marshal	2019 – On-going	L, A, C, H, I, U

Mitigation Action Items: Multi-Jurisdictional

The pages that follow document the specific hazard mitigation action items that each entity has elected to implement.

Multi-Hazard

Multi-Jurisdictional Multi-Hazard MAI No 1			
Mitigation Project Summary: Partner with other organizations (e.g. other federal, state, and local agencies, the Red Cross, other volunteer groups, etc.) to implement public education programs that focus on hazard mitigation. This project will help provide the following items: • Reach out to public schools to provide information on emergency preparedness and mitigation activities. • Provide mitigation workshops to community groups, emphasizing family preparations for disasters and hazards.			
Description of the Problem: Established emergency response agencies in the County have very limited staff and cannot take advantage of all of the opportunities there are for decreasing the risk of damage from hazards.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	BCEM	Annual – On-going	U, A, C

Multi-Jurisdictional Multi-Hazard MAI No 2			
Mitigation Project Summary: Implement CodeRED system that evaluates and streamlines the current process for giving out information to the public in a hazard event. Changes will be made as necessary to the process to ensure that correct and factual information reaches the public in a timely fashion. Consideration will be given to the differing information needs of the general public, media, businesses associated with tourism and travel, and other groups with special need or interests.			
Description of the Problem: Delays in providing information to the general public while obtaining official permission can make the information less useful than it might have been otherwise.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	BCES	Implemented	D, U

Wildfire

Multi-Jurisdictional Wildfire MAI No. 1			
Mitigation Project Summary: Develop and implement a wildfire prevention education program. Educate the general public, especially targeting children, fire equipment users, builders and developers, and homeowners. Create a funded position to coordinate this program who focuses on public contact, both with individuals and groups.			
Description of the Problem: Property developers and owners in the interface are often not aware of the problems and risks they face. Many homeowners have done very little to manage or offset fire hazards on their property.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	BCEM & combined Fire Districts/Departments	2020/ On-going	U, A, C

Multi-Jurisdictional Wildfire MAI No. 2			
Mitigation Project Summary: Work with WSU Extension, Master Gardner's and other existing programs to offer Firewise Landscaping clinics to assist property owners in maintain fire-resistant defensible space around their property.			
Description of the Problem: Many homeowners have done very little to manage or offset fire hazards on their property.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Low	BCEM & combined Fire Districts/Departments	2020/ On-going	C, H, I, U

Windstorm

Multi-Jurisdictional Windstorm MAI No. 1			
Mitigation Project Summary: Evaluate the development and implementation of a public education program (in coordination with the Benton Clean Air Agency) to educate the community (in particular those typically involved in ground clearing, e.g. builders, developers, and farmers) on the need to maintain groundcover and not leave soil exposed to wind.			
Description of the Problem: Bare soil is eroded by the wind and contributes to blowing dust. The blowing dust exacerbates the impacts of windstorms.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Benton County Planning/Building Department and Benton County Clear Air Agency	2019/On-Going	U

Mitigation Action Items: Benton City

The pages that follow document the specific hazard mitigation action items that this entity has elected to implement.

Multi-Hazard

Benton City Multi Hazard MAI No. 1			
Mitigation Project Summary: Develop evacuation plans for all-natural hazard scenarios.			
Description of the Problem: As a part of a continued effort to prepare the residents of Benton City for natural hazard scenarios, evacuation plans need to be developed for the various natural hazards that are addressed below.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Public Works	2 years	U
Goals Addressed: 3			

Benton City Multi-Hazard MAI No. 2			
Mitigation Project Summary: Determine a means of supplying backup power to well number 5 and sewer lift stations during the event of a power-outage. See ***Benton City Sewer Drainage Basin Map*** at the end of this section for more information.			
Description of the Problem: **Water:** The city currently does not have any backup power for any of the wells. If the city was to lose power for more than 24 hours, it would impact our ability to service water. We currently have 4 operating wells. Considering how the system is currently set up we would only need a generator at well #5. This would allow the upper reservoir to furnish water to the whole town. **Sewer:** Our sewer lift stations have no back-up power. The city currently has 7 operating lift stations around town. In the case of a power outage lift station #1 is at WWTP with backup power already, #2 would last about 4hrs, # 3 about 8hours, #4 about 30 minutes, #5 about 2 hours, #6 about 5 hours, #7 about 4 hours currently. These numbers are based on peak flow times. We need some sort of backup power for the lift stations as the water will last 24 hours and the lift stations will not. Water and sewer go hand in hand. If we can supply water but cannot supply power to take care of the sewer then the system is not meeting the needs of the community.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Public Works	2-5 years	A, U, C
Goals Addressed: 3			

Earthquake

Benton City Earthquake MAI No. 1			
Mitigation Action Summary: Assess structural integrity of major structures in Benton City as they relate to earthquake hazards and make any structural improvements necessary.			
Problem Description: Schools, fire stations, the post office, and city hall are larger buildings that should be assessed along with the bridge that spans the Yakima River.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Public Works	2023	U, A, C, D
Goals Addressed: 1, 3, 4, 5			

Flood

Benton City Flood MAI No. 1			
Mitigation Project Summary: Perform GIS mapping/modeling of Benton city to show flooding at different flood stages as part of a public education and awareness effort.			
Description of the Problem: Yakima River flooding continues to be a public safety concern that can only be addressed through outreach and education.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Public Works	2020	U, J
Goals Addressed: 3			

Benton City Flood MAI No. 2			
Mitigation Project Summary: Draft an action plan that outlines city responsibilities and involvement during a flood event.			
Description of the Problem: City preparedness for flood events is an on-going process that requires planning and organizational diligence.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Public Works	2020	U
Goals Addressed: 3			

Benton City Flood MAI No. 3			
Mitigation Project Summary: Determine a way to close off sewer main lines to prevent river water from entering the city sewer system in the event of a flood. See ***Benton City Sewer Drainage Basin Map*** at the end of this section for more information.			
Description of the Problem: Should flood waters rise high enough, river water will enter the city sewer system and be pumped by the lift stations. Lift stations #5 should have two additional shut-off valves and lift station #6 should have three additional shut-off valves.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Public Works	2021	U, J, A
Goals Addressed: 3			

Benton City Flood MAI No. 4			
Mitigation Project Summary: Increase the capacity of the storm water drain system and/or construct storm water retention ponds in problematic areas.			
Description of the Problem: Severe weather events pose a flash flood risk as the storm water drain system can become inundated during heavy rainfall. Portions of the system have become overloaded on several occasions due to heavy storms.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Public Works	2021	H, M, B
Goals Addressed: 3			

Landslide

Benton City Landslide MAI No. 1			
Mitigation Action Summary: Assess slope stability of McBee grade along the slopes of the Horse Heaven Hills.			
Problem Description: Situated at the toe slope of the Horse Heaven Hills, Benton City could be affected by a landslide event; particularly structures along the southernmost edge of Benton City and those near McBee Grade.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Low	Public Works	2021-2024	H, L
Goals Addressed: 1, 3, 4, 5			

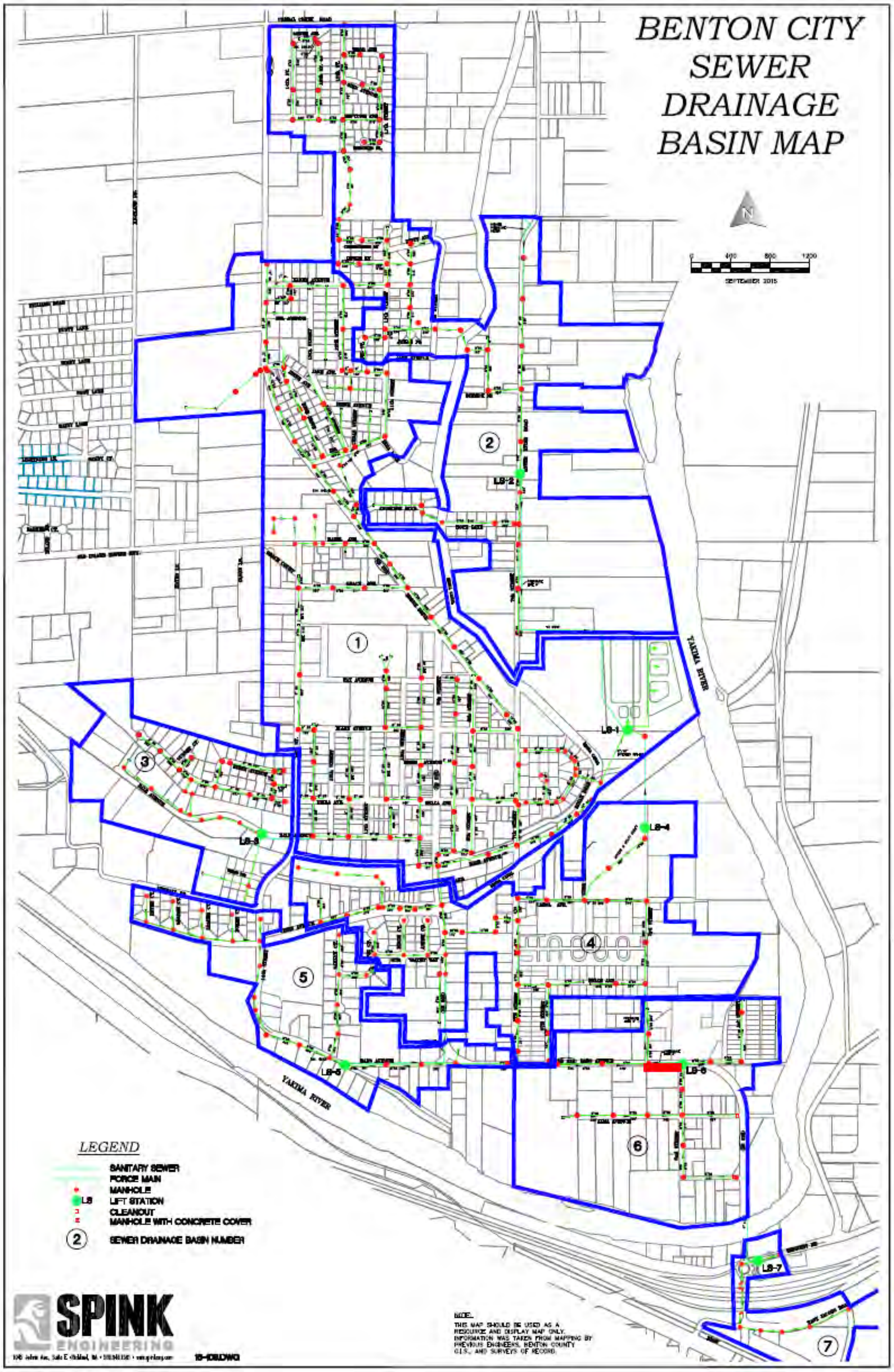
Wildfire

Benton City Wildfire MAI No. 1			
Mitigation Action Summary: Continue to promote wildfire awareness in the community through public education and outreach efforts.			
Problem Description: City preparedness for wildfire events is an on-going process that requires planning and organizational diligence.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Fire District #2	Annually	U, L
Goals Addressed: 1, 2, 3, 4			

Benton City Wildfire MAI No. 2			
Mitigation Action Summary: Work with Benton County to control weeds, brush, and debris and develop firebreaks within the county, particularly in areas bordering on higher density land uses and/or municipal boundaries.			
Problem Description: Accumulation of weeds, brush, and debris pose a wildfire hazard.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	City Administrator	Annually	U, L
Goals Addressed: 1, 2, 3, 4			

Windstorm

Benton City Windstorm MAI No. 1			
Mitigation Action Summary: Work with Benton PUD and Benton REA to replace aboveground power lines with underground power lines.			
Problem Description: Severe windstorms can directly and indirectly damage aboveground power lines, causing power outages and disruption of services and businesses.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Public Works	2021-2025	K, O, C, A
Goals Addressed: 1, 3, 4, 5			


BENTON CITY SEWER DRAINAGE BASIN MAP
SEPTEMBER 2015
YAKIMA RIVER
LS-1
LS-2
LS-3
LS-4
LS-5
LS-6
LS-7
LEGEND
SANITARY SEWER
FORCE MAIN
MANHOLE
LS LIFT STATION
CLEANOUT
MANHOLE WITH CONCRETE COVER
2 SEWER DRAINAGE BASIN NUMBER
SPINK ENGINEERING
NOTE:
THIS MAP SHOULD BE USED AS A RESOURCE AND DISPLAY MAP ONLY. INFORMATION WAS TAKEN FROM MAPPING BY PREVIOUS ENGINEERS, BENTON COUNTY G.I.S., AND SURVEYS OF RECORD.

Mitigation Action Items: City of Kennewick

The pages that follow document the specific hazard mitigation action items that this entity has elected to implement.

Flood

Kennewick Flood MAI No. 1			
Mitigation Summary: Work with the U.S. Army Corps of Engineers, Walla Walla District, to provide erosion protection to the riverbank along the Columbia Park Trailway.			
Problem Description: The riverbank and Columbia Park Trail are subject to erosion and undermining during flood flows. The Walla Walla District maintains authority over the riverbank. Any project involving placement of riprap or other material along the riverbank will require USACE approval and permitting.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Kennewick Parks and Recreation	2021	H, B, A, C
Goals Addressed: 1, 4, 5			

Wildfire

Kennewick Wildfire MAI No. 1			
Mitigation Action Summary: Develop wildfire mitigation actions for the urban interface in concert with Benton County rural fire districts. Actions may include: public education in the most vulnerable areas, review and updating of codes and ordinances, fuel mitigation (e.g. thinning especially in the canyons), and evaluation of using physical barriers (similar to snow fences) to prevent tumbleweeds from accumulating along urban interface residential fences. The following items are in Chapter 6 of the Benton County CWPP (see Appendix E for more information) • **Distribute Firewise-type educational brochures with occupancy permit (CWPP MAI 6.1a).** • **Prepare for wildfire events in high risk areas by conducting home site risk assessments and developing area-specific “Response Plans” to include participation by all affected jurisdictions and landowners (CWPP MAI 6.2c).** • **Locate funding for fuel reduction projects throughout the City, but particularly within the riparian zones identified (CWPP MAI 6.2i, Benton Conservation District).** • **Fund the existing fire Prevention/Public Education Division to develop a public information campaign addressing wildland fire safety and defensible space (CWPP MAI 6.2j).** • **Train local firefighters to perform home assessments which will provide home owners with quality advice on how to make their homes defensible (CWPP MAI 6.4b)**			
Problem Description: Wildfires burning northward toward Kennewick from the Horse Heaven Hills are difficult to access due to the steep terrain. Access is typically available to individual houses, but not into the hills and canyons around the houses. Weed and brush control on undeveloped lands outside the City’s boundaries is lacking.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	**Kennewick Fire Department**	**2019-2020**	**U, L,**
Goals Addressed: 1, 2, 3			

Windstorm

City of Kennewick Windstorm MAI No. 1			
Mitigation Action Summary: Develop a public education, recovery, and debris management approach for dealing with windstorm impacts on a City-wide basis. Provide residents with information on tree management to help preserve and maintain their trees in a way that reduces the potential for windstorm damage.			
Problem Description: Severe windstorms can directly damage trees on both public and private property, and create secondary effects such as loss of power, damage to property, blocked roadways, etc.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Kennewick Municipal Services	2020	H, I, A, U
Goals Addressed: 2, 6			

Mitigation Action Items: City of Prosser

The pages that follow document the specific hazard mitigation action items that this entity has elected to implement.

Multi-Hazard

Prosser Multi-Hazard MAI No. 1			
Mitigation Action Summary: Develop an Emergency Operations Plan for the City of Prosser. In addition to the basic hazard and emergency response items to be addressed, the plan should address mitigation, preparation, and response activities for the following community concerns: • A large-scale ammonia release. • Railroad accident involving hazardous materials. • Hazardous materials incident (at plant or during transport by truck). • Event at the East Prosser Industrial Park. • Chlorine gas incident at WWTP. • Urban fire in downtown Prosser.			
Description of Problem: Prosser lacks a city-specific emergency operations plan.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	City Administrator	COMPLETED	

Prosser Multi-Hazard MAI No. 2			
Mitigation Action Summary: Develop alternate sources of power for the City to include (a) ensuring that all critical facilities have sufficient emergency power generators to maintain operations during the emergency; and (b) identify an alternate source of primary power transmission to shorten the recovery period.			
Problem Description: The City is served by a single main power transmission line. Failure of the line would cut off power to the City for however long it took to repair the line. Emergency generators are available for the City's critical facilities with the exception of the Housel Middle School (the emergency shelter and incident command post). Also, there is insufficient emergency power capability to fully maintain water supply and treatment, including waste treatment.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Public Works	2022	A, C, D,

Prosser Multi-Hazard MAI No. 3			
Mitigation Action Summary: Procure traffic directional signage and barricades sufficient to direct traffic into Housel Middle School when shelter is required, and to direct Prosser residents out of town if evacuation is required.			
Problem Description: Although the city has designated Housel Middle School as an emergency shelter, they lack portable traffic signs and barricades to direct traffic during an evacuation scenario.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Police Department	2021	K, U, D, C

Prosser Multi-Hazard MAI No. 4			
Mitigation Action Summary: Acquire portable radios so that in the event of an emergency multiple departments can communicate with Public Works crews.			
Problem Description: Currently the Prosser Public Works Department has no radio system. In the event of an emergency communication is dependent on cellular service. A portable to portable system is less likely to be impacted by an emergency such as a power outage or other event.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Police Department	Short term	U, D, A ,C

Flood

Prosser Flood MAI No. 1			
Mitigation Project Summary: Address high vulnerability of wastewater lines to flooding by (1) re-directing wastewater flow from the City north of the river directly to the WWTP, eliminating the need for the flow crossing the river twice; and (2) re-engineer the lines connecting the south side of the City with the plant to provide adequate flood protection, perhaps by raising them above the river (using nearby road bridges).			
Description of the Problem: Wastewater is collected from the City north of the Yakima River, pumped across the river to the south side of the City, and then sent back across the river in two buried lines to the City's treatment plant. All wastewater entering the plant does so through these two lines crossing the bottom of the Yakima River. The wastewater lines crossing the river are highly vulnerable to flood damage. The wastewater treatment plant is a critical facility for the City.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Public Works	2024	H, B, M, O, A , C
Goals Addressed: 5			

Prosser Flood MAI No. 2			
Mitigation Project Summary: Provide structural flood mitigation/protection measures to the wastewater treatment plant pump house and drying beds.			
Description of the Problem: At the wastewater treatment plant, the area around the drying beds, including the pump house at the plant, is subject to flooding during the 100-year flood event. The pump house and the drying beds are considered moderately vulnerable to flood damage.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Public Works	2024	C, A, B, U
Goals Addressed: 5			

Prosser Flood MAI No. 3			
Mitigation Project Summary: Redevelop downtown storm drains to accommodate current levels of storm water run-off and redesign drains to prevent debris blockage.			
Description of the Problem: Currently the Downtown floods due to a combination of poorly designs drains and undersized drain capacity. As Prosser has grown, and impervious surfaces increased, the amount of water carried to the downtown during nearly every significant storm has resulted in flooding of businesses in the Downtown.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Public Works	2023	H, A, C, B
Goals Addressed: 5			

Windstorm

Prosser Windstorm MAI No. 1			
Mitigation Action Summary: Fully develop the Tree Management Program to allow for continual maintenance of the city-owned trees, including evaluation of potential hazards and immediate response to identified hazards.			
Problem Description: The City owns approximately 961 large old trees within parks, rights-of-way, etc. Periodic grants from the state have allowed development of a Tree Management Program to inventory trees and identify immediate hazards. However, funding has not been sufficient for the City to adequately maintain the tree hazard elimination aspects of the program. Severe windstorms can directly damage trees, and create secondary effects such as loss of power, damage to property, blocked roadways, etc.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Public Works	2020	H, L, U , C

Prosser Windstorm MAI No. 2			
Mitigation Action Summary: Expand the Tree Management Program to include a public education and/or assistance component, providing residents with information on tree management, and possibly some form of assistance to preserve and maintain their trees in a way that mitigates against hazard damage.			
Problem Description: The current Tree Management Program does not provide for public education for addressing tree issues on private property. Severe windstorms can directly damage trees, and create secondary effects such as loss of power, damage to property, blocked roadways, etc.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Public Works	2019-2021	U, H, L , U ,C

Other Hazards

Prosser Other Hazard MAI No. 4			
Mitigation Action Summary: Identify and evaluate mitigation measures for urban fire hazards in Prosser, including public communication and education efforts.			
Problem Description: Urban fire is a serious concern for downtown Prosser. The older sections of downtown are turn-of-the-century unsupported brick buildings, lacking firewalls and sprinklers, and often with open or connected basements. A fire in the downtown area would be difficult to stop until it burned the entire connected block.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	WBFR	2021	U, other Fire Prevention Grants

Mitigation Action Items: City of Richland

The pages that follow document the specific hazard mitigation action items that this entity has elected to implement.

Multi-Hazard

Richland Multi-Hazard MAI No. 1			
Mitigation Action Summary: Develop partnerships to deliver public education and training for hazard mitigation.			
Proposed Solution: This is consistent with the department's objective for the prevention of fire, injury, accident, and illness.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Fire	2019	U

Richland Multi-Hazard MAI No. 2			
Mitigation Action Summary: Streamline the process for providing information to the public pre, during, and post incident.			
Proposed Solution: The Department's Public Information Officer is already active with other high-profile organizations that closely interact with prevention programs. He is also experienced with multi-agency response and unified command through participation with Interagency Incident Management Teams on incidents.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	COR Fire, Police and Marketing and BCEM	On-going	U

Richland Multi-Hazard MAI No. 3			
Mitigation Action Summary: Evaluate the equipment that will be required by emergency response personnel to ensure that personnel are self-contained			
Problem Description: The Fire Department will have to further refine plans to ensure self-sufficiency for at least a 72-hour period of active duty. A second concern is to ensure that firefighter's families are prepared so that firefighters can leave them and respond to the emergency.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Fire	2019	U

Richland Multi-Hazard MAI No. 4			
Mitigation Action Summary: Continue to evaluate data and conduct studies to provide for more in-depth and accurate evaluation of potential disaster impacts.			
Problem Description: While the emergency response components are generally well developed and exercised through preparation for technological disasters in the area, other elements such as education, enforcement, economic incentives, and engineering for specific natural threats require more thorough evaluation.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Fire, BCEM	2020	U

Richland Multi-Hazard MAI No. 5			
Mitigation Action Summary: Evaluate evacuation routes through and from the City.			
Problem Description: Topographical restrictions produce significant bottlenecks on the main arterial roads between south and central Richland. The Fire Department will have to develop a comprehensive route plan to address this issue.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Low	Fire, Public works	2023	U, K

Richland Multi-Hazard MAI No. 6			
Mitigation Action Summary: A system wide evaluation of the water system to identify specific issues that could occur during a hazard event.			
Problem Description: The department is totally reliant on the reticulated water supply for fire operations. Mutual aid tenders and static supply alternatives will be identified in the event of a water system failure.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Fire, Public Works	2023	U, A, C, O

Richland Multi-Hazard MAI No. 7			
Mitigation Action Summary: Evaluate critical infrastructure for self-sustainability in the event of catastrophe.			
Problem Description: Water, sewer, electricity, health care, and emergency facilities must be evaluated to confirm that they are capable of withstanding a 7.0 or greater earthquake with redundancies which will provide for self-sustainability over a period of at least 72 hours.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Public Works	2022	U, A, C

Richland Multi-Hazard MAI No. 8			
Mitigation Action Summary: Wide spread information delivery capabilities are important to ensuring calm and effective delivery of services during an emergency.			
Problem Description: City of Richland must have a system in place which will allow dissemination of information throughout the city regardless of damage to traditional communication channels.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Low	Communications and Marketing	2024	U, A, C

Richland Multi-Hazard MAI No. 9			
Mitigation Action Summary: City of Richland must have a complete critical infrastructure and key resources (CIKR) inventory with the ability to provide community triage both city wide and in zones depending on the size, type, and severity of an incident.			
Proposed Solution: The CIKR must integrate with mobile data terminals and dispatching centers to allow rapid and calculated initiation of triage for CIKR in the city. All CIKR stakeholders within the city must be aware of the triage system and reasons for triaging prior to an incident.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Community Development, Fire, BCES, Public Works	2023	U, A, C,

Earthquake

Richland Earthquake MAI No. 1			
Mitigation Action Summary: Develop more stringent seismic rating system for buildings and other major structures.			
Problem Description: New development and developmental-expansion onto steeper, less stable terrain has increased Richland's vulnerability to earthquake events.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Low	Community Development	2025	U, N, A , C

Flood

Richland Flood MAI No. 1			
Mitigation Action Summary: Develop a flood mitigation plan that focuses on, but is not limited to, prevention projects such as an assessment of the dyke system, identification of at-risk structures, and assessment of wastewater transportation and treatment capabilities.			
Problem Description: With the Columbia and Yakima Rivers converging in side city limits, the potential for a flood event is high. A flood could inundate structures in flood zones and overwhelm infrastructure such as wastewater transportation and treatment facilities.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	Community Development, BCEM, public works,	2024	U, C, B, A

Wildfire

Richland Wildfire MAI No. 1			
Mitigation Action Summary: Develop a program to foster communication and coordination of wildfire prevention measures between wildland/urban interface property owners, developers, and city agencies. The following items are in Chapter 6 of the Benton County CWPP (see appendix E for more information): • **Implementation of youth and adult wildfire educational programs (CWPP MAI 6.2a).** • **Distribute educational information regarding construction in high risk wildfire areas (CWPP MAI 6.2b).** • **Work with area homeowner's associations to foster cooperative approach to fire protection and awareness and identify mitigation needs (CWPP MAI 6.2d).** • **Work with WSU Extension, Master Gardeners, and other existing programs to offer firewise landscaping clinics to assist property owners in maintaining fire-resistant defensible space around structures (CWPP MAI 6.2e)** • **Develop a range of public education programs to encourage healthy management of natural resources on private property (CWPP MAI 6.2f).** • **Fund the existing fire Prevention/Public Education Division to develop a public information campaign addressing wildland fire safety and defensible space (CWPP MAI 6.2j).** • **Train local firefighters to perform home assessments which will provide home owners with quality advice on how to make their homes defensible (CWPP MAI 6.4b).**			
Proposed Solutions: • **Encourage single-family residences to have fire plans and practice evacuation routes.** • **Encourage fire inspections in residential homes by fire departments to increase awareness among homeowners and potential fire responders.** • **Encourage a standard for the State Fire Marshall to evaluate fire plans and emergency plans.** • **Encourage landowners and/or developers who choose to build in the wildland/urban interface to identify and mitigate conditions that aggravate wildland/urban interface wildfire hazards.** • **Encourage property owners to retrofit existing structures to remove/replace shake roofs.**			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Fire	2020	U, L, A, C,

Richland Wildfire MAI No. 2
Mitigation Action Summary: Develop a detailed WUI and Wildfire Hazard Assessment for the City of Richland. The following items are in Chapter 6 of the Benton County CWPP (see appendix E for more information): • **Review State Building Codes and recommend revisions to meet Firewise standards as needed (CWPP MAI 6.2g).** • **Enhance radio availability in each district, link to existing dispatch, improve range within the region, and convert to a consistent standard of radio types (CWPP MAI 6.4a).**
Proposed Solution: • **Identify areas where existing vegetation creates a wildfire hazard.** • **Identify locations with limited access for emergency equipment due to width and grade of road.** • **Identify location with inadequate water supplies.**

• **Evaluate areas with inadequate fuel breaks, or lack of defensible space.** • **Evaluate the use of highly flammable construction materials.** • **Identify building lots and subdivisions that are not in compliance with state and local land use and fire protection regulations.**			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Fire	2021	U, M

Richland Wildfire MAI No. 3			
Mitigation Action Summary: Develop and implement a plan to reduce wildfire potential in the Yakima River delta and Amon Creek drainage. The following item is in Chapter 6 of the Benton County CWPP (see appendix E for more information): • **Locate funding for fuel reduction projects throughout the City, but particularly within the riparian zones identified (CWPP MAI 6.2i, Richland).**			
Proposed Solution: • **Employ mechanical thinning to abate the risk of catastrophic fire and restore the more natural regime of higher frequency, low-intensity burns. Mechanical thinning can provide benefits to ecosystems by thinning hazardous vegetation and restoring ecological diversity to areas homogenized by invasive plants.** • **Clear trimmings, trees, brush, and other debris completely from sites when performing routine maintenance and landscaping to reduce fire risk.**			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Fire	2021	U, H, L, M,

Richland Wildfire MAI No. 4			
Mitigation Action Summary: Conduct fuels mitigation projects and implement community fire protection standards.			
Proposed Solution: • Enter into contracts with US Army Corps of Engineers, BLM, and DNR, which provide for fuel mitigation in critical locations within the City of Richland. Critical locations include Yakima River delta, Amon Creek Drainage, Bateman Island, Columbia Point, and federally controlled lands located in south Richland. Contracts must identify and provide for pre-incident fuel mitigation cost allocations. Financial responsibilities must also be identified for combat and rehabilitation of these wildlands in the event of a catastrophic event. • Identify and employ hazard mitigation programs within the above-mentioned critical locations. Hazard mitigation will include mechanical thinning, creation of firebreaks, and improvement/annual maintenance of access and egress points in the identified areas to ensure access for responders as well as safe egress for users in the event of fire. • Develop and implement a program using existing Fire-Wise criteria and materials to ensure that current residents as well as developers in urban interface zones have the knowledge and tools needed to reduce the potential for loss of life and property in the event of wildfire. Current hazard zones are identified in the City of Richland Community Wildfire Protection Plan.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	Fire	2021	U, M C

<table>
<tr><td colspan="4">Richland Wildfire MAI No. 5</td></tr>
<tr><td colspan="4">Mitigation Action Summary: Develop and implement a plan to reduce wildfire potential in the wild land-urban interface.
• Prepare for wildfire events in high risk areas by conducting home site risk assessments and developing area-specific “Response Plans” to include participation by all affected jurisdictions and landowners (CWPP MAI 6.2c).</td></tr>
<tr><td colspan="4">Proposed Solution:
• Badger Mountain is characterized by light fuels with very little potential for effective fuel mitigation. This area is a hazard due to its recreational attraction and will require awareness education for visitors to improve fire safety.
• BLM owns a large piece of contiguous property inside the City of Richland, between Keene Rd. and Heritage Hills, which is comprised primarily of grasses and sagebrush. This area is being quickly surrounded by housing developments. As a result, the area is seeing increased human activity and further potential for problems. Ongoing education of homeowners in the area will reduce property losses in the event of a fire in this area.</td></tr>
<tr><td>Priority</td><td>Lead Agency</td><td>Timeline</td><td>Funding Sources</td></tr>
<tr><td>High</td><td>Fire</td><td>2020</td><td>L, U, C A</td></tr>
</table>

Windstorm

<table>
<tr><td colspan="4">Richland Windstorm MAI No. 1</td></tr>
<tr><td colspan="4">Mitigation Action Summary: Pruning and removal of hazard trees will reduce the potential for injury to people and damage to property during a windstorm event.</td></tr>
<tr><td colspan="4">Problem Description: Hazard trees are not only capable of interrupting critical infrastructure through power line disruption but are a hazard to homes and lives during a significant wind event. With increasing budgetary constraints, funding for hazard abatement personnel and equipment needs to be a high priority. A fully funded dual-role hazard abatement team with equipment would be capable of performing hazard mitigation prior to wind events as well as fuel mitigation projects identified above in the Wildfire section.</td></tr>
<tr><td>Priority</td><td>Lead Agency</td><td>Timeline</td><td>Funding Sources</td></tr>
<tr><td>High</td><td>Public Works</td><td>2020</td><td>U, H,</td></tr>
</table>

Mitigation Action Items: City of West Richland

The pages that follow document the specific hazard mitigation action items that this entity has elected to implement.

Multi-Hazard

West Richland Multi-Hazard MAI No. 1			
Mitigation Action Summary: Develop alternate routes of access into and out of the City, including constructing a new bridge over the Yakima River connecting the City to SR 240, completing the Keene Road extension and other projects as detailed in the City's Six-Year Transportation Improvement Program. In addition, the City will work with State and Federal highway agencies to develop a new access to I-82 west of Candy Mountain.			
Problem Description: The City's access routes are insufficient in the event of large-scale evacuation (whether into or out of the City). Some suggested transportation projects, such as a new connection to I-82, require action by State and Federal agencies.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	West Richland Public Works	Long (> 5 yrs)	K, N, O

West Richland Multi-Hazard MAI No. 2			
Mitigation Action Summary: Develop an Emergency Operations Plan for the City of West Richland. In addition to the basic hazard and emergency response items to be addressed, the plan should address various evacuation scenarios.			
Description of Problem; West Richland does not have a city-specific emergency operations plan. The City relies on the general Benton County Comprehensive Emergency Management Plan developed by BCEM. The general County Plan, however, lacks community-specific detail on various potential hazards and situations of concern to the City and local residents.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	West Richland Public Works	Short (0 - 2 yrs)	U

West Richland Multi-Hazard MAI No. 3			
Mitigation Action Summary: Develop alternate sources of power for the City to ensure that all critical facilities have sufficient emergency power generators to maintain operations during the emergency.			
Problem Description: The City has insufficient emergency power capability to fully maintain water supply and treatment, including waste treatment services in the event of a sustained power outage.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	West Richland Public Works	Short (0 - 2 yrs)	A, D, C, U

Flood Hazard

West Richland Flood MAI No. 1			
Mitigation Project Summary: Redesign and engineer the WWTP to ensure protection against future flooding, including: placing the influent line underground; installing a pumped outflow to the river with a backflow prevention device; and acquiring backup generators for the entire system (including sewer lift stations). The City anticipates building a new expansion plant of similar capacity adjacent to the existing facility in five years to accommodate increasing growth. Ideally, protection of the existing WWTP should occur prior to or in sync with the new construction.			
Description of the Problem: The wastewater treatment plant has experienced flood damage during significant flood events. During the flood of February 1996, floodwaters damaged the aboveground influent pipe to the plant, and damaged the power supply. The gravity flow effluent system failed, and effluent backed up within the berm around the plant.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	West Richland Public Works	Long	U, A, J, C

Wildfire

West Richland Wildfire MAI No. 1			
Mitigation Action Summary: Develop a detailed Wildland Urban Interface and Wildfire Hazard Assessment through a cooperative agreement between the City and Benton County Fire Protection District No. 4.			
Problem Description: As new homes are built on the edge of the open area surrounding the City, there is an increasing amount of potential for property damage.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
Medium	West Richland Code Enforcement/Benton County Fire District No. 4	Short (< 5 yrs)	U,L

Windstorm

West Richland Windstorm MAI No.1			
Mitigation Action Summary: Develop and implement programs to keep trees from threatening lives, property and public infrastructure during windstorm events.			
Problem Description: A number of power lines are surrounded by trees throughout the City. Damage to any of these trees could mean the loss of a power line causing an outage in a significant portion of the City.			
Priority	**Lead Agency**	**Timeline**	**Funding Sources**
High	West Richland Public Works	Short (< 1-2 yrs)	U, H, L, C, A

Appendix A: Forms

The various forms in Appendix A are designed to assist the planning committee in maintaining the Hazard Mitigation Plan. These forms can be used to document mitigation projects as they are completed and assist in annual plan updates.

Mitigation Action Implementation Worksheet

Complete a mitigation action implementation worksheet for each identified mitigation action.

Jurisdiction:	
Mitigation Action/Project Title:	
Background/Issue:	
Ideas for Integration:	
Responsible Agency:	
Partners:	
Potential Funding:	
Cost Estimate:	
Benefits: (Losses Avoided)	
Timeline:	
Priority:	
Worksheet Completed by:	(Name/Department)

Mitigation Action Progress Report Form

Progress Report Period	From date:	To date:
Action/Project Title		
Responsible Agency		
Contact Name		
Contact Phone/Email		
Project Status	❑ Project completed ❑ Project canceled ❑ Project on schedule Anticipated completion date: ____________________________ ❑ Project delayed Explain ____	

Summary of Project Progress for this Report Period

1. What was accomplished for this project during this reporting period?

2. What obstacles, problems, or delays did the project encounter?

3. If uncompleted, is the project still relevant? Should the project be changed or revised?

4. Other comments

Plan Update Evaluation Worksheet

Plan Section	Considerations	Explanation
Planning Process	Should new jurisdictions and/or districts be invited to participate in future plan updates?	
	Have any internal or external agencies been invaluable to the mitigation strategy?	
	Can any procedures (e.g., meeting announcements, plan updates) be done differently or more efficiently?	
	Has the Planning Team undertaken any public outreach activities?	
	How can public participation be improved?	
	Have there been any changes in public support and/or decision- maker priorities related to hazard mitigation?	
Capability Assessment	Have jurisdictions adopted new policies, plans, regulations, or reports that could be incorporated into this plan?	
	Are there different or additional administrative, human, technical, and financial resources available for mitigation planning?	
	Are there different or new education and outreach programs and resources available for mitigation activities?	
	Has NFIP participation changed in the participating jurisdictions?	
Risk Assessment	Has a natural and/or technical or human-caused disaster occurred?	
	Should the list of hazards addressed in the plan be modified?	
	Are there new data sources and/or additional maps and studies available? If so, what are they and what have they revealed? Should the information be incorporated into future plan updates?	
	Do any new critical facilities or infrastructure need to be added to the asset lists?	
	Have any changes in development trends occurred that could create additional risks?	

Plan Section	Considerations	Explanation
	Are there repetitive losses and/or severe repetitive losses to document?	
Mitigation Strategy	Is the mitigation strategy being implemented as anticipated? Were the cost and timeline estimates accurate?	
	Should new mitigation actions be added to the Action Plan? Should existing mitigation actions be revised or eliminated from the plan?	
	Are there new obstacles that were not anticipated in the plan that will need to be considered in the next plan update?	
	Are there new funding sources to consider?	
	Have elements of the plan been incorporated into other planning mechanisms?	
Plan Maintenance Procedures	Was the plan monitored and evaluated as anticipated?	
	What are needed improvements to the procedures?	

Appendix B: Capabilities Assessment

Hazard mitigation capabilities include existing authorities, policies, programs, and resources that reduce hazard impacts or that could be used to implement hazard mitigation activities.

Benton County Capabilities Assessment

Planning and Regulatory

Planning and regulatory capabilities are the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. Please indicate which of the following your jurisdiction has in place.

Plans	Yes/No Year	Does the plan address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan	Yes, 2018	The current Benton County Comprehensive Plan has a chapter dedicated to natural resources which covers flood hazards and geologic hazards as mandated by State law. While the plan does not specifically outline mitigation strategies, it does reference development regulations. Benton County recently completed updating its Comprehensive Plan which has goals and policies related to wildland fire hazards.
Capital Improvements Plan	Yes, 2018	The Capital Improvement plan does not specifically address hazard mitigation. However, projects that might address hazard mitigation would be added to the CIP in order to be funded.
Economic Development Plan	Yes, 2014	No. The Economic Development Plan is a high-level strategic document that deals with broad economic development goals and objectives, lists possible large-scale projects, and identifies possible strategic partnerships.
Local Emergency Operations Plan	Unknown	Refer to Benton County Emergency Services
Continuity of Operations Plan	Unknown	Refer to Benton County Emergency Services
Transportation Plan	Yes, 2018	The transportation plan does not address natural hazards but does include projects that are intended to improve roadway safety. The transportation plan would not be an appropriate place to implement mitigation actions.
Stormwater Management Plan	No	
Community Wildfire Protection Plan	Yes 2019	Refer to Benton County CWPP – revised 2019
Other special plans (i.e., brownfields redevelopment , disaster recovery, coastal zone management, climate change adaptation)	No	

Building Code, Permitting, and Inspections	Yes/No	Are codes adequately enforced?
Building Code	Yes	BCC 3.04; revised 3/2016. Building codes are enforced by either the building inspectors (3 FT inspectors) or with the assistance of the Code Enforcement Officer
Building Code Effectiveness Grading Schedule (BCEGS) Score	No	Score:
Fire department ISO rating	No	Rating:
Site plan review requirements	Yes	All site plans are reviewed by the building and planning departments for compliance with both departments codes, including compliance with any critical area (flood/geologic hazard) requirements.
Land Use Planning and Ordinances	**Yes/No**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	Yes	The zoning ordinance is effective to the degree that it discourages development or redevelopment within natural hazard areas by requiring compliance with its regulations. Yes, this ordinance is adequately administered and enforced by the Planning Department and additionally enforced by the Code Enforcement Officer.
Subdivision ordinance	Yes	Yes, the ordinance is effective, please see some of the following requirements: All subdivision applications undergo a critical area review and must have adequate means of ingress and egress. Applications are forwarded on to the following agencies for their review and requirements; Fire Marshal and Fire Districts; at which time they can address proposed access issues if necessary. All subdivisions must meet applicable emergency vehicle standards. Lot sizes in excess of the minimum standards may be required if hazards are present. A subdivision may be recommended for disapproval if flood conditions occur on the subject parcel. The ordinance is well enforced as no subdivision development can occur without meeting all the regulations set forth in the subdivision ordinance.
Floodplain ordinance	Yes	The Flood Damage Prevention ordinance regulates develop within FEMA flood zones and floodways. This ordinance reduces flood hazard impacts by ensuring all FEMA regulations are met, such as elevating structures 1 foot above the base flood elevation that fall within a 100 yr flood zone. Yes, this ordinance is adequately enforced, as no building permit is issued until it's requirements are met.
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Yes	Title 15 of the Benton County Code covers Critical Areas and Resources. Pertaining to hazard mitigation, it includes rivers and creeks, frequently flooded areas, and geologically hazardous areas. The ordinance is effective at reducing geologic and flood hazards. The 2018 update to this CAO is complete and will be more effective at reducing hazard impacts.
Flood insurance rate maps	Yes	The use of the FEMA FIRM maps does reduce hazard impacts by ensuring all development within flood zones and floodways are regulated. These maps are used during critical area reviews, administered and enforced.
Acquisition of land for open space and public recreation uses	Yes	The County has had multiple opportunities to acquire property for parks, recreation, and conservation purposes. While this has not been specifically for hazard mitigation, the ordinance would facilitate that.
Other		

Administrative and Technical

Identify whether your community has the following administrative and technical capabilities. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. For smaller jurisdictions without local staff resources, if there are public resources at the next higher-level government that can provide technical assistance, indicate so in your comments.

Administration	Yes/No	Describe capability Is coordination effective?
Planning Commission	Yes	The Planning Commission serves as an advisory board on matters related to physical development of land in the unincorporated area. They often defer to the expertise of Planning Staff on issues such as flood and geologic hazards as well as outside technical expertise if necessary.
Mitigation Planning Committee	No	
Maintenance programs to reduce risk, e.g., tree trimming, clearing drainage systems	Yes	The Public Works Department regularly performs tree trimming along roadways, cleaning of roadside ditches, cleaning of culverts and cleaning of storm drainage facilities. The focus of this effort is roadway operations and safety.
Mutual aid agreements	Yes	Benton County has mutual aid agreements with surrounding jurisdictions for provision of equipment, labor and materials. Coordination is effective.
Staff	**Yes/No FT/PT42**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	Yes, FT	Building staff is adequate to enforce building code regulations with assistance from the Code Enforcement Officer. Staff is not generally trained on hazards and mitigation, however Building staff rely on Planning Department for some hazard regulations.
Floodplain Administrator	Yes, FT	The Benton County Planning Department acts as the local floodplain administrator in coordination with the Building Department.
Emergency Manager	No	Benton County defers all services under this role to Benton County Emergency Services.
Community Planner	Yes, FT	Yes, staff is adequate to enforce regulations with the assistance of the Code Enforcement Officer. All four FT Planners are trained on identifying critical area hazards and implementing the appropriate regulations to help mitigate potential affects. Coordination between agencies and staff is very effective.
Civil Engineer	Yes, FT	Staffing is adequate to enforce regulations which are limited for this position. Staff is trained on hazards and mitigation and can coordinate well with other agencies.
GIS Coordinator	Yes, FT	This position does not enforce regulations. This position creates the data layers for Benton County's GIS maps (including critical areas) and does not do any work on mitigation.
Other	Yes, FT	FT Code Enforcement Officer enforces many of the County's regulations.

[42] Full-time (FT) or part-time (PT) position

Technical	Yes/No	Describe capability Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	No	Responsibility of Benton County Emergency Services.
Hazard data and information	No	
Grant writing	Yes	Grant writing capabilities are on a case-by-case basis, mostly dependent on the rigor and workload needed to complete the task. If a project is important but is beyond the capabilities of staff, professional services are contracted.
Hazard analysis	Yes	Planning Department does a critical area (geologic and flood hazard) review for parcels during the development permit process.
Other		
How can these capabilities be expanded and improved to reduce risk?		

Financial

Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.

Funding Resource	Access/ Eligibility (Yes/No)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Yes	Yes, the County has access to this type of project funding, however historically it has not been used on hazard mitigation.
Authority to levy taxes for specific purposes	Yes	Yes, the County has access to this type of project funding, however historically it has not been used on hazard mitigation.
Fees for water, sewer, gas, or electric services	No	
Impact fees for new development	Yes	Yes, the County has access to this type of project funding, however historically it has not been used on hazard mitigation.
Storm water utility fee	Yes	Yes, the County has access to this type of project funding, however historically it has not been used on hazard mitigation.
Incur debt through general obligation bonds and/or special tax bonds	Yes	Yes, the County has access to this type of project funding, however historically it has not been used on hazard mitigation.
Incur debt through private activities	No	
Community Development Block Grant	Yes	Yes, the County has access to this type of project funding, however historically it has not been used on hazard mitigation.
Other federal funding programs	Yes	Yes, the County has access to this type of project funding, however the sources and types of funding that has been historically utilized is unknown.
State funding programs	Yes	Yes, the County has access to this type of project funding, however the sources and types of funding that has been historically utilized is unknown.
Other		
How can these capabilities be expanded and improved to reduce risk?		

Education and Outreach

Identify education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	Lower Columbia Basin Audubon, works to conserve and restore ecosystem in the area; Benton Conservation District, works on environmental conservation; Tapteal Greenway is a local environmental group, there is an annual NW Preparedness Expo in Prosser; American Red Cross. Most of the groups listed above may not have the capacity to do mitigation work.
Ongoing public education or information program, e.g., responsible water use, fire safety, household preparedness, environmental education.	Yes	Benton Conservation District addresses water conservation; Local fire districts address fire safety.
Natural disaster or safety related school programs	No	Not sure, recommend asking the school district superintendents for more information.
StormReady certification	No	Unknown.
Firewise Communities certification	No	Not within our purview, ask Fire Districts?
Public-private partnership initiatives addressing disaster-related issues	No	Not sure.
Other		
How can these capabilities be expanded and improved to reduce risk?		

Kennewick Capabilities Assessment

Planning and Regulatory

Planning and regulatory capabilities are the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. Please indicate which of the following your jurisdiction has in place.

Plans	Yes/No Year	Does the plan address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan	Yes 2017	The Comprehensive Plan sets policies regarding hazards. No. No, but policies can be used to develop code requirements that will implement mitigation actions.
Capital Improvements Plan	Yes 2016	No No The plan is used to identify funding that can be used to implement mitigation actions
Economic Development Plan	No	
Local Emergency Operations Plan	Yes	Yes; No; No
Continuity of Operations Plan	Yes 2015/2017	Yes; No; No
Transportation Plan	Yes, 2008	Yes; Yes; Yes
Stormwater Management Plan	Yes, 2007	Yes; Yes; Yes
Community Wildfire Protection Plan	Yes	Yes; Yes; Yes
Building Code, Permitting, and Inspections	**Yes/No**	**Are codes adequately enforced?**
Building Code	YES	Version/Year: 2015 INTERNATIONAL BUILDING CODE
Fire department ISO rating	YES	Rating:3 WASHINGTON STATE USES WSRB RATINGS
Site plan review requirements	YES	YES
Land Use Planning and Ordinances	**Yes/No**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	YES	YES – FLOODING; YES
Subdivision ordinance	YES	YES
Floodplain ordinance	YES	YES
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	NO	
Flood insurance rate maps	YES	YES
Acquisition of land for open space and public recreation uses	YES	YES
How can these capabilities be expanded and improved to reduce risk?		

Administrative and Technical

Identify whether your community has the following administrative and technical capabilities. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. For smaller jurisdictions without local staff resources, if there are public resources at the next higher-level government that can provide technical assistance, indicate so in your comments.

Administration	Yes/No	Describe capability Is coordination effective?
Planning Commission	YES	The Planning Commission holds public hearings and provides recommendations to the City Council on rezones, comprehensive plan amendments and changes to development regulations contained in the municipal code. Coordination with the commission has generally been positive and beneficial.
Mitigation Planning Committee	NO	
Maintenance programs to reduce risk, e.g., tree trimming, clearing drainage systems	YES	Tree trimming on public property as well as maintaining all facets of the City's stormwater system Yes
Mutual aid agreements	YES	Both Fire and Police have entered into mutual aid agreements with their respective counterparts in the region. Yes
Staff	**Yes/No (Full/Part Time)**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	Yes FT	Yes; No; Yes
Floodplain Administrator (Planning Dept handles flood permits)	Not certified.	Yes; Somewhat; Yes
Emergency Manager	Yes	Depends on event. For natural disasters the Fire Dept typically takes lead and coordinates public works, police and other necessary agencies. If a large event, a regional team is assembled at the EOC.
Community Planner	Yes (FT)	Yes; Somewhat; Yes
Civil Engineer	Yes (FT)	Yes; Somewhat; Yes
GIS Coordinator	Yes	No; No; Yes
Technical	**Yes/No**	**Describe capability Has capability been used to assess/mitigate risk in the past?**
Warning systems/services	No	
Hazard data and information	Yes	The city has GIS layers for steep slopes and flood hazard areas
Grant writing	Yes	Public Works have been the main grant writers and recipients of grant funding. Yes, Clearwater Ave. safety assessment and implementation of mitigation measures.
Hazus analysis	No	
How can these capabilities be expanded and improved to reduce risk?		

Financial

Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.

Funding Resource	Access/ Eligibility (Yes/No)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Yes	Yes, Hildebrand Rd/Bob Olson Parkway has been constructed providing emergency vehicle access to the urban interface area in Southridge
Authority to levy taxes for specific purposes	No	
Fees for water, sewer, gas, or electric services	Yes	No Maybe, depending on the project
Impact fees for new development	Yes	The City currently has traffic impact fees and park impact fees. Traffic impact fees have been used for improvements linked to Hildebrand Rd/Bob Olson Parkway that has provided emergency vehicle access to the urban interface. Yes, if traffic related or if there was a parks improvement that would double as hazard mitigation
Storm water utility fee	Yes	These funds have been used for education and pretreatment activities. Yes
Incur debt through general obligation bonds and/or special tax bonds	Yes	Not that I am aware of
Incur debt through private activities	No	CDBG funds have been used in the past for road reconstruction. In those instances, the streets are brought up to current stormwater standards. Yes
Community Development Block Grant	Yes	These are mainly used for road construction or water/sewer projects Yes
Other federal funding programs	Yes	These are mainly used for road construction or water/sewer projects Yes
State funding programs	Yes	This resource could be used in the future to fund mitigation actions as funds become available.
How can these capabilities be expanded and improved to reduce risk?		

Education and Outreach

Identify education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	There are community groups and churches that promote emergency preparedness and environmental protection, but not sure if they are equipped to implement mitigation measures. Unfortunately, I don't know the names of the organizations, but have heard that they are out there.
Ongoing public education or information program, e.g., responsible water use, fire safety, household preparedness, environmental education.	Yes	Fire safety education programs are available from the City as well as alarm battery replacement for the elderly and disabled. Water conservation education done in cooperation with neighboring jurisdictions.
Natural disaster or safety related school programs	?	I suspect that the schools still have fire drills other drills and that staff receives training on what to do during a disaster.
Storm Ready certification	No	
Firewise Communities certification	No	
Public-private partnership initiatives addressing disaster-related issues	No	
How can these capabilities be expanded and improved to reduce risk?		

Richland Capabilities Assessment

Planning and Regulatory

Planning and regulatory capabilities are the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. Please indicate which of the following your jurisdiction has in place.

Plans	Yes/No Year	Does the plan address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan	YES	YES
Capital Improvements Plan	YES 2018	NO NO The CIP is used for identifying and prioritizing projects for budget consideration that can be used for mitigation actions.
Economic Development Plan	YES	Addressed in comprehensive plan; mitigation strategies and actions not yet included.
Local Emergency Operations Plan	YES	Coordinated with Benton County through the Benton County Comprehensive Emergency Management Plan.
Continuity of Operations Plan		
Transportation Plan	YES 2005	YES YES YES
Stormwater Management Plan	YES 2016	YES YES YES
Community Wildfire Protection Plan	YES	Coordinated through the Benton County Wildfire Protection Plan.
Other special plans (i.e., brownfields redevelopment ,disaster recovery, coastal zone management, climate change adaptation)	NO	

Building Code, Permitting, and Inspections	Yes/No	Are codes adequately enforced?
Building Code	YES	Version/Year: 2015
Building Code Effectiveness Grading Schedule (BCEGS) Score	YES	Score: 3
Fire department ISO rating	YES	Rating: 3
Site plan review requirements	YES	YES
Land Use Planning and Ordinances	**Yes/No**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	YES	YES YES
Subdivision ordinance	YES	YES YES
Floodplain ordinance	YES	YES YES
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	YES	YES YES
Flood insurance rate maps	YES	YES YES
Acquisition of land for open space and public recreation uses	YES	YES YES
Other		
How can these capabilities be expanded and improved to reduce risk?		

Administrative and Technical

Identify whether your community has the following administrative and technical capabilities. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. For smaller jurisdictions without local staff resources, if there are public resources at the next higher-level government that can provide technical assistance, indicate so in your comments.

Administration	Yes/No	Describe capability Is coordination effective?
Planning Commission	YES	The Planning Commission serves as an advisor to the City Council to promote the physical development of the City, with the purpose of, among other things, secure safety from fire, preservation of clean air, water, and natural qualities of the environment, analyze and flood protection. YES.
Mitigation Planning Committee	NO	
Maintenance programs to reduce risk, e.g., tree trimming, clearing drainage systems	YES	Public Works, Energy Services and Park & Public Facility implement maintenance programs for their respective utilities/facilities. YES.
Mutual aid agreements	YES	The City of Richland has mutual aid agreements with Kennewick, Pasco, West Richland and Benton County for both fire and police services.
Staff	**Yes/No FT/PT[43]**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	YES FT	YES NO YES
Floodplain Administrator	YES. Program managed by Planning Dept.	YES NO YES
Emergency Manager	YES	Coordinated through City Fire Department, Police Department and Benton County Emergency Services.
Community Planner	YES FT	YES. NO. TES.
Civil Engineer	YES FT	YES To Some Extent. YES
GIS Coordinator	YES FT	YES To Some Extent YES
Other		

[43] Full-time (FT) or part-time (PT) position

Technical	Yes/No	Describe capability Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	NO	
Hazard data and information	YES	Floodplain, Steep Slopes and Sensitive Lands are mapped throughout the City.
Grant writing	YES	Public Works is the primary recipient of grant funding to address the needs that may arise from the Transportation Plan. Grant funds to construct the Duportail Bridge will benefit the City and surrounding communities include improved traffic safety, improved emergency response, and improved water supply security.
Hazus analysis	NO	
Other		

How can these capabilities be expanded and improved to reduce risk?

Financial

Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.

Funding Resource	Access/ Eligibility (Yes/No)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	YES	YES Construction of Duportail Bridge.
Authority to levy taxes for specific purposes	NO	
Fees for water, sewer, gas, or electric services	YES	Fees for each utility are collected to support the financial obligations of each utility, respectively. POSSIBLY.
Impact fees for new development	YES	The City currently implements a South Richland Traffic Impact Fee to finance transportation improvements in south Richland, and a Park Mitigation Fee for the acquisition or development of open space.
Storm water utility fee	YES	Funds are to be used for system operation/maintenance, regulatory compliance, planning/design/improvements.
Incur debt through general obligation bonds and/or special tax bonds	YES	Unknown.
Incur debt through private activities	NO	
Community Development Block Grant	YES	CDBG funds have been used for infrastructure improvements.
Other federal funding programs	YES	Federal funds have been used for street and utility improvements. YES.
State funding programs	YES	Federal funds have been used for street and utility improvements. YES.
Other		

How can these capabilities be expanded and improved to reduce risk?

Education and Outreach

Identify education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	?	
Ongoing public education or information program, e.g., responsible water use, fire safety, household preparedness, environmental education.	YES	Fire, Police, Public Works, Energy Services all implement conservation and safety awareness programs.
Natural disaster or safety related school programs	?	
StormReady certification	?	
Firewise Communities certification	?	
Public-private partnership initiatives addressing disaster-related issues	NO	
Other		

How can these capabilities be expanded and improved to reduce risk?

Prosser Capabilities Assessment

Planning and Regulatory

Planning and regulatory capabilities are the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. Please indicate which of the following your jurisdiction has in place.

Plans	Yes/No Year	Does the plan address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan	Yes/2018	Complete Review was completed in 2018
Capital Improvements Plan	Yes/2018	CFP was updated spring of 2018
Economic Development Plan	No	
Local Emergency Operations Plan	Yes	
Continuity of Operations Plan	No	
Transportation Plan	Yes	
Stormwater Management Plan	NA	
Community Wildfire Protection Plan	NA	
Other special plans (i.e., brownfields redevelopment ,disaster recovery, coastal zone management, climate change adaptation)	Yes	Housing Incentive Program to include low income density bonuses

Building Code, Permitting, and Inspections	Yes/No	Are codes adequately enforced?
Building Code	Yes	Version/Year:
Building Code Effectiveness Grading Schedule (BCEGS) Score		Score:
Fire department ISO rating	NA	Rating: WBRFA is a separate fire authority. Prosser lies within its district boundary
Site plan review requirements	Yes	Chapter 18 and 19 of the Prosser Municipal Code
Land Use Planning and Ordinances	**Yes/No**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	Yes	
Subdivision ordinance	Yes	
Floodplain ordinance	Yes	Shoreline plan
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Yes	Several ordinances to include Steep Slope Residential Zoning address
Flood insurance rate maps	Yes	FIRM 530012 0005 C October 31, 1981
Acquisition of land for open space and public recreation uses	Yes	Comprehensive Plan as Subdivision regulations
Other		
How can these capabilities be expanded and improved to reduce risk?		

Administrative and Technical

Identify whether your community has the following administrative and technical capabilities. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. For smaller jurisdictions without local staff resources, if there are public resources at the next higher level government that can provide technical assistance, indicate so in your comments.

Administration	Yes/No	Describe capability Is coordination effective?
Planning Commission	Yes	Coordination is limited to staff and citizens
Mitigation Planning Committee	No	
Maintenance programs to reduce risk, e.g., tree trimming, clearing drainage systems	Yes	Some tree and maintenance programs are enacted through the budget
Mutual aid agreements	Yes	Prosser Police Department
Staff	**Yes/No FT/PT[44]**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	No	
Floodplain Administrator	No	
Emergency Manager	No	
Community Planner	Yes 1 FTE	
Civil Engineer	Yes/ Contracted Service with HLA	
GIS Coordinator	Yes	
Other		

[44] Full-time (FT) or part-time (PT) position

Technical	Yes/No	Describe capability Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	No	
Hazard data and information	No	
Grant writing	Yes	Contracted service with Sue Jetter Consulting
Hazus analysis	No	
Other		

How can these capabilities be expanded and improved to reduce risk?

Financial

Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.

Funding Resource	Access/ Eligibility (Yes/No)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding		
Authority to levy taxes for specific purposes		
Fees for water, sewer, gas, or electric services		
Impact fees for new development		
Storm water utility fee		
Incur debt through general obligation bonds and/or special tax bonds		
Incur debt through private activities		
Community Development Block Grant		
Other federal funding programs		
State funding programs		
Other		
How can these capabilities be expanded and improved to reduce risk?		

Education and Outreach

Identify education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	No	
Ongoing public education or information program, e.g., responsible water use, fire safety, household preparedness, environmental education.	Yes	Program is two part- Physical display of water conservation tips at City Hall and reminders sent in water bills.
Natural disaster or safety related school programs	No	
StormReady certification	NA	
Firewise Communities certification	No	
Public-private partnership initiatives addressing disaster-related issues	No	
Other		

How can these capabilities be expanded and improved to reduce risk?

West Richland Capabilities Assessment

Planning and Regulatory

Planning and regulatory capabilities are the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. Please indicate which of the following your jurisdiction has in place.

Plans	Yes/No Year	Does the plan address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan	Yes / 2017	No " " " "
Capital Improvements Plan	Yes / 2017	No " " " "
Economic Development Plan	Yes / 2017	No " " " "
Local Emergency Operations Plan	N/A to the City.	Yes. Interlocal Agreement for Benton County Emergency Services – Contract number: 145-11
Continuity of Operations Plan	N/A to the City.	Yes. Same as above
Transportation Plan	Yes / Annual update	No " " " "
Stormwater Management Plan	Yes / Annual update	No " " " "
Community Wildfire Protection Plan	N/A to the City.	
Other special plans (i.e., brownfields redevelopment ,disaster recovery, coastal zone management, climate change adaptation)	No	

Building Code, Permitting, and Inspections	Yes/No	Are codes adequately enforced?
Building Code	Yes	2015 IBC
Building Code Effectiveness Grading Schedule (BCEGS) Score	No	Score:
Fire department ISO rating	Yes	Rating: 5 per WSRB
Site plan review requirements	Yes	A detailed review is performed for every permit.
Land Use Planning and Ordinances	**Yes/No**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	Yes	Document is current.
Subdivision ordinance	Yes	Yes, so far as the entire municipal code is applied but not with respect to wildfire. Yes
Floodplain ordinance	Yes	Yes
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Yes	Yes to stormwater & slopes. The city does not regulates for wildfire management.
Flood insurance rate maps	Yes	Yes " "
Acquisition of land for open space and public recreation uses	Yes	The park plan identifies areas of focus for local and regional parks and trails. Hazard impacts are managed via the SMP, Critical Areas Ordinances and other development regulations.
Other	N/A	
How can these capabilities be expanded and improved to reduce risk?		
Wildfire management would be the area I can think of with respect to fire breaks and weed & vegetation management. The Fire District BCFD#4 would be able to address this.		

Administrative and Technical

Identify whether your community has the following administrative and technical capabilities. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. For smaller jurisdictions without local staff resources, if there are public resources at the next higher-level government that can provide technical assistance, indicate so in your comments.

Administration	Yes/No	Describe capability Is coordination effective?
Planning Commission	Yes	The 7 member commission effectively applies the municipal code.
Mitigation Planning Committee	No	
Maintenance programs to reduce risk, e.g., tree trimming, clearing drainage systems	No	
Mutual aid agreements	Yes.	The West Richland P.D. and BCFD#4 have these agreements and coordination is effective.
Staff	**Yes/No FT/PT[45]**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	Yes / FT	Yes Unsure Yes
Floodplain Administrator	Yes / FT as the Director	Yes No Yes
Emergency Manager	Yes, PT Mayor and FT Police Chief	Yes Yes Yes
Community Planner	Yes / FT	Yes " " " "
Civil Engineer	Yes / FT	Yes " " " "
GIS Coordinator	No	
Other		

[45] Full-time (FT) or part-time (PT) position

Technical	Yes/No	Describe capability Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Unsure	WRPD and/or BCFD#4 would know.
Hazard data and information	Unsure	WRPD and/or BCFD#4 would know.
Grant writing	No	
Hazus analysis	No	
Other		

How can these capabilities be expanded and improved to reduce risk?
This would be best answered after a discussion with WRPD and BCFD#4

Financial

Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.

Funding Resource	Access/ Eligibility (Yes/No)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Yes	Yes. For infrastructure improvements. None applied for/utilized to my knowledge.
Authority to levy taxes for specific purposes	Yes	Unsure.
Fees for water, sewer, gas, or electric services	Yes	Yes. Accounts for impact to infrastructure systems. No to my knowledge.
Impact fees for new development	Yes	Transportation impact and parks mitigation. No per Washington State law.
Storm water utility fee	Yes	Yes. Outfall elimination projects. Unsure but would assume so.
Incur debt through general obligation bonds and/or special tax bonds	Unsure	
Incur debt through private activities	?	Is this related to impact fees or development agreements?
Community Development Block Grant	No	
Other federal funding programs	See comment to the right column.	The Federal funding the city receives has been applicable to infrastructure projects, not land use development.
State funding programs	See comment to the right column.	The State funding the city receives has been applicable to infrastructure projects, not land use development.
Other		

How can these capabilities be expanded and improved to reduce risk?

Education and Outreach

Identify education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	No	
Ongoing public education or information program, e.g., responsible water use, fire safety, household preparedness, environmental education.	Yes	Participation staffing a booth that discusses stormwater and the NPDES requirements at the annual Benton County Fair & Rodeo.
Natural disaster or safety related school programs	No	
StormReady certification	Not to my knowledge.	Inquire with BCFD#4.
Firewise Communities certification	Not to my knowledge.	Inquire with BCFD#4.
Public-private partnership initiatives addressing disaster-related issues	Not to my knowledge.	Inquire with BCFD#4.
Other		
How can these capabilities be expanded and improved to reduce risk?		

Benton City Capabilities Assessment

Planning and Regulatory

Planning and regulatory capabilities are the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. Please indicate which of the following your jurisdiction has in place.

Plans	Yes/No Year	Does the plan address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan	YES 2017	NO
Capital Improvements Plan	YES (?)	NO; YES; NO
Economic Development Plan	NO	
Local Emergency Operations Plan	NO	
Continuity of Operations Plan	NO	
Transportation Plan	YES	6 YEAR STREET PLAN
Stormwater Management Plan	NO	
Community Wildfire Protection Plan	NO	BCFPD #2
Building Code, Permitting, and Inspections	**Yes/No**	**Are codes adequately enforced?**
Building Code	YES	Version/Year: 2015 INTERNATIONAL BUILDING CODE
Fire department ISO rating	YES	Rating:3 WASHINGTON STATE USES WSRB RATINGS
Site plan review requirements	YES	
Land Use Planning and Ordinances	**Yes/No**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	YES	YES – FLOODING; YES
Subdivision ordinance	YES	YES
Floodplain ordinance	YES	YES
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	NO	
Flood insurance rate maps	YES	
Acquisition of land for open space and public recreation uses	YES	
How can these capabilities be expanded and improved to reduce risk?		

Administrative and Technical

Identify whether your community has the following administrative and technical capabilities. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. For smaller jurisdictions without local staff resources, if there are public resources at the next higher-level government that can provide technical assistance, indicate so in your comments.

Administration	Yes/No	Describe capability Is coordination effective?
Planning Commission	YES	YES
Mitigation Planning Committee	NO	
Maintenance programs to reduce risk, e.g., tree trimming, clearing drainage systems	YES	YES
Mutual aid agreements	YES	YES
Staff	**Yes/No (Full/Part Time)**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	CONTRACTED	
Floodplain Administrator	YES, PT	AT THIS TIME. MORE TRAINING WOULD BE HELPFUL.
Emergency Manager	NO	
Community Planner	NO	
Civil Engineer	CONTRACTED	
GIS Coordinator		
Technical	**Yes/No**	**Describe capability Has capability been used to assess/mitigate risk in the past?**
Warning systems/services	NO	
Hazard data and information	NO	
Grant writing	NO	
Hazus analysis	NO	
How can these capabilities be expanded and improved to reduce risk?		

Financial

Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.

Funding Resource	Access/ Eligibility (Yes/No)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	YES	HISTORY (?); YES
Authority to levy taxes for specific purposes	YES	HISTORY (?); YES
Fees for water, sewer, gas, or electric services	YES WATER SEWER	HISTORY (?); YES
Impact fees for new development	NO	
Storm water utility fee	NO	
Incur debt through general obligation bonds and/or special tax bonds	YES	HISTORY (?); YES
Incur debt through private activities	NO	
Community Development Block Grant	YES	HISTORY (?); YES
Other federal funding programs	YES	HISTORY (?); YES
State funding programs	YES	HISTORY (?); YES
How can these capabilities be expanded and improved to reduce risk?		

Education and Outreach

Identify education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	NO	
Ongoing public education or information program, e.g., responsible water use, fire safety, household preparedness, environmental education.	YES	WATER BILL INSERTS INFO ON WEBSITE YES
Natural disaster or safety related school programs	NO	
Storm Ready certification	NO	
Firewise Communities certification	YES	BCFPD#2
Public-private partnership initiatives addressing disaster-related issues	NO	
How can these capabilities be expanded and improved to reduce risk?		

Appendix C: Documentation of Participation

Documentation of Committee Participation

October 26, 2017 – Committee Meeting Agenda

A G E N D A

Hazard Mitigation Plan & Community Wildfire Protection Plan Meeting

Thursday, October 26th, 2017

1:30 p.m. – 3:30 p.m.

Location: Benton County Emergency Management

651 Truman Avenue, Richland WA

1:30 pm	**OPEN – Introductions**	Benton Count EM
1:45 pm	**GROUP MEETING** I. Northwest Management Presentation ✓ Planning Process Powerpoint Presentation ✓ Preparing a HMP/CWPP ✓ Question & Answer – Committee Expectations II. Discuss Mission, Vision, and Goals Statement ✓ Present and Review statements III. Resources and Capabilities ✓ Handout form ✓ Equipment List? ✓ Logos IV. Risk Assessments ✓ Assessment Format ✓ Specific Areas of Concern V. Map Products ✓ Review Examples ✓ Data Availability? ✓ Begin Identifying Projects VI. Meeting Schedule ✓ Timeline ✓ Monthly Meeting Dates ✓ Public Meeting Dates	Northwest Management, Inc.
3:20 pm	**OPEN DISCUSSION**	Group

Contact List:

HPM/CWPP Steering Committee Lead: Benton County Emergency Management

Matthew Blackmarr
509-572-8066
m.blackmarr@bces.wa.gov

Deanna Davis
509-628-8092
d.davis@bces.wa.gov

NMI Project Managers: 208-883-4488

Mark Corrao (ext. 129)
mcorrao@nmi2.com

Bill Mathews (ext. 128)
mathews@nmi2.com

Tera King (ext. 133)
king@nmi2.com

October 26, 2017 – Committee Meeting Sign-In Sheet

BENTON COUNTY
Emergency Management

Benton County Hazard Mitigation Plan
Planning Committee Meting
10/26/17

Sign-In Sheet

Name (Please print)	Company/Agency	E-Mail
Patrick Purcell	WWEMD	ppurcell ~~[illegible]~~@co.walla-walla
Liz Jessee	WWEMD	ljessee@co.walla-walla.wa.us
Edward Dunbar	BCFD 4	edunbar@bcfd4.org
Kyle Kurth	Benton City	KKurth@ci.benton-city.wa.
Bill Mathews	Northwest Management	mathews@nmi2.com
Scott Clemenson	Richland Fire	sclemenson@ci.richland.wa
Pete Rogalsky	Richland Public Works	progalsky@ci.richland.wa.us
Cary Roe	City of Kennewick	cary.roe@ci.kennewick.wa
Anthony Muai	City of Kennewick	anthony.muai@ci.kennewick.wa
Kevin Howard	Port of Benton	kevinh@portofbenton.com
Jerrod MacPherson	Benton County	jerrod.macpherson@co.ben
Matt Blackman	BCEM	m.blackman@bces.wa.gov

BENTON COUNTY
Emergency Management

Hazard Mitigation Plan Meeting with
WA-EMD
10/26/17

Sign-In Sheet

Name (Please print)	Company/Agency	E-Mail
Matt Blackman	BCEM	m.blackman@bces.wa.gov
Derrick Hiebert	WA EMD	derrick.hiebert@mil.wa.gov
Bill Mathews	North West Management	Mathews@nmi2.com
Patrick Purcell	WWEMD	ppurcell@co.walla-walla.wa
Liz Jessee	WWEMD	ljessee@co.walla-walla.wa.us
Sean Davis	FCEM	sdavis@co.franklin.wa.us
Deanna Davis	BCEM	ddavis@bces.wa.gov
Ron Duncan	BCFPD 2/RFD	

December 12, 2017 –Committee Meeting Agenda

A **G** **E** **N** **D** **A**	**Hazard Mitigation & Community Wildfire Protection Plan Meeting** **Tuesday, December 12th, 2017** **11:00 p.m. – 1:00 p.m.** **Location: Benton County Emergency Management** **651 Truman Ave, Richland WA**	
11:00 am	**OPEN – Introductions**	Deanna Davis, Matthew Blackmarr
11:15 am	**GROUP MEETING** I. Discuss Agenda, and Non-meeting hours ✓ Additional Stakeholders or Committee Members II. Document: ✓ Proposed Outline ✓ Capabilities Assessments ✓ Review Hazard Profiles (Previous Plan & State) ✓ Status report III. Press Release IV. Risk Assessments ✓ Review Countywide Wildfire Risk Assessment ✓ Data Needs ✓ HAZUS Data for Flood Analysis V. Public Meetings ✓ Potential Outreach Methods ✓ Dates and Venues ✓ Press Release	Northwest Management, Inc.
12:30 pm	**OPEN DISCUSSION**	Group

December 12, 2017 – Committee Meeting Sign-In Sheet

BENTON COUNTY Emergency Management

Benton County Hazard Mitigation Plan
Planning Committee Meeting

December 12, 2017

Name (Please print)	Company/Agency	E-Mail
Matthew Blackmarr	BCEM	m.blackmarr@bces.wa.gov
Deanna Davis	BCEM	d.davis@bces.wa.gov
Bill Mathews	Northwest Management	mathews@nmi2.com
Mark Corrao	Northwest Management	mcorrao@nmi2.com
Chuck Freeman	Kennewick Irr. Dist	cfreeman@kid.org
Charlie Cronk	BLM	cpcronk@blm.gov
Kyle Kurth	Benton City	KKurth@ci.benton-city.wa.us
Scott Clemenson	Richland Fire	sclemenson@ci.richland.wa.u
Aaron Lambert	City of West Richland	alambert@westrichland.org
SHANE O'NEILL	CITY OF RICHLAND	SONEILL@CI.RICHLAND.WA.U
Jerrod MacPherson	Benton County	jerrod.macpherson@co.b
Michelle Cooke	Benton County	michelle.cooke@co.be

BENTON COUNTY Emergency Management

Benton County Hazard Mitigation Plan
Planning Committee Meeting

December 12, 2017

Name (Please print)	Company/Agency	E-Mail
Lonnie Click	BCFD #1	Lonnie@Bcfd1.org
Anthony Muai	COK	anthony.muai@ci.kennewick.wa.u
Neil Hines	Kenn Fire Dept.	neil.hines@ci.kennewick.wa.u

December 12, 2017 –Committee Meeting Notes

1) Prefer the document organized by jurisdiction.
2) Capabilities assessment to follow: how each jurisdiction can respond to hazards, what plans are available, and their resources.
3) NMI will only focus on the natural hazards and the County will add in their manmade hazards of interest following the document completion to not infringe on FEMA's direction.
4) Is there a way to add flash flooding from localized storms? (also debris that enter irrigation canals and cause overtopping and damage)
5) When the wind exceeds 20mph the irrigation district deploys vegetation clearing crews to canals.
6) Ice storms and freezing rains impacting powerlines and grid supply throughout the region.
7) KID (Kennewick Irrigation Dist.) levy failure and canal lining to mitigate flood hazards for communities and residents. Also, semantics for inclusion of flooding that may occur from dam failure.
8) FEMA is completing the HAZUS runs for earthquake hazards for Benton County.
9) There are some 9-foot in diameter syphons for Kennewick that would be susceptible to earthquakes and should be included in the FEMA HAZUS modeling.
10) LiDAR flood estimation mapping for Benton at 25, 100 and 500-year event elevation levels for county risk discussions only.
11) California Ground squirrel or gophers are natural hazards that impact the irrigation canal infrastructure and have led to damage of private property and safety concerns in the past.
12) Drought challenges impact the irrigation district curtailment because people begin to use potable water for irrigation when they start getting reduced and then the officers need to be dispatched to uphold the ordinance. If the ordinance is upheld during a drought there is a risk of increased wildfire.
13) Need to add some project language for a FIREWISE program funding as they currently do not have an official program and work on an as-available business.
14) Fire map has a lot of green area and most of the county that doesn't get irrigation will indeed burn. Comment: the old plan suggested longer fire return intervals because they assumed sagebrush ecosystems….now much of the county area is cheat grass so the return interval is more like 3-5 years.
15) Condense the fire section to something simple that says "there is grass there and the wind blows a lot…so when we have a wet spring there is a greater fire danger because the fuels grow, when there is a drought there is often a less critical fire risk because the grass grows less." More of a narrative that supports the graphics that show grass and wind are the main drivers in their risk areas. Have the narrative align with the need for fuel reduction needs and infrastructure, human safety concerns. There are really only localized pockets of sage brush and then Russian Olive along water ways, everything else is grass.
16) Identify some "high priority" fuel breaks (roads, tilling, retardant etc.) as these may have a greater value and better importance to the County than just the vegetation condition. There are some areas of the County that need fuel reduction practices as well as identifying the fuel

break locations. The "Rattlesnake area" is not a place they are able to treat and currently in the fire modeling we have completed it is skewing the whole heat map. We asked for a general identification of area where risk is the greatest in their experience and for them to make a "fat crayon" map.

17) Local TV network to advertise the plan public outreach meeting dates, times and locations. Kelly Mackhart is the contact. Meeting in Prosser, Richland, and Kennewick for the public meeting locations. Use the Utility bill flyers for helping to notice people.

Matt will setup an email, Facebook announcement, and link to the document on the EM webpage. NMI will develop a flyer in .PDF form to post along with the draft document for the public to view in case folks don't want to read the document and would rather just read an overview and see the times, dates and locations of the three public meeting locations.

March 8, 2018 - Committee Meeting Agenda

A G E N D A

Hazard Mitigation & Community Wildfire Protection Plan Meeting

Thursday, March 8th, 2018

11:00 p.m. – 1:00 p.m.

Location: Benton County Emergency Management

651 Truman Ave, Richland WA

11:00 am	**OPEN – Introductions**	Deanna Davis,
11:15 am	**GROUP MEETING** I. Risk Assessment Workshop ✓ Review prior plans Mitigation Action Items ✓ Work through risk assessment maps to determine new Mitigation Action Items II. Public Meetings ✓ Solidify Outreach Methods ✓ Dates and Venues	Northwest Management, Inc.
12:30 pm	**OPEN DISCUSSION**	Group

District Summaries received: BCFD #2 and West Benton Fire Rescue

March 8, 2018 – Committee Sign-In Sheet

BENTON COUNTY Emergency Management

Benton County Hazard Mitigation Plan Meeting
March 8, 2018

Sign-In Sheet

Name (Please print)	Company/Agency	E-Mail
KEN BUECHLER	RFD	
Bill Mathews	Northwest Management	mathews@nmi2.com
Adam Herrenbruck	Northwest Management	herrenbruck@nmi2.com
Deanna Davis	BCEM	d.davis@bcesWA.gov
Edward Dunbar	BCFD 4	edunbar@bcfd4.org
Neil Hines	KFD	neil.hines@ci.kennewick.wa.us
Lonnie Click	BCFD #1	LonnieC@Bcfire.org
Michelle Cooke	Benton County	michelle.cooke@co.bento
AL LAWSON	WADNR	alan.lawson@dnr.w
Kevin Howard	Port of Benton	kevinh@portofbenton.com
Charles Freeman	KID	cfreeman@kid.org

BENTON COUNTY Emergency Management

Benton County Hazard Mitigation Plan Meeting
March 8, 2018

Sign-In Sheet

Name (Please print)	Company/Agency	E-Mail
Tia Burbach		
Kyle Kurth	City of Benton City	KKurth@ci.Benton-City.WA.US
Jerrod MacPherson	Benton County	jerrod.macpherson@co.benton.wa.us
Anthony Muai	City of Kennewick	anthony.muai@ci.kennewick.wa.us
Scott Clemenson	Richland Fire + Emergency Services	sclemenson@ci.richland.w
William Whealan	BCFD4	wwhealan@bcfd4.org
SETH JOHNSON	WBFR	sjohnson@westbentonfirerescu

March 8, 2018 –Committee Meeting Minutes

Agenda Item #1 – Introductions

Deanna Davis opened the meeting by introducing Bill Mathews and Adam Herrenbruck, both with NMI. Bill briefly discussed where the plan stands in the update process. He plans to start sending out portions of the plan out, 1-2 chapters at a time, for the committee to review and give feedback.

Another topic Bill brought up was the location of the flood map data. So far NMI has seen the earthquake data sent by the state but has not seen the new flood hazard data. Some members of the committee noted that the data needed might be found at the Army Corps of Engineers or the irrigation district.

Agenda Item #2 – Risk Assessment Workshop

Bill led a review of the mitigation action items that were expressed in previous plans. Using a handout that summarized previous mitigation projects, the committee discussed: 1) are the action items still current (have they been completed or are they still necessary); 2) is there a more specific timeframe for implementation of each action item; and 3) are the details regarding each action item still applicable or specific enough.

Many changes were made to the past action items due to vague language, completed initiatives, or shifts in objectives. The changes recommended by the committee were recorded so they could be incorporated into the updated Hazard Mitigation Plan. Details of some action items were unknown by those present at the meeting. These action items will need to be discussed by the appropriate parties and then the feedback will be sent to Deanna Davis and NMI.

Bill asked the committee members present to consider any new action items they might want to incorporate into the Hazard Mitigation Plan update. The committee discussed adding some initiatives, particularly ones that address landslide and earthquake mitigation. No specific action items were raised by the committee, but some suggestions might be raised over the next few weeks.

Agenda Item #3 – Plan for moving forward (public meetings)

Bill asked the committee how they would like to proceed with the Hazard Mitigation Plan update process, specifically regarding the public meeting portion. It was suggested and agreed upon to hold the public meetings in three different locations throughout the county, on two different days. The locations chosen were Kennewick, Richland and Prosser, but specific venues have not yet been determined. Tentative dates for these meetings are April 25, at 4:00 in Richland and 6:00 in Kennewick and April 26 in Prosser. The exact times and dates will be finalized when venue availability is determined by Deanna. There will also be a planning committee meeting prior to the first meeting on April 25, at Benton County Emergency Management.

Agenda Item #4 – CWPP Discussion

Bill led the area fire chiefs in a review of the fire hazard risk map, seeking their feedback and corrections. Many recommendations were made and noted and will be incorporated into an updated hazard risk map and hazard vulnerability assessments.

Bill asked if water sources were necessary for inclusion in the hazard risk map. It was determined that the sources should be included in case the information is needed for any future funding.

The next CWPP meeting was scheduled for Wednesday, April 18 from 9:00 a.m. to 11:00 a.m. at Benton County Emergency Management.

July 19th, 2018 –Committee Meeting Agenda

A G E N D A	Hazard Mitigation & Community Wildfire Protection Plan Meeting Thursday, July 19, 2018 11:30 p.m. – 1:30 p.m. Location: Benton County Emergency Management 651 Truman Ave, Richland WA	
11:30 am	OPEN – Introductions	Deanna Davis,
11:40 am	GROUP MEETING I. Quick Status Update II. Hazard Mitigation Plan ✓ Review draft ✓ Discuss missing pieces and committee comments III. Community Wildfire Protection Plan ✓ Review committee draft ✓ Discuss missing components ✓ Threat Level Mapping ✓ Project map review IV. Next Steps ✓ Public comment periods ✓ Review process for state and federal review ✓ Timelines for completion	Northwest Management, Inc.
1:30 pm	OPEN DISCUSSION	Group

July 19th, 2018 –Committee Meeting Sign-In Sheet

BENTON COUNTY Emergency Management

Benton County Hazard Mitigation Plan Meeting
July 19th 2018

Sign-In Sheet

	Name (Please print)	Company/Agency	E-Mail
★	Deanna Davis	BCEM	d.davis@bces.wa.gov
	Kyle Kurth	Benton City	KKurth@Ci.Benton-City.WA
★	Scott Clemenson	RF+ES	sclemenson@ci.richland.wa.
	Aaron Lambert	City of W. Richland	alambert@westrichland.org
	SHANE O'NEILL	CITY OF RICHLAND	SONEILL@CI.RICHLAND.WA.US
★	Lori Ferris	BCEM	l.ferris@bceswa.gov
	Anthony Muai	Kennewick	anthony.muai@ci.kennewick.wa.
	Michelle Cooke	Benton Co.	michelle.cooke@co.benton.wa.us
	Tena R King	NMI	King@nmi2.com
★	William Whealan	BCFD4	wwhealan@bcfd4.org
★	Neil Hines	KFD	neil.hines@ci.kennewick.wa.us

★ Stayed for CWPP specific planning mtg.

January 30, 2019 –Committee Meeting Sign-In Sheet

BENTON COUNTY Emergency Management

Benton County Hazard Mitigation Plan Meeting
January 30, 2019

Sign-In Sheet

Name (Please print)	**Company/Agency**	**E-Mail**
Scott Clemenson	Richland Fire + Emergency Services	sclemenson@ci.richland.wa.
Michelle Cooke	Benton County	michelle.cooke@co.benton.
Jerrod MacPherson	Benton County	jerrod.macpherson@co.ben
Kyle Kurth	Benton City	KKurth@ci.Benton-city.wa.us
Brian Calvert	BCEM	b.calvert@bces.wa.gov
SHANE O'NEILL	RICHLAND PLNG	SONEILL@CI.RICHLAND.WA.US
SETH JOHNSON	WBFR	sjohnson@westbentonfirerescue.c
Lori Ferris	BCEM	~~tee~~ lferris@bceswa.gov
Neil Hines	KFD	neil.hines@ci.kennewick.wa.
Deanna Davis	BCEM	d.davis@bces.wa.gov
ERIC NELSON	NMI	nelson@nmi2.com
Lonnie Click	BCFD #1	

Documentation of Public Involvement

November 15th, 2017 -Press Release to Public

Benton County

Media Release

From: **Deanna Davis, Emergency Manager**
Date: **November 15, 2017**
RE: **Benton County Natural Hazard Mitigation Plan & Community Wildfire Protection Plan Update**

Benton County Set to Update Hazard Risk Plans

Richland, WA. Benton County has launched a project to update the Benton County Natural Hazard Mitigation Plan. This update will include an update of the Benton County Community Wildfire Protection Plan as well. Local agencies and organizations in Benton County have created a committee to complete the required 5-year updates of these documents as part of the FEMA Pre-Disaster Mitigation program and National Fire Plan and Healthy Forests Restoration Act. The project is being funded through a grant from FEMA.

The planning update will include risk analyses, vulnerability assessments, and mitigation recommendations for the hazards of flood, landslide, earthquake, severe weather, wildland fire, and others.

Northwest Management, Inc. has been retained by Benton County to provide risk assessments, hazard mapping, field inspections, interviews, and to collaborate with the planning committee to update the Plans. The committee includes representatives from local communities, rural and wildland fire districts, Washington DNR, Bureau of Land Management, highway districts, area businesses, various Benton County and City departments, and others.

One of the goals of the planning process will be to increase the participating jurisdictions' eligibility for additional grants that will help minimize the risk and potential impact of disaster events. The planning team will be conducting public meetings to discuss preliminary findings and to seek public input on the Plans' recommendations. A notice of the dates and locations of these meetings will be posted in local newspapers. Once completed, the updated draft Plans will also be available for public review and comment.

The first meeting was held on October 26th, located at the Benton County Emergency Management Office at 651 Truman Ave, Richland, Wa 99352. For more information on the Benton County Natural Hazard Mitigation Plan update contact Deanna Davis, Emergency Manager at (509)628-8092, email d.davis@bces.wa.gov

April 18th, 2018 – Press Release: Schedule of Public Meetings

Public meeting comments on Benton County Hazard Mitigation plan:

Wednesday April 25th 4:00 P.M.
Richland Public Library Conference Rm A&B
955 Northgate, Richland WA 99352

Wednesday April 25th 5:00 P.M.
West Benton Fire & Rescue
1200 Grant, Prosser WA 99350

Wednesday April 25th 6:00 P.M.
Benton PUD Auditorium
2721 W. 10th Kennewick WA 99336

For more information call 509-628-8092

ADD TO BEGIN ON APRIL 18TH AND END ON APRIL 26TH – ADD CAN RUN IN THE MISC ANNOUCMENTS SECTION.

Contact: Deanna Davis, EM Manager
Benton County Emergency Services
509-628-8092 or cell: 509-380-4522
d.davis@bces.wa.gov

April 18th, 2018 – Newspaper Advertisement for Public Meetings

Public meeting comments on Benton County Hazard Mitigation plan:
Wednesday April 25th 4:00 P.M.
Richland Public Library Conference Rm A&B 955 Northgate, Richland WA 99352
Thursday April 26th 5:00 P.M.
West Benton Fire & Rescue
1200 Grant, Prosser WA 99350
Wednesday April 25th 6:00 P.M.
Benton PUD Auditorium
2721 W. 10th Kennewick WA 99336
For more information call
509-628-8092

April 25th and 26th, 2018 - Public Meeting Presentation

1

2

3

4

5

6


Tornado events in Washington state
Severe Weather

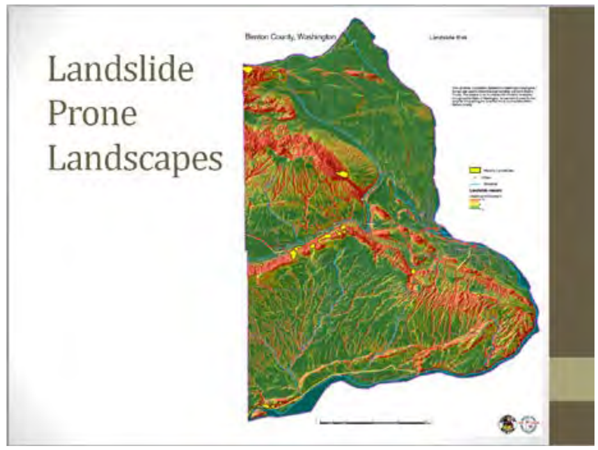
7


Wildfire

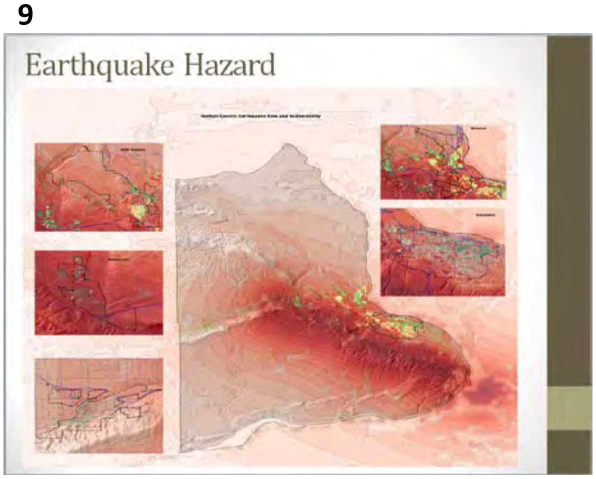
8


Flood
City Herald
Kennewick Hit Hard

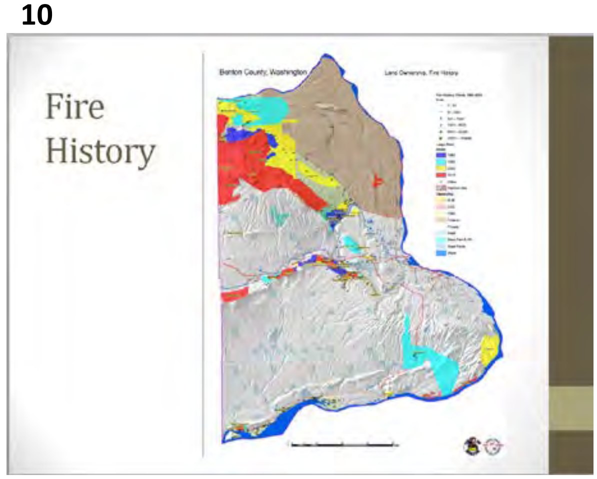
9


Landslide
Prone
Landscapes
Benton County, Washington

10

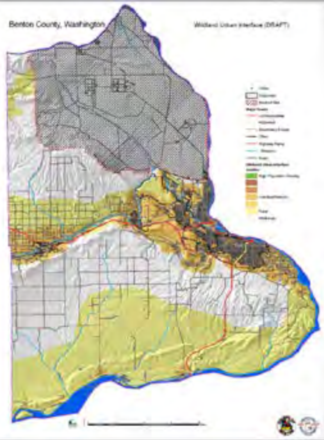

Earthquake Hazard

11


Fire
History
Benton County, Washington

12

Wildland Urban Interface



13

Preparedness

- Emergency Services
- Fire Protection
- Weather Impacts
- Flood Protection/Programs
- Earthquake, Landslide, & Storm Readiness
- Hospital Protection
- Public Works/Highway District Readiness
- Communications

14

Types of Projects

- Defensible Space and Fuels Treatments
- Floodplain Management and Infrastructure Upgrades
- Slope Stabilization
- Studies (e.g. watershed) and Evaluations (e.g. culvert capacity)
- Access Improvements
- Emergency Response Needs
- Policy Issues
- Infrastructure Hardening and Communication Upgrades
- Public Education

15

Public Involvement

- Press Releases and Social Media
- Public Meetings x3
- Public Review of the DRAFT Plan
- Open public adoption hearings

16

Your Input

- Maps on the walls – Mark them up!
- Talk to one of the planning committee members.
- Let us know your ideas and concerns.
- Make this YOUR Plan!

Thank you for attending and participating! Please visit with us.

17

Benton County, Washington
Multi-Hazard Mitigation Plan Update and Community Wildfire Protection Plan

18

Appendix D: NFIP Status Letter for Benton County

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
1250 West Alder Street • Union Gap, Washington 98903-0009 • (509) 575-2490

June 11, 2019

Deanna Davis
Benton County Emergency Manager
651 Truman Avenue
Richland, WA 99352

Dear Deanna Davis:

You indicated that Benton County, Washington, is working towards the completion of its Hazard Mitigation Plan and information is needed regarding the standing of the County in the National Flood Insurance Program (NFIP).

This is to certify that Benton County (Community Identification Number 530237) participates in the NFIP and is a member in good standing in that program. Benton County established eligibility in the Regular Phase of the NFIP on July 19, 1982. A Community Assistance Visit (CAV) was conducted by Ecology on April 15, 2009 and was closed on December 6, 2010.

This is to certify that the City of Benton City (Community Identification Number 530010) participates in the NFIP and is a member in good standing in that program. Benton City established eligibility in the Regular Phase of the NFIP on July 16, 1979. A Community Assistance Visit (CAV) was conducted by Ecology on October 4, 2013 and was closed on October 8, 2013.

This is to certify that the City of Kennewick (Community Identification Number 530011) participates in the NFIP and is a member in good standing in that program. Kennewick established eligibility in the Regular Phase of the NFIP on August 15, 1979. A Community Assistance Visit (CAV) was conducted by Ecology on September 29, 2010 was closed on September 21, 2011.

This is to certify that the City of Prosser (Community Identification Number 530012) participates in the NFIP and is a member in good standing in that program. Prosser established eligibility in the Regular Phase of the NFIP on June 30, 1976. A Community Assistance Visit (CAV) was conducted by Ecology on July 1, 1987 and was closed on July 1, 1988.

This is to certify that the City of Richland (Community Identification Number 535533) participates in the NFIP and is a member in good standing in that program. Richland established eligibility in the Regular Phase of the NFIP on March 31, 1970. A Community Assistance Visit (CAV) was conducted by Ecology on August 20, 2010 and was closed on August 25, 2010.

This is to certify that the City of West Richland (Community Identification Number 530014) participates in the NFIP and is a member in good standing in that program. West Richland established eligibility in the Regular Phase of the NFIP on September 30, 1981. A Community Assistance Visit (CAV) was conducted by Ecology on July 29, 2008 and was closed on August 4, 2008.

If you have any questions, please feel free to contact me at (509) 457-7139 or matt.gerlach@ecy.wa.gov.

Sincerely,

Matt Gerlach

Matt Gerlach
Central Washington NFIP Coordinator

ec: Suzanne Sarpong, FEMA
Dave Radabaugh, Ecology

Appendix E: 2018 Benton County CWPP MAI's

The following tables contain the mitigation action items (MAI's) from the 2018 Benton County Community Wildfire Protection Plan (CWPP) update. This appendix serves to cross reference the wildfire MAI's found in chapter 5 of this plan with those found in the CWPP.

Policy and Planning Efforts

Wildfire mitigation efforts should be supported by a set of policies and regulations that maintain a solid foundation for safety and consistency. The recommendations enumerated here serve that purpose. Because these items are regulatory in nature, they will not necessarily be accompanied by cost estimates. These recommendations are policy related and therefore are recommendations to the appropriate elected officials; debate and formulation of alternatives will serve to make these recommendations suitable and appropriate.

Table 58) Action Items in Safety and Policy.

Action Item	Goals Addressed (see page 2)	Responsible Organization	Timeline
6.1.a: Distribute Firewise-type educational brochures with occupancy permit.	**CWPP Goal #1, 2, 4, 6, 7, & 9**	**Lead:** KFD Prevention Division **Support:** Kennewick Suppression Crews	

Fire Prevention and Education Projects

The protection of people and structures will be tied together closely because the loss of life in the event of a wildland fire is generally linked to a person who could not, or did not, flee a structure threatened by a wildfire or to a firefighter combating that fire. Many of the recommendations in this section involve education and increasing wildfire awareness among Benton County residents.

Residents and policy makers of Benton County should recognize certain factors that exist today, the absence of which would lead to increased risk of wildland fires in Benton County. The items listed below should be acknowledged and recognized for their contributions to the reduction of wildland fire risks:

Shrub-steppe Management has a significant impact on the fuel composition and structure in Benton County. The shrub-steppe management programs of the Bureau of Land Management, Bureau of Reclamation, and numerous private landowners in the region have led to a reduction of wildland fuels. Furthermore, shrub-steppe systems are dynamic and will never be completely free from risk. Treated areas will need repeated treatments to reduce the risk to acceptable levels in the long term. Recommended treatments include mechanical thinning of shrubs and/or light prescribed burning to reduce fuel loads. Monitoring invasive species in these areas will also be required.

Table 59) Action Items for Fire Prevention, Education, and Mitigation.

Action Item	Goals Addressed (see page 2)	Responsible Organization	Timeline

Action Item	Goals Addressed (see page 2)	Responsible Organization	Timeline
6.2.a: Implementation of youth and adult wildfire educational programs.	**CWPP Goal #1, 4, 6, & 9**	**Lead:** Richland Fire and Emergency Services	
6.2.b: Distribute educational information regarding construction in high risk wildfire areas.	**CWPP Goal #1, 4, 6, & 9**	**Lead:** Richland Fire and Emergency Services	
6.2.c (Kennewick): Prepare for wildfire events in high risk areas by conducting home site risk assessments and developing area-specific "Response Plans" to include participation by all affected jurisdictions and landowners.	**CWPP Goal #1, 2, 4, 6, & 9**	**Lead:** KFD Prevention Division **Support:** Kennewick suppression crews	
6.2.c (Richland): Prepare for wildfire events in high risk areas by conducting home site risk assessments and developing area-specific "Response Plans" to include participation by all affected jurisdictions and landowners.	**CWPP Goal #1, 2, 4, 6, & 9**	**Lead:** Richland Fire and Emergency Services	
6.2.d: Work with area homeowner's associations to foster cooperative approach to fire protection and awareness and identify mitigation needs.	**CWPP Goal #1, 2, 4, 6, & 9**	**Lead:** Richland Fire and Emergency Services	
6.2.e: Work with WSU Extension, Master Gardeners, and other existing programs to offer firewise landscaping clinics to assist property owners in maintaining fire-resistant defensible space around structures.	**CWPP Goal #1, 4, 6, & 9**	**Lead:** Richland Fire and Emergency Services	
6.2.f: Develop a range of public education programs to encourage healthy management of natural resources on private property.	**CWPP Goal #1, 4, 6, & 9**	**Lead:** Richland Fire and Emergency Services	
6.2.g: Review State Building Codes and recommend revisions to meet Firewise standards as needed**.**	**CWPP Goal #1, 3, 5, 6, 8, & 9**	**Lead:** Richland Fire and Emergency Services	
6.2.h (BCFD #1): Locate funding for fuel reduction projects throughout BCFD#1's response area, but particularly within the WUI areas of Summitview, Triple Vista, Clodfelter, Badger Canyon and the South Finley area.	**CWPP Goal #1, 6, &7**	**Lead:** BCFD #1 **Support:** Benton County Fire Districts	

Action Item	Goals Addressed (see page 2)	Responsible Organization	Timeline
6.2.h (Richland): Locate funding for fuel reduction projects throughout BCFD#1's response area, but particularly within the WUI areas of Summitview, Triple Vista, Clodfelter, Badger Canyon and the South Finley area.	**CWPP Goal #1, 6, &7**	**Lead:** Richland Fire and Emergency Services	
6.2 i (Benton Conservation District): Locate funding for fuel reduction projects throughout the City, but particularly within the riparian zones identified.	**CWPP Goal #1, 2, 4, 6, 7, & 9**	**Lead:** Benton Conservation District **Support:** Kennewick Fire Department	
6.2 i (Richland): Locate funding for fuel reduction projects throughout the City, but particularly within the riparian zones identified.	**CWPP Goal #1, 2, 4, 6, 7, & 9**	**Lead:** Richland Fire and Emergency Services	
6.2.j (Kennewick): Fund the existing fire Prevention/Public Education Division to develop a public information campaign addressing wildland fire safety and defensible space.	**CWPP Goal #1, 2, 4, 6, 7, & 9**	**Lead:** KFD Prevention Division **Support:** Kennewick Fire Department	
6.2.j (Richland): Fund the existing fire Prevention/Public Education Division to develop a public information campaign addressing wildland fire safety and defensible space.	**CWPP Goal #1, 2, 4, 6, 7, & 9**	**Lead:** Richland Fire and Emergency Services	

Resource and Capability Enhancements

There are a number of resource and capability enhancements identified by the rural and wildland firefighting districts in Benton County. All of the needs identified by the districts are in line with increasing the ability to respond to emergencies and are fully supported by the CWPP steering committee.

The implementation of each action item will rely on either the isolated efforts of the rural fire districts or a concerted effort by the county to achieve equitable enhancements across all of the districts. Given historic trends, individual departments competing against neighboring departments for grant monies and equipment will not necessarily achieve countywide equity.

Table 60) Action Items for Resource and Capability Enhancements.

Action Item	Goals Addressed (see page 4)	Responsible Organization	Timeline

Action Item	Goals Addressed (see page 4)	Responsible Organization	Timeline
6.4.a: Enhance radio availability in each district, link to existing dispatch, improve range within the region, and convert to a consistent standard of radio types.	**CWPP Goal #1, 6, 8, & 9**	**Lead:** Richland Fire and Emergency Services	
6.4.b (Kennewick): Train local firefighters to perform home assessments which will provide home owners with quality advice on how to make their homes defensible.	**CWPP Goal #1, 2, 4, 6, 7, & 9**	**Lead:** KFD Training Division **Support:** Kennewick Fire Department	
6.4.b (Richland): Train local firefighters to perform home assessments which will provide home owners with quality advice on how to make their homes defensible.	**CWPP Goal #1, 2, 4, 6, 7, & 9**	**Lead:** Richland Fire and Emergency Services	

Appendix F: Lists of Figures and Tables

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How to Cite this Document:

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